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<td></td>
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<td>General Comment - HRSD has shifted some of the responsibilities, including risk assessment and claims, previously under the Community Relations Liaison between Public Information Specialist in the Communications Department and the Real Estate Manager position within the Engineering Department. A careful review of all sections including Master Specifications that previously referenced responsibilities of and coordination with the Community Relations Liaison is warranted.</td>
</tr>
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<td>Table of Contents</td>
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<td>The 2020 version of these Standards includes significant organizational changes with respect to renumbering and placement of sections as compared to previous publications. Please take an opportunity to review and become familiar with the Table of Contents to help you map out the new order of sections.</td>
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<td>1</td>
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<td>Previous Paragraph E.1.b. regarding AACE Estimate Classifications has been moved to Section 5 “Capital Project Cost, Schedule and Risk Reporting”.</td>
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<td>Capital Project Cost, Schedule and Risk Reporting</td>
<td>The information regarding use of AACE cost estimate classifications was moved from Section 1 and now resides in Paragraph A Introduction in this section along with a template Project History and AACE Classification report as Exhibit B.</td>
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<td>References have been included throughout this section to a new Section 7 “HRSD Building Information Model (BIM) Requirements”.</td>
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<td>This is a new section to the 2020 publication of these Standards.</td>
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<td>This section has been revised significantly from the 2019 version and warrants a careful review.</td>
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<tr>
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<td>Preconstruction Assessments and Damage Mitigation Procedures</td>
<td>This section has been reformatted and revised from the 2019 version and warrants a careful review.</td>
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<td>13</td>
<td>Coordination with Virginia Department of Environmental</td>
<td>This section has been revised to remove references to sales tax exemption for sanitary sewer projects.</td>
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<td>20</td>
<td>Condition Assessment Protocol for Repaired or Abandoned Pipelines</td>
<td>This section was revised significantly from the 2019 edition and warrants a careful review.</td>
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<td>21</td>
<td>Regulatory Reporting and Requirements for Spills</td>
<td>Revisions made to Paragraph C for work days and phone numbers.</td>
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| 24      | Pipelines and Appurtenances | Revisions made to the following:  

Paragraph C.1.n.iv. added regarding proprietary restraint systems.  
Paragraph F.4 revised to clarify use of corrosion proof materials. |
| 27      | Trenchless Crossing Installations | This section has been revised to separate trenchless crossings from rehabilitation methods and materials. A new Section 29 “Rehabilitation of Sanitary Sewer Systems” has been introduced in the 2020 edition of these standards. A careful review of Section 27 is warranted due to extensive revisions. |
| 29      | Rehabilitation of Sanitary Sewer Systems | This section is new to the 2020 edition of these standards. |
| 30      | Pump Stations | The following new attachments are incorporated into this section:  

Attachment A – Pump Station Substantial Completion Checklist  
Attachment B – Temporary Portable Pump Alarms and Setup Standards |
| 31      | Treatment Plants | This section has been revised for formatting and content from the 2019 version and warrants a careful review. |
| 32      | Electrical and Instrumentation | The following new exhibits are incorporated into this section:  

Exhibit H – SCADA / MMP Site  
Exhibit I – Future SWIFT Design |
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<td>This section and the accompanying EJCDC front-end documents have been updated for the 2018 edition of the Design-Bid-Build EJCDC documents.</td>
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<td>The following Master Specifications have been revised from the 2019 publication:</td>
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<td>• Part 3 Execution includes requirements related to Temporary Portable Pump Alarms and Setup</td>
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<td>• Revisions incorporated in Paragraphs 3.2.B.2; 3.2.B.3; and 3.3</td>
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<td>VDEQ Virginia Clean Water Revolving Loan Fund (VCWRLF)</td>
<td>This is a new section to the 2020 publication of the Standards and details the process for HRSD and our consultants to follow for VCWRLF projects.</td>
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12. Preconstruction Assessments and Damage Mitigation Procedures 12-1

A. Introduction

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   a. Research and Investigations during Design Phase
   b. Determinations during the Design Phase
   c. Potential of Construction Related Impacts
      i. Noise Generation and Impacts
      ii. Vibration Impacts
      iii. Dewatering Impacts on Ground and Structure Settlement
      iv. Construction Impacts on Existing Topography, Hard Surfaces, Hydrology, and Construction Travel Routes
      v. Dust, Odor, and Other Emissions Beyond Construction Zone
13. Coordination with Virginia DEQ for Certificate to Construction and Certificate to Operate
   A. Introduction
   B. Approval CTC Process for State Water Quality Improvement Fund (WQIF) Projects
   C. Abbreviated Administrative Process for Non-WQIF Projects
   D. Approval Process for Non-WQIF Projects that Involve Greater than 25% Capacity Increase or Decrease
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4. Instruction to Bidders  
5. Questionnaire  
6. Bid Bond  
7. Agreement  
8. Performance Bond  
9. Payment Bond  
10. Escrow Agreement  
11. General Conditions of the Construction Contract  
12. Supplementary Conditions  
D. Specific Documents Requiring FIRM Input  
1. Advertisement for Bid  
2. Instructions to Bidders  
3. Agreement  
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Attachment A – EJCDC Front End Documents (PDF)  

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Forward

Engineering Director’s Viewpoint

The HRSD Engineering Department was created in 1987 to better manage the growing infrastructure needs of the organization. Since the inception of the Engineering Department, it has been our goal to rely on both the region’s consulting and contracting community to provide needed support to supplement the capabilities of HRSD staff.

As an extension of our staff, we expect consultants and contractors to work collaboratively to find the best solution to a problem or issue. We expect our consultants to be technically competent and strive for innovative solutions. We expect the project team to deliver a quality project. We define quality as consistently meeting or exceeding customer expectations. A quality project must strike a balance between budget, schedule, quality and sustainability. Open, honest and effective communication is essential for success. We expect our staff, and therefore our consultants/contractors, to keep our Vision in mind as we plan, design and construct needed infrastructure. This Vision is; “Future Generations will inherit clean waterways and be able to keep them clean.”

A great project is only possible if we have competent contractors to implement the design intent. This requires a team approach and a mindset of collaboration. On large projects we often use the process of Partnering to assure project success. The concept of Partnering is built on the foundational areas of content, procedures and relationships. Partnering strives to build an environment of trust and mutual respect between all parties. Although we typically use formal Partnering on large projects, the concepts inherent in this approach are applied to all projects. Trust is built on integrity, communication and a clear understanding of the expectations and needs of all team members. These concepts are not new however can be easily forgotten as difficult challenges arise during the delivery of projects.

At the end of the day, we are a team. There can be no losers. We should look to find ways to meet the goals of each respective team member while delivering on the infrastructure needs of HRSD. The ratepayers of HRSD expect that we will do these things and we must deliver!
Section 1 - Introduction

A. Purpose – The purpose of this document is to present information to Professional Services Firms to design projects, prepare construction documents and provide contract administration and inspection more efficiently while satisfying the needs and desires of HRSD. The term “FIRM” is used throughout this document to refer to the firm or individual providing professional consulting services for the design, contract administration, and inspection of HRSD facilities. HRSD expects the FIRM to bring their experience, expertise, and enthusiasm to projects while recognizing the culture and desires of HRSD. The FIRM must carefully review the information contained in this document, raise questions where appropriate, and deliver projects, which incorporate HRSD standards as laid out in this document. HRSD must be specifically advised in writing of any cases when these standards that make up this document have not been incorporated in the final plans, specifications, and Bid Documents.

B. Expectations, Outcomes and Sustainability – For an Engineered Construction Project to be successful, a number of outcomes are required. These outcomes include meeting project quality, schedule and cost objectives. Projects must meet all regulatory, environmental, safety and other needs of HRSD and the citizens we serve. Each project results in the delivery of infrastructure assets to HRSD. These assets must provide the needed level of service, within an acceptable level of risk, at the lowest life cycle cost. As such, FIRMs should consider the full life cycle of assets when planning, designing, and constructing HRSD projects. Life cycle cost accounting should include capital, operating, maintenance, rehabilitation, and decommissioning costs of the asset. FIRMs should compare asset alternatives based on Net Present Value (NPV) per anticipated years of service (NPV/anticipated years of service). HRSD strives to deliver projects sustainably. To be consistent and develop a common understanding of what sustainability means, FIRMs shall utilize the Institute for Sustainable Infrastructure (ISI) Envision checklist when evaluating and designing projects. The Envision checklist will assist the project team in identifying and engaging stakeholders, identifying project risks and opportunities, and evaluating the project from multiple perspectives. Because project adjustments can be most economically incorporated early in a project’s life, the first use of the Envision checklist should occur sometime between the start of preliminary engineering and the start of project design. The primary goal of utilizing ISI Envision is to plan, design, and construct better infrastructure projects for HRSD, our ratepayers, and our local partners; not to receive accreditation or an award. In some instances pursuing project accreditation and award may be justified. Better infrastructure projects are the result of evaluating the project from economic, social, and environmental perspectives (the triple bottom line), and evaluating project alternatives and project components based on their life cycle costs. For certain small, fast-track or specialized projects, use of the Envision Checklist may not be required. Elimination of this requirement should be discussed and approved by the HRSD Project Manager.

C. Project Delivery Methods – As a political subdivision of the Commonwealth of Virginia, HRSD follows the requirements of the Virginia Public Procurement Act. In addition, HRSD has developed the HRSD Procurement Policy to more specifically define our efforts to meet specific procurement related matters. Engineered construction projects are typically delivered
using a Design-Bid-Build method, however HRSD has the authority to use alternative forms of project delivery if certain procedures and requirements are followed. Alternative (or Collaborative) delivery methods including: Construction Management, Job Ordering Contracting and Design-Build are evaluated on a case by case basis and must be approved by HRSD Commission for each each project prior to starting an Alternative Delivery method.

D. Distribution - This document is incorporated by reference into all HRSD Professional Services Agreements for the design and construction of HRSD facilities. This document is posted on the HRSD web site at www.hrsd.com

E. Preparation of Design Documents – HRSD employs numerous FIRMs for technical assistance in the preparation of design documents. Each of these FIRMs bring unique expertise to the design effort. These differences result in new ideas and methods for both the design and implementation of HRSD’s Capital Improvement Program. Although HRSD has some specific preferences for certain aspects of the design, much of the procedures, details and technical information required for the project should be determined by the FIRM. The following information is an overview of some of the general requirements required by HRSD for the preparation of design documents.

1. General Requirements

   a. Vertical construction projects (pump stations, pressure reducing stations, treatment plants, wet weather storage tanks, and administrative buildings) are to be designed in a 3-D CADD format as approved by HRSD Project Manager that can be viewed and reviewed by HRSD staff with non-licensed viewer software packages and are compatible with BIM use. HRSD may request additionally that these 3-D models support both virtual reality (VR) and augmented reality (AR) for design reviews. The FIRM shall continue to incorporate changes proposed by the Contractor during submittal reviews and Change Proposals to confirm that alternate equipment, materials, and changes from the FIRM’s developed Bid Documents will not cause further conflicts. The final 3-D design files are also to be delivered to HRSD in their native software format.

   b. Total project cost estimates should be provided listing design, construction, land acquisition, wetlands mitigation and all other anticipated project costs. Costs should also include necessary contingencies and these contingencies should be clearly defined. Along with each developed and published project or construction cost estimate by the FIRM, the ENR Construction Index of the month the estimate was prepared shall be documented in the footnote of the published cost estimate.

2. Study and Preliminary Engineering Report (PER)

   a. Studies and PERs should clearly state the purpose, goals and assumptions used in preparation of the document.
b. The PER should include an Executive Summary in the front of the document. The Executive Summary should include a brief overview of the project, recommendations, all project costs (design, construction, property acquisition, etc.) and schedule to implement the work. The Executive Summary should be limited to approximately five (5) pages. The PER should consider alternates for the various systems, processes and equipment to be included in the final design. Materials of construction for the significant items of construction should also be included. A thoughtful method of comparing various alternatives is needed with specific recommendations.

c. Large amounts of data or other technical information should be included in an appendix with a summary of the information included in the text of the document.

d. Studies and PERs must be provided in an electronic PDF format for ease of use by HRSD. Paper copies may also be required and the quantity of those is project specific.

e. Specific requirements for the technical aspects of the study or PER will be included in the Professional Services Agreement.

f. PERs should be prepared in compliance with the Commonwealth’s Sewage Collection and Treatment (SCAT) Regulations.

g. Depending on the type of project, HRSD has an expectation and process for incorporating architectural features and landscaping into site rehabilitation and both new and rehabilitation of vertical projects (pumping stations, pressure reducing stations, wet weather storage tanks, administration buildings, and certain treatment plant facilities). Specifics regarding these architectural guidelines and HRSD’s Architectural Review Committee’s role in the PER and Design phases is included in Section 2 – Architectural and Landscaping Design and Review Process.


   a. The FIRM should prepare the Project Manual in accordance with this document and all state and local regulatory requirements. The Project Manual should generally be organized as follows:

      • Volume 1: Construction Contract Requirements and Technical Specifications
      • Volume 2: Construction Drawings
      • Volume 3: Other documents as required

   b. The documents used for regulatory approval and for construction bidding must be sealed and signed by a Professional Engineer or Architect licensed in the Commonwealth of Virginia.
c. The type of media and method used for the distribution of the Project Manual shall be agreed upon by HRSD and the FIRM prior to finalization of the design documents.

d. Specific requirements for the technical aspects of the Project Manual are described further in this document and will be included in the Professional Services Agreement.

e. Project and construction cost estimates during plan development shall be as described above in Paragraph E.1.b. of this section.

F. Common Historical Issues in the Design and Construction Phase - HRSD has routinely encountered a number of recurring issues in both the design and construction phases of projects. Some of these relate to HRSD preferences that may differ from the FIRM’s or industry’s normal practices. These are summarized below by design and construction phase.

1. Design Phase

a. Specification sections were included in the Bid Documents that are not applicable to the specific project.

b. Plans and specifications were not well coordinated.

c. The general intent is that existing HRSD drawings are to be reviewed and all pertinent information included on current project drawings so that these drawings represent the complete picture of the HRSD facility in the areas covered.

d. Sequences of construction to ensure maintenance of plant operations (MOPO), pipelines and pumping stations were not prepared or carefully considered.

e. Technical specifications were not coordinated with HRSD standard front end documents. Do not repeat in the technical specifications items that are covered in the front end documents.

f. X-references used in drawings were not bound to drawings before record drawings are delivered to HRSD.

g. A consistent format (font, page numbering, paragraph numbering, etc.) was not used throughout the technical specifications.

h. Existing field conditions were not verified at final design stage, resulting in conflicts.

i. Location of piping and appurtenances such as air release valves and isolation valves in busy intersections needs to be considered for maintenance and operation access.

j. Access for sampling or maintenance of equipment needs to be considered at treatment plants, pump stations, covered tanks and other facilities.
k. Lack of consideration of how the project will negatively impact the public (noise, odors, access, etc.)

2. Construction Phase

a. FIRM’s submittal reviewers were not carefully checking that Contractor submittals were in full compliance with the Bid Documents, and the approved products and materials do not result in conflicts with other aspects of the physical space or other aspects of the Contract Documents.

b. Field personnel (FIRM’s representative) did not have a copy of or were familiar with plans, specifications and approved shop drawings / submittals.

c. Field personnel did not check materials received against approved shop drawings / submittals.

d. Field personnel used personal experience, not plans and specifications, when considering changes, answering questions, etc.

e. Field personnel relied on Jurisdictional/VDOT or other agency inspectors for contract item compliance when either the jurisdiction or VDOT was administering the construction contract that included impacts on HRSD facilities.

f. Field personnel relied on Contractor’s record drawing keeping and failed to closely monitor progress and field changes. Field personnel should keep their own record drawing information and frequently review Contractor’s record drawings.

g. FIRM failed to prepare independent cost estimates for use in verifying/negotiating changes with Contractor.

h. Field personnel were unaware of special features for the project. Design personnel should brief field personnel on special features and participate in startup to ensure compliance with the specifications.

i. Field and design personnel did not receive copies of all change documents, i.e., addenda, change orders, field orders, work change directives, etc.

j. Consideration was not given to final site restoration including work best performed by certified landscape contractors.

k. Field personnel were not monitoring, documenting nor enforcing when the Contractor was outside of rights of way and easements that he was limited to work within.

l. Field personnel were not monitoring, documenting nor enforcing when the Contractor was violating jurisdictional maintenance of traffic restrictions.
G. **Use of Autonomous Vehicles (AVs)**

Due to potential issues with the use of prohibited airspace, privacy concerns, the changing regulatory environment and the risk of injury and damages that could result from the use of AVs, HRSD requires that the use of AVs must comply with all relevant regulations, insurance requirements and policies. The use of AVs should be limited to circumstances when the AV provides HRSD with a financial, safety or functionality benefit over other reasonably available options. When the use of the AV will involve a Consultant, Contractor, or other individual, written permission from the HRSD Department Director and the HRSD General Manager will be required. The request submitted must clearly state the need and benefit afforded by using the AV, the name of the individual controlling the AV and insurance coverages. The request should include the Remote Pilot Certification number of the responsible individual controlling UAS (Unmanned Aircraft Systems) and should note that they will fully meet all federal, state, and local regulations relating to the use of AVs.

End of Section
Section 2 – Architectural and Landscaping Design and Review Process

A. Introduction – This section serves to provide information and guidelines for architectural and aesthetic features to be incorporated into highly visible HRSD projects in the communities. There is a need for high level of review and buy-in at early stages of concept development for all vertical structures that HRSD will construct in the communities that we serve. HRSD’s Architectural Review Committee (ARC) will provide direction to the project team and FIRM (design engineers and architects) at the earliest possible stage to help ensure our designers, architects and staff verify the proper land requirements and secure stakeholder buy-in for both form and function of these facilities such that these facilities can be efficiently brought to completion. Attached to this section are guidelines, forms, and templates to assist the FIRM and project team with incorporating architectural and landscaping concepts.

B. HRSD Architectural Review Committee (ARC) - The following steps are to be followed for vertical construction projects:

1. FIRM to research the current zoning, and building styles (residential, public, business) in the surrounding neighborhoods or areas within one-half mile radius of the proposed construction site. This research should influence the design of the structure in a way that will allow it to blend in with the surrounding community.

2. FIRM to review the current HRSD Pump Station Architectural Guidelines (Attachment A) and Aesthetics Considerations Log (Attachment B) to this section for best fit and desired styles/considerations to blend into the surrounding areas where the facility is to be constructed or renovated.

3. FIRM to provide varying conceptual architectural treatment options/styles (minimum of three for new construction and two for beautification initiatives) along with Opinion of Probable Construction Costs (OPCC) at AACE Class 4 estimate {as defined in Section 5 - Capital Project Cost, Schedule and Risk Reporting} for each option to the HRSD Project Manager at the draft Preliminary Engineering Report (PER) stage for the ARC’s review. These architectural renderings shall be at a level of development to envision how the structure would blend into the surrounding area, what the facility would look like from all sides, and to include all known above ground external appurtenances, including but not limited to: fixtures, yard piping, generators, bypass pumps, odor control system, emergency connections and panels.

4. FIRM to provide conceptual landscape design appropriate to the style of the new or renovated structure or blending with the surrounding community. HRSD’s preference is to use evergreen, low maintenance and native, to the area (Tidewater, Virginia), vegetation whenever possible and if compatible with the locality’s landscaping requirements. The FIRM to research the area of planting (soil type, flood zone-type, dry soils) for proper selection and successful planting/growth. Once the landscaping design is
approved, the FIRM shall also provide a Landscaping Planting Plan. An example is provided in Attachment E to this section.

5. FIRM to provide conceptual fencing design appropriate to the style of the new or renovated structure or blending with the surrounding community. HRSD’s preference is to not utilize hardscape fencing on a property if landscaping can be utilized to the same affect. Fencing may be used if deemed necessary for safety of the general or motoring public or HRSD’s infrastructure. If hardscape fencing has been deemed mandatory, HRSD’s preference is not to use privacy or panel fencing completely obscuring view.

6. HRSD Project Manager to coordinate with their Chief to receive early feedback and concurrence on the architectural and landscaping concepts to be presented to the ARC.

7. HRSD Project Manager will submit the architectural/landscaping/fencing rendering options to the HRSD ARC for comment and direction. This committee to be comprised of the following HRSD members: General Manager, Director of Communications, and the department director for whom the facility is being constructed.

8. The HRSD Project Manager will schedule a meeting with the ARC within approximately two (2) weeks of submittal of the renderings to discuss their comments and guidance for moving forward. Title the appointment/meeting: Architectural Review Committee Meeting – PROJECT or INITIATIVE NAME.

   a. During this meeting the HRSD Project Manager should provide:

      i. A brief and high-level review of the project (why is this initiative needed, how old is the existing infrastructure or the reason for the new structure, current budget for this CIP/Beautification Initiative, where we are in the process to-date as well as any external architectural steps taken to this point such as meetings with the city/county to obtain requirements).

      ii. Provide a ‘live’ Google Earth street view ‘walk through’ of the surrounding area and buildings - allowing the ARC to view the existing structures in the community for comparison.

      iii. Provide 2 or 3 preliminary design rendering options developed by the architectural/design firm for the HRSD ARC to consider as described above. The ARC will decide, if these renderings meet their desired vision and will provide additional direction.

   b. The FIRM (and/or the Architect) may be allowed to attend a portion of this meeting to hear direct comments from the ARC, after ARC internal discussion.

   c. HRSD Project Manager to inquire if the ARC believes there is a need for a full meeting to discuss this project or if the ARC can submit their comments via an email discussion. The ARC has opted for this email response method for past beautification initiatives or cases where the ARC is satisfied with the originally presented and discussed concept.
d. If a response is required by a certain date, please note that date for the ARC.

9. The FIRM shall modify the renderings according to direction given by the ARC and prepare a sample board of color and material selections (if desired by the ARC) and resubmit to the ARC for final concurrence within two (2) weeks of the first meeting with the ARC.

10. The accepted architectural concept by the ARC will be incorporated into the final PER by the FIRM.

11. The FIRM shall base their scope of services and fee proposal for the design phase upon the final PER recommendations.

12. Depending on the locality’s review and approval process regarding architectural style and landscaping, the FIRM will need to accommodate within their proposed completion schedule for additional submittals and reviews by governing bodies.

13. FIRM shall submit to the Project Manager additions to the Aesthetics Considerations Log, using the template provided in Attachment B, not already captured.

14. HRSD Project Manager shall ensure the approved safety and address signage are ordered and installed on the structure, as directed by the ARC.

C. **Attachments** – the following information is provided for guidance:
   1. Attachment A - Pump Station Architectural Guidelines.
   2. Attachment B - Aesthetics Consideration Log
   3. Attachment C - Address Sign Specification
   4. Attachment D - Safety Sign Specification for Buildings
   5. Attachment E - Landscaping Planting Plan Sample

*End of Section*
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INTENT OF GUIDELINES

These Guidelines shall be used by architects/engineers in the design of new Hampton Roads Sanitation District (HRSD) pump stations and pump station support facilities. They shall also be referenced when designing additions, renovations and modifications to existing pump stations.

The Guidelines shall direct the aesthetic design of pump station facilities, and shall supplement the engineering, technical and operational standards and requirements, including HRSD’s current edition of *Standards and Preferences for Engineered Construction Projects*, as directed by HRSD.

The Guidelines are intended to be a “living document” and updated periodically by HRSD to address new materials, new building systems, new technology and refinement of aesthetic design standards.

PRINCIPLES OF DESIGN

The design of the pump stations should strive to achieve the following principles:

+ Overall site and building design should respect the community in which the facility is located.
+ Architecture should blend into the local context of the site and community where feasible.
+ Building façade should show quality detailing and finely tuned proportions.
+ Materials should be selected for durability and low maintenance.
+ Building design should balance aesthetic form and operational function.

CONFORMANCE WITH LOCAL DESIGN GUIDELINES

Designs shall meet the guidelines of the City/County, including design standards, overlay districts and community character corridors. Designs shall also meet any guidelines adopted by the local community. If local design guidelines conflict with these Architectural Guidelines, the local guidelines shall take precedent.
SITE DESIGN

Site Layout and Views
+ General site characteristics of neighboring properties should be considered in pump station design.
+ Consider views from adjacent streets, public spaces, and neighboring buildings and lots.
+ Particular attention should be paid to sites located near cultural landmarks, significant buildings, and public spaces.
+ Buildings shall be sited to screen any visible electrical, plumbing, and mechanical items from primary views.
+ If land is needed for future expansion, consideration should be given to interim use of this land as a park, greenspace, or other public/community use.
+ Where possible, locate emergency pump connections away from primary views.

Building Setbacks
+ Building setbacks shall follow local zoning requirements, and also reflect the setback already established by buildings on adjacent properties.
+ Depending on scale and mass, it may be appropriate to site pump stations further back than adjacent buildings to avoid overwhelming the adjacent structures.

Driveways and Hardscape
+ All pump stations should be designed with pervious pavement systems, in keeping with the environmental focus of HRSD.
+ Pervious pavement (asphaltic or concrete) should be used for all access drives at a minimum. Where secondary or emergency drives are required, pervious paver or grass paver systems should be used.
+ Concrete or asphalt paving should only be used where heavy equipment or vehicle loading is expected.
+ Where possible, driveways should not be placed against the building. A green space of 3’ is recommended between drives and the building foundation.
+ Width of driveways should be the minimum needed for vehicular access, and consistent with neighboring properties when possible. Site paving should be the minimum needed to maintain appropriate access for maintenance and operations.
+ Edge treatment should be provided at all access drives visible to the public.
**Fencing**

- High durability and low maintenance materials such as aluminum, closed-cell PVC and fiber cement should be used for fencing.
- Fencing should only be used where needed for visual screening or building security.
- In general, fencing should be consistent with the character of surrounding properties.
- Privacy fencing should be used when appropriate to hide unsightly elements of the architecture or site, such as louvers, exhaust, piping, monorail, etc. However, elements that are low to the ground (manholes, concrete pad) or other less visually impactful elements may be left outside of fencing.
- When possible, fencing the buildings and other elements as necessary is preferable to fencing the entire site.
- Fencing should expose at least the front façade of the building – more if possible within design constraints.
- If fencing is needed for security, use decorative black aluminum fencing, 6’ high.

**Landscaping**

- Existing vegetation should be considered in site design as it can provide screening and visual softening of pump stations.
- Design landscaping that is sustainable, low maintenance and drought resistant.
- Decorative landscaping shall be minimized, but may be needed as a tool for shielding unsightly facades or softening visible foundations on larger buildings.
BUILDING DESIGN // GENERAL

Building Massing
+ In general, buildings should be designed to a scale and style that is sympathetic to residential structures, or sympathetic to adjacent contextual buildings.
+ Smaller pump stations should be designed to appear like traditional “outbuildings”, with scale that is appropriate for those buildings.
+ Avoid large monolithic walls and roof surfaces. Break larger masses down into smaller elements with plan offsets, gables, roof breaks, etc. Use porches and other residential elements where needed to soften larger masses.
+ Large pump stations in small-scale neighborhoods should be designed with smaller elements reflective of the neighboring buildings.
+ Buildings should be carefully articulated with functional doors and louvers, placed in an organized method that is appropriate for architectural balance on the elevations while supporting the functional requirements of the facility. Avoid haphazard placement of louvers, openings and other elements on walls.

Building Façade Design
+ Several factors may influence the overall height of a building: a high capacity pump station may require greater height for equipment, or a building location in a flood plain may require the floor to be raised significantly above grade. A variety of techniques should be used to achieve good proportions on the building façades.
+ Consider raising the first floor slab at least 12” above grade to avoid water infiltration and contribute to a well-proportioned elevation.
+ For taller buildings, consider simulating a half story above the first floor. Alternatively, a half story of false windows at grade can create an “English basement” aesthetic.
+ A water table (a traditional masonry projection at the foundation line) of up to 4’-0” above grade can be utilized to break down the overall height of a building, regardless of the actual floor level.
+ Head and sill heights, widths, and overall spacing of doors, windows, louvers, and other elements should be coordinated and provide visual balance.
**BUILDING DESIGN // PRIMARY ELEMENTS**

**Exterior Wall Cladding**
+ Primary exterior wall finish shall be brick, in color and size to blend with adjacent structures. Where no structures are in the vicinity, brick should be standard size (6 courses per 16 vertical inches) or oversize (5 courses per 16 vertical inches).
+ Where no structures are in the vicinity, brick should be a Tidewater Virginia traditional red blend, with a full range to include a percentage of flashed bricks.
+ Mortar shall be straw or natural color. Mortar joints shall be grapevine or concave.
+ Optional exterior cladding shall be fiber cement siding (Hardiplank or equal), weatherboards, smooth finish with 6” to 7” exposure. Fiber cement siding should be factory finished in color to blend with neighboring structures.
+ If appropriate to the context of the site, other styles of siding (board-and-batten, shingles, etc.) may be used. Material and finish shall be the same as described above.

**Roofing**
+ Sloped roofs (pitch 8:12 or greater) are strongly recommended, unless a different pitch is needed for compatibility with surrounding structures.
+ Roofing materials shall be either standing seam metal or architectural shingles.
+ Standing seam metal roofing color shall blend with adjacent structures. Where no structures are in the vicinity, color shall be medium or dark bronze. Roofing shall have an 18” maximum exposure on panel size.
+ Architectural shingles shall be 40-year warranty asphalt-fiberglass shingles, with medium to dark color to blend with adjacent structures. Where no structures are in the vicinity, color shall be slate blend, dark gray blend or weathered wood blend.
+ Avoid gutters and downspouts unless absolutely necessary for adequate roof drainage.
+ Where ground gutters are needed, provide materials that blend with the building and landscaping.
+ Fall protection anchors should be included in roof design.

**Doors and Windows**
+ Depending on the needs of the pump station, functional doors will be located on various faces of the building. When they are highly visible it may be appropriate to clad them with an architectural finish. For less visible locations, painting doors to match the exterior siding will allow them to recede from view.
+ Decorative doors could be located at the front of buildings to create a focal point for the building.
Decorative windows & false widows should be used to break down mass of larger blank walls, and provide articulation to facades. Unless other window styles are needed to blend with adjacent structures, windows should be double-hung in appearance, with a width-to-height proportion in the range of 1:2 to 1:2.3. In general, primary windows should not be smaller than 2’-8” x 6’-2”. Larger windows may be needed for larger scale buildings. Half story windows above should match the size of one sash of the double hung windows below.

When windows are needed for natural light, care should be taken in areas of high vandalism. Second story windows or dormers can provide natural while mitigating security issues. When windows are added only for aesthetic reasons, glass can be blacked out and openings blocked up on the interior side.

Brick inset windows and shuttered windows can be used to break up a blank façade. Sill and header details should match other building penetrations for visual uniformity, and sizing should fit into the overall proportions for the building. Shutters should be constructed from high durability low maintenance materials such as closed cell PVC, fiberglass or fiber cement.

Trim and Cornices

- High durability and low maintenance materials such as closed cell PVC, fiber-cement, fiberglass, or composites should be selected for cornices, exterior trim, and columns.
- Cornices should be designed appropriately for different scaled buildings: while a small pump station may resemble an outbuilding and have only a crown moulding and short roof overhang, larger buildings will require larger cornices with multiple members.
- Use square or round porch columns with an 8” minimum width. Avoid overly ornate columns.
- 6” corner boards should be used at weatherboard siding.
- Handrails should be included with any stairs of more than 3 risers. Personnel entrances, porches, and other occupiable spaces should receive guardrails and handrails as required by code. Decorative, non-occupiable porch rails should be at an appropriate height, but not above 36”, unless mandated by code.

Louvers

- Functional louvers have a very large impact on the exterior of a pump station; therefore, their design must be carefully coordinated.
- All visible louvers should receive a high quality fluoropolymer finish and color to match other exterior elements.
- Where possible, the top of louvers should align with the top of adjacent windows, doors, or closed shutters. The widths of louvers should also correspond to adjacent architectural
items. Placement of louvers should align with the overall spacing of exterior elements.
+ Locate oversized and odd louvers on the rear elevations or behind screening elements.
+ Where possible, fans should be mounted on the interior with only architectural louvers on the building exterior.

BUILDING DESIGN // OTHER ELEMENTS

Emergency Generators and Stand-by Pumps
+ Locate generators and pumps within an enclosed building where feasible for both visual screening and noise control.
+ If enclosure of equipment is not feasible, locate generators and pumps at rear of building or at least visible side of building, away from view by the public and adjacent properties.
+ Provide screening of all generators and pumps located outside enclosed buildings, using screen walls, fencing, evergreen landscaping or combination thereof.
+ Care should be taken where generators or pumps must be elevated due to flood zone requirements. In these cases, enclosure in a building may be the only way to effectively screen equipment.

Monorail
+ Only use monorails where absolutely necessary, and other solutions have been ruled out.
+ Locate monorail on rear elevations to decrease street visibility when possible.
+ Monorail can be simplified to a single column and beam, or can be disguised with roofs and architectural columns.

Odor Control
+ Integrate odor control into building interior when possible.
+ Secondarily, provide high privacy fencing or wall to screen from view.
+ Where soil conditions allow, odor control systems may be placed below grade for concealment.

Vertical Exhaust
+ Vertical exhaust elements should be placed at rear when possible.
+ A decorative masonry chimney may be used to help to disguise a number of smaller exhaust and/or venting elements.
+ Avoid large exhausts on roof.
**Signage**

- Safety signage should be placed at the personnel entrance to the building.
- The location and size of HRSD property signage may vary depending on context and intent of signage.
- Locate street address signage on the front façade over the front door or other prominent location.

**Exterior Lighting and Security Cameras**

- Use motion sensors to control exterior lighting unless building is in a high traffic area or urban area.
- Use full cutoff light fixtures to minimize spillover of light to adjacent properties.
- Lamp type/color should match context: HPS, HID, LED, etc. If no other exterior lights are present in the vicinity, lamp shall be LED.
- If pole mounted lighting is required on site, care should be given to placement, finish, and height of poles. Light poles should be factory finished aluminum and no more than 12 feet above grade. Style and color should match the building scheme, with the color usually dark bronze or black.
- If security cameras are needed, placement should be discrete and screened from view if possible.
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<td>15</td>
<td>Architectural Louver &amp; Dormers</td>
<td>30 Newmarket Creek Pump Station</td>
</tr>
<tr>
<td>16</td>
<td>Doors</td>
<td>32 Arctic Avenue, Virginia Beach</td>
</tr>
<tr>
<td>18</td>
<td>Cornice</td>
<td>33 East Beach, Norfolk</td>
</tr>
<tr>
<td>20</td>
<td>Porches</td>
<td>34 Locust Valley Pump Station, Long Island NY</td>
</tr>
<tr>
<td>21</td>
<td>Fences</td>
<td>35 Currituck County Waterworks, NC &amp; James City County Pump Station</td>
</tr>
<tr>
<td>22</td>
<td>Signage</td>
<td>36 Stonehouse Station, James City County</td>
</tr>
<tr>
<td></td>
<td></td>
<td>37 Bay Shore Lane Pump Station</td>
</tr>
</tbody>
</table>
EXHIBITS // DRAWINGS

General Building Proportions

Small Pump Stations
The following example gives proportions and detail elements appropriate for small buildings.
EXHIBITS // DRAWINGS

General Building Proportions

Large Pump Stations
For larger building, the following elevation provides recommendations for proportions, roof-lines, cornices, window and door detailing.

ELEVATION
EXHIBITS // DRAWINGS

General Building Proportions

Large Pump Stations

This elevation shows an example of proportions appropriate for a large building highlighting the use of faux brick windows, louver and door locations to create a visual grid. The placement of these elements helps to create a visual hierarchy and break up long spans of solid facades.
EXHIBITS // DRAWINGS

Chimney Elevation

If vertical venting is required, a chimney can be used to disguise the vent space. Chimneys should maintain a high level of architectural detail and be in proportion to the overall structure.
EXHIBITS // DRAWINGS

Window & Closed Shutter

4" CASING

WINDOW GRILLE (MUNTINS)

WINDOW SASH

WINDOW SILL WIDE ENOUGH TO RECEIVE 4" WIDE TRIM

WINDOW ELEVATION

BRICK ARCH HEADER

2" TRIM

PAINTED SHUTTER

BRICK ROW LOCK SILL

SHUTTER AND TRIM SHALL BE PLACED BEHIND FACE OF WALL BRICK.

CLOSED SHUTTER ELEVATION
EXHIBITS // DRAWINGS

Architectural Louver & Dormers

ARCHITECTURAL LOUVER

3-5/8" CROWN MOULD
FIBER-CEMENT SIDING

1X6 TRIM (NO BRICK MOULD)

1 1/2" X 1/2" Ogee Trim

DOUBLE HUNG WINDOW
(MIN. 2'-7" X MAX. 3'-1"
WIDE AND MIN. 4'-5" X
MAX. 5'-8" TALL)

DORMER
EXHIBITS // DRAWINGS

Doors

Examples of architectural door treatments are below. Corrosion-resistant doors may be simply painted, or when desirable or highly visible, can receive decorative treatment applied to the front.
Doors

Examples of architectural door treatments are below. Corrosion-resistant doors may be simply painted, or when desirable or highly visible, can receive decorative treatment applied to the front.
EXHIBITS // DRAWINGS

Cornice

The following cornice details are intended to give examples of the range of possibilities. Cornice details should be in proportion to the overall building scale.
EXHIBITS // DRAWINGS

Cornice

LARGE CORNICE

CORNICE RETURN
EXHIBITS // DRAWINGS

Porches

In some cases of high visibility or importance, a porch may be desired to maintain continuity in a neighborhood or hide unsightly but necessary elements.
Fences

A picket fence should be used where visual screening is less important, but perimeter security is still required. A solid fence may be used where visual screening is of primary concern.
EXHIBITS // DRAWINGS

Signage

Standard signage to be used to designate property & combined safety sign to be displayed at personnel entrances.
EXISTING CONDITIONS // STREET VIEW
1. Immediate rural site in suburban surroundings.
2. No clear front setback created by neighboring properties, so location of pump station is acceptable.
3. Lack of established tree cover and close neighbors results in the pump station being highly visible.
4. Bright yellow fence should be eliminated or replaced with one more contextually appropriate.

EXISTING CONDITIONS // SIDE VIEW
1. Aluminum louvers of different styles and shapes should be standardized to the extent possible and painted to match brick or doors.
2. The roof slope is too low and displays a lack of detailing.
3. Electrical equipment is highly visible from the front facade and should be relocated away from views or screened.
4. Exhaust fans should be located inside with louvers visible on the exterior.
**EXHIBITS // CASE STUDY I**

*Big Bethel Road Pressure Reducing Station*

1. Relocate electrical equipment to rear.
2. Service entrance at rear, and side if necessary.
3. L-Shaped Massing is broken up by faux porch extension.

**NEW SITE PLAN**

**NEW // STREET VIEW**

1. Massing and material choices should reflect the surrounding areas.
2. Closed shutters at front facade are used to create visual interest.
3. Head heights for doors, windows, and louvers should be well coordinated.
4. Aesthetic front porches should be sufficient in depth.
5. Add Handrails at front entrance to create focus on doorway.
EXITING CONDITIONS // STREET VIEW
1. This site has high visibility from four sides - Providence Road (elevated above the site) and Old Providence Road (the “front” entrance).
2. At Providence Road, fencing does little to screen view. Use of landscaping and vegetation would be recommended.

EXITING CONDITIONS // SIDE VIEW
1. Doors, louvers, and exhaust items should be painted to match existing brick.
EXHIBITS // CASE STUDY II
Providence Road Pressure Reducing Station

OPTION 1 // STREET VIEW
1. Extended roof structure hides unsightly monorail and helps to block unbalanced facade.
2. Full and clerestory faux brick windows create a rhythm to the facade.
3. The hip roof lessens the impact of the large building.

OPTION 1 // SIDE VIEW
1. Louvers fit easily into established grid of brick window openings.
2. Large cornice details are used to match scale of building.
3. The hip roof lessens the impact of the large building.
EXHIBITS // CASE STUDY II

Providence Road Pressure Reducing Station

OPTION 2 // STREET VIEW

1. Painted doors blend into the brick and visually disappear.
2. A simple column dressed in brick lessens the impact of the monorail.

OPTION 2 // SIDE VIEW

1. Faux brick arches provide rhythm to the black facade and allow for well placed louvers.
EXHIBITS // CASE STUDY III

Atlantic Pressure Reducing Station

EXITING CONDITIONS// STREET VIEW
1. Existing pump station extends past the established setback line of the surrounding structures.
2. Massing shows no connection or response to adjacent houses.
3. Hip roof lessens the impact of such a large structure.

EXITING CONDITIONS// SIDE VIEW
1. The blank front facade of the existing pump station provides low architectural detail in contrast to the surrounding residential neighborhood.
New pump stations should respect the front setback established by existing adjacent buildings.

Corner views should also be considered in design. Where existing tree cover blocks the view, the architectural treatment can be lessened. Where no screening exists, attention should be given to side elevations.

Break up large massing into smaller elements with particular focus of the street side.

If hardscape is required at front, choose aesthetic and permeable pavers.

**NEW SITE PLAN**

**NEW // STREET VIEW**
1. The hip roof lessens the impact of the large building.
2. 3’-6” Water table.
3. 7’-0” Fence for additional screening and to match scale of pump station.
4. Narrow driveway can widen behind fence.
EXISTING CONDITIONS // STREET VIEW
1. Electrical equipment could be moved to side or rear of pump station.
2. Driveway should be the same width as adjacent properties, or less - access at rear can be wider.
3. Fencing should be scaled back to front facade and replaced to match surrounding materials.

EXISTING CONDITIONS // SIDE VIEW
1. New vent piping should be added in a careful manner and not merely applied to exterior.
2. Existing flood protection was modified and should be removed.
3. Service doors can be painted to blend into brick.
1. Fence as little of the site as possible. If possible, fencing should be set back from the front facade.

2. Maintain a narrow driveway but still allow for wide service pad in fenced area.

3. Small manholes or access hatches at grade may be left outside of fenced area if properly secured.

NEW SITE PLAN

NEW PUMP STATION // STREET VIEW
1. Faux or real entry door at front can be laminate with architectural treatment.
2. Closed shutters provide simple pattern at the front facade.
3. Fence is set back from front facade as much as possible.
4. If necessary, protruding elements can be painted to blend into surrounding brick.
EXHIBITS // EXAMPLE PUMP STATIONS

Arctic Avenue, Virginia Beach

ARCTIC AVENUE

1. Front porch and trellis gives scale to the building and mirrors the surrounding shore architecture.
2. Aesthetic security fence is appropriate to surroundings and screening needs.
3. Since this pump station is quite visible, the monorail should be hidden or modified to reduce its visibility.
1. High quality details are used throughout this pump station.
2. The generator and paved areas could be better visually screened.
3. If possible, the chimney/vent stack should be better proportioned to the building size.
4. Electrical equipment could be moved off of the façade adjacent the main street.
5. Use appropriate fencing for screening or security.
LOCUST VALLEY
1. The close proximity of adjacent houses demanded attention in exterior detailing.
2. Permeable paving is appropriate for the residential context and for amount of expected wear.
EXHIBITS // EXAMPLE PUMP STATIONS
Currituck County Waterworks, NC & James City County Pump Station

1. Architectural louver and door are similarly detailed and appropriate in height.
2. Large eave overhang is reflective of large building.
3. Half story closed shutters are used due to building height.

CURRITUCK COUNTY WATERWORKS

JAMES CITY PUMP STATION

1. Architectural louver and door are similarly detailed and appropriate in height.
2. Small eave overhang is reflective of a small building.
3. Light fixture should be cutoff type, and less obtrusive.
EXHIBITS // EXAMPLE PUMP STATIONS

Stonehouse Station, James City County

STONEHOUSE

1. Fence hides elements from view, but could provide more screening by wrapping the corner.
2. Steep roof, short eave overhang, and covered entry demonstrate appropriate scale.
BAY SHORE LANE

1. Design challenges with pump stations retrofitted with emergency generators. This example is also elevated due to flood zone requirements. This is not appropriate for pump stations visible from public areas or adjacent to residential areas.
## Sample Beautification

### Selections Log : Project: Powhatan PS (SS)

<table>
<thead>
<tr>
<th>Description</th>
<th>Company</th>
<th>Website</th>
<th>Contact</th>
<th>Cost 2018</th>
<th>Reasoning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Door</td>
<td>Chempruf</td>
<td><a href="http://www.chem-pruf.com/">http://www.chem-pruf.com/</a></td>
<td>Amy Crotty, <a href="mailto:acrotty@senneca.com">acrotty@senneca.com</a> 800-444-6924 ext 5385</td>
<td>$ 2,793.34</td>
<td>Paintable if tagged with spray, and fire resistant</td>
</tr>
<tr>
<td>Gutters</td>
<td>Atlantic Roofing and Siding</td>
<td><a href="http://www.atlanticroofingllc.com/">http://www.atlanticroofingllc.com/</a></td>
<td>Michelle Davis, michelle@atlanticroofingllc, 340-0045</td>
<td>$ 1,040.00</td>
<td>Had the color we were looking for to match other products</td>
</tr>
<tr>
<td>Fascia Wrap</td>
<td>Atlantic Roofing and Siding</td>
<td><a href="http://www.atlanticroofingllc.com/">http://www.atlanticroofingllc.com/</a></td>
<td>Michelle Davis, michelle@atlanticroofingllc, 340-0046</td>
<td>$ 575.00</td>
<td>Had the color we were looking for to match other products</td>
</tr>
<tr>
<td>Landscape</td>
<td>Ritter Grounds Maintenance Inc.</td>
<td><a href="http://rittergrounds.com/">http://rittergrounds.com/</a></td>
<td>Tom Ritter, <a href="mailto:tom@rittergrounds.com">tom@rittergrounds.com</a>, 650-5901</td>
<td>$ 3,487.36</td>
<td>Was only company to give me a quote</td>
</tr>
</tbody>
</table>

### Considerations

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Recommendation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduit</td>
<td>Paint all conduit to match the color of the wall it is set on so it blends better.</td>
<td>*Note this may be multiple colors-brick wall and soffit/fascia background color</td>
</tr>
<tr>
<td>WW Fan Equipment</td>
<td>Have the starter box for the fan powder coated to match gutters if the box is in the public’s view and</td>
<td>*Ensure this does not void warranty</td>
</tr>
<tr>
<td>Plants / landscaping</td>
<td>Will be specific to each facility</td>
<td>*Desired for native to this area of Virginia, hearty, evergreen and low/minimal</td>
</tr>
<tr>
<td>Address Plaques</td>
<td>Standard is Black background and white lettering - see standard</td>
<td>*May need to consider color of plaque to match color scheme of station</td>
</tr>
<tr>
<td>Fencing</td>
<td>No full panel or privacy; preferably no fencing if possible; use decorative or vegetation</td>
<td></td>
</tr>
<tr>
<td>Shutters</td>
<td>Will be specific to each facility</td>
<td>*may not always be used</td>
</tr>
<tr>
<td>Safety Signage</td>
<td>See standard</td>
<td></td>
</tr>
<tr>
<td>mailbox</td>
<td>must be small, locate to the side or back of building</td>
<td></td>
</tr>
<tr>
<td>Odor control system</td>
<td>try to obscure from public view</td>
<td>*use chimney stack, building alcove, decorative fencing/vegetation to block</td>
</tr>
<tr>
<td>Placement of equipment (new and when replacing existing equipment)</td>
<td>try to put as much as possible inside of the building and design the façade of the building around it</td>
<td>*Be thoughtful in the design this structure should be functional and esthetically pleasing</td>
</tr>
<tr>
<td>Lighting</td>
<td>add decorate and functional lighting that fits with the design or upgrade</td>
<td></td>
</tr>
<tr>
<td>Gutters</td>
<td>install 'leaf guard' type of system to ensure minimal/ zero maintenance</td>
<td></td>
</tr>
<tr>
<td>Roof Safety hook attachments</td>
<td>for future maintenance work on the building / safety requirement</td>
<td>*consult Ray Holmes</td>
</tr>
<tr>
<td>outlet boxes/other</td>
<td>blend these into the building/ if</td>
<td></td>
</tr>
<tr>
<td>Siding</td>
<td>hardiplank 8+-inch reveal; architectural siding or shingles</td>
<td></td>
</tr>
</tbody>
</table>
Attachment C – Address Sign Specification

HRSD Address Sign Standard Specification

In an effort for consistency, ease of maintenance HRSD has chosen a standard address plaque to be used for all new or beatification initiative projects (pump station, PRS and other). In most cases the background should be black with white lettering and trim. This sign should not include the street address but just the numbers. The Architectural Review Committee will approve any variation of the color scheme if it is recommended it be altered from the standard to match the structures esthetics.

The plaques have been ordered from Wayfair.com in the Cambridge 1 style; SKU: VFHD2596 but another vendor may be used if the specs are matched or better.

Weight and dimensions
Overall 6” H x 10.25” W x 0.32” D
Overall Product Weight 1.9 lb.

Features

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Wall Address Plaque; Lawn Address Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theme</td>
<td>Classic/Decorative</td>
</tr>
<tr>
<td>Plaque Shape</td>
<td>Arch</td>
</tr>
<tr>
<td>Text Capacity</td>
<td>Yes</td>
</tr>
<tr>
<td>Orientation</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Number of Lines</td>
<td>1</td>
</tr>
<tr>
<td>Number of Characters</td>
<td>4</td>
</tr>
<tr>
<td>Maximum Character Height</td>
<td>3 Inches</td>
</tr>
<tr>
<td>Primary Material</td>
<td>Aluminum</td>
</tr>
<tr>
<td>Primary Material Details</td>
<td>Cast in recycled aluminum</td>
</tr>
<tr>
<td>Country of Origin</td>
<td>United States</td>
</tr>
</tbody>
</table>

Sample Cambridge 1 – Line Address Plaque:
EMERGENCY CONTACT NUMBER
757-XXX-XXXX
EMERGENCY CONTACT NUMBER
757-XXX-XXXX

DANGER

NO SMOKING

HARD HAT AREA

HOT WORK PERMIT REQUIRED

CAUTION

NO TRESPASSING

HEARING PROTECTION REQUIRED

WHILE GENERATOR IS RUNNING

WATCH YOUR STEP
Sign Specifications:

Phone Number - Insert the appropriate phone number for each shore (NS, SS, SC)

Sizes:
10” X 8.5” small emergency #
10” x 20” larger, full info sign

- Black text
- Double lined boarder
- 040 Aluminum
- Printed on Oraray 3651 RA
- Laminated with Oraguard 210 (2+ year UV protection)
*This standard approved by HRSD General Manager and Safety Manager
2017
Project Map

Attachment E - Landscape Planning Plan Example

City Center Boulevard to Oyster Point Road Median Landscape Restoration

Legend

<table>
<thead>
<tr>
<th>Tree Type</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regal Prince Columnar Oak</td>
<td>10</td>
</tr>
<tr>
<td>Brandywine Red Maple</td>
<td>14</td>
</tr>
<tr>
<td>Muskogee Crape Myrtle</td>
<td>70</td>
</tr>
<tr>
<td>Chinese Pistache</td>
<td>22</td>
</tr>
<tr>
<td>Nghtower Willow Oak</td>
<td>24</td>
</tr>
<tr>
<td>Bosque Lacebark Elm</td>
<td>30</td>
</tr>
</tbody>
</table>
Section 3 - Use of Technical Memorandum for CIP Projects

A. **Introduction** - HRSD and our Professional Services firms have used technical memorandum to summarize design criteria and equipment recommendations on many of our past projects. A technical memorandum is typically more limited in scope than a Preliminary Engineering Report (PER) and is normally used to document project decisions rather than review numerous aspects of a conceptual design.

B. **Circumstances for Use** - A technical memorandum can be used instead of a PER in the following circumstances:

1. When the project is of a relatively small size (<$500K)
2. When the project involves a relocation of an existing HRSD pipeline as part of a VDOT or Locality administered roadway project that impacts HRSD’s facilities
3. When an immediate decision is required due to a documented time constraint by HRSD
4. When a series of technical memorandum will be used and ultimately grouped together in a PER

C. **Approval for Use** - The use of a technical memorandum instead of a PER shall only be used with approval by the Chief of Design and Construction.

*End of Section*
Section 4 – Monthly Project Status Reporting

A. Introduction - Professional Services firms (FIRM), who are contracted for project design and construction related services, are required to generate and submit a project status report along with their monthly payment request for services rendered, in addition to other required forms. This Section contains specific guidelines for FIRMs to follow related to content and format of these project status reports.

B. Content and Format for Project Status Report (Part 1)

1. The template in “Exhibit A” shall be used by each FIRM for any capital and/or non-capital funded project unless otherwise agreed to by the HRSD Project Manager / Task Manager in writing as part of the Record of Negotiation.

2. The Project Status Report shall be updated monthly and submitted along with the payment request.
   b. For Non-Capital Projects – submit to either the Project Manager or Contract Specialist per specific request.

C. Content and Format for Project Expenditure Tracking (Part 2)

1. The example graph in “Exhibit B” shall be generated by each FIRM for any capital and/or non-capital funded project unless otherwise agreed to by the HRSD Project Manager / Task Manager in writing as part of the Record of Negotiation. For each assigned phase of a project, the graph to reflect the following:
   a. Originally forecast project spending based upon the negotiated services fee.
   b. Actual expenditures by the FIRM tracked monthly.
   c. Adjustment of fee and scope of services via an approved amendment to the negotiated services for the active phase of work.

2. The Project Status Report shall be updated monthly and submitted along with the payment request and Part 1 of the Project Status Report.
   a. For Capital Projects – submit via HRSD ERP.
   b. For Non-Capital Projects – submit to either the Project Manager or Contract Specialist per specific request.
Exhibit A

HRSD CONSULTANT PROGRESS REPORT
FOR
[INSERT PROJECT NAME AND CIP #]
FOR PERIOD FROM [INSERT START DATE] TO [INSERT END DATE]

General Status:

[Provide a high level status update including project phase in 1-2 sentences.]

Work Completed by Consultant:

[Provide a detailed summary of work completed during the progress period. CA/CI summary tables may be deleted if the project is not in the Construction phase.]

➢ Example 1 (Design). Addressed HRSD’s 90% review comments and prepared site plan submittal
➢ Example 2 (Construction). Conducted and documented Progress Meeting No. 1 on 1/1/2011
➢ Example 3 (Construction). Prepared and issued Work Change Direction No. 1 regarding vertical offset around storm drain

Construction Administration Summary:

<table>
<thead>
<tr>
<th>Items Reviewed / Issued</th>
<th>Total – This Period</th>
<th>Project Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submittals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requests for Information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requests for Proposal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Orders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work Change Directives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change Orders</td>
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<td></td>
</tr>
<tr>
<td>Payment Applications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progress Meetings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Meetings</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Construction Inspection Summary:

<table>
<thead>
<tr>
<th>Week Beginning (Monday)</th>
<th>No. of Hours (Inspector Name #1)</th>
<th>No. of Hours (Inspector Name #2)</th>
<th>No. of Hours (Inspector Name #3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/2/2016</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5/9/2016</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[*Note: If there are more than three inspectors, you may list hours by discipline (e.g. general, electrical, structural, etc.) or consult the HRSD Project Manager.]
Work Completed by Contractor:

[During the construction phase, provide a brief summary of construction activities conducted during the progress period.]

➢ Example 1. Finished laying pipe from First Street to Tenth Street and performed pressure test

Upcoming Activities:

➢ [List work to be completed in the next 30 days by the consultant.]

Problems / Deviations from Plan:

➢ [List any scope changes during the design phase, major changes to the design documents during construction, or any other problems/deviations encountered.]

Information / Approvals Needed:

➢ [List any information or approvals needed from HRSD, a Locality, a Regulatory Agency, a Railroad, another utility, etc.]

Additional Services Request for Payment:

[Use of Additional Services requires prior authorization. Provide a list of authorized additional services invoiced during this period and include the necessary documentation.]

➢ Example 1. Public meeting conducted by Engineer ($Dollar Amount)

➢ Example 2. Additional test holes performed by Subsurface Utility Provider ($Dollar Amount)

Potential Upcoming Commission Items:

➢ [Describe any items that may require HRSD Commission Action in the next 60 days with estimated cost and schedule implication.]
End of Section
Section 5 - Capital Project Cost, Schedule and Risk Reporting

A. Introduction - The Director of Engineering has been providing quarterly briefings to the Commission that include information on the performance of staying on schedule and within budget for capital projects. Comparisons are made to actual project budget verses planned project budget, and actual project duration verses planned project duration for each capital project underway with PER, design, or construction efforts. Both project costs and schedules tend to grow higher and longer due to a number of justified reasons as compared to the figures that HRSD includes in our published CIP manual. For projects such as those included in the EPA Rehabilitation Action Plan where missing a completion deadline comes with stipulated penalties and damage to our credibility, it is critical that HRSD have accurate assessment of schedules, costs, and risks that may jeopardize these desired outcomes.

HRSD has adopted the Association for the Advancement of Cost Engineering (AACE) construction cost estimate classes for the various stages of study and plan development as listed below. These classifications are to be used for reporting to HRSD at these described milestones the Opinion of Probable Construction Costs (OPCC) along with the upper and lower range of the class estimate.

- **Class 5**: up to 2% project definition (Initial Budget Development stage) with expected accuracy range of -20% to -50% under and +30% to +100% above calculated cost.
- **Class 4**: project definition between 1% and 15% (Study or PER stage) with expected accuracy range of -15% to -30% under and +20% to +50% above calculated cost.
- **Class 3**: project definition between 10% and 40% (Preliminary Design stage) with expected accuracy range of -10% to -20% under and +10% to +30% above calculated cost.
- **Class 2**: project definition between 30% and 70% (Pre-Final Design stage) with expected accuracy range of -5% to -15% under and +5% to +20% above calculated cost.
- **Class 1**: project definition between 70% and 100% (Bid Advertisement or Preconstruction stage) with expected accuracy range of -3% to -10% under and +3% to +15% above calculated cost.

This Section identifies tracking total project costs, OPCC, schedule and risks to cost / schedule against the CIP baseline during the life of each project. HRSD desires to learn what is happening on individual projects as well as have an opportunity to make changes to compress budget or schedule at earlier stages if needed. Cost estimates should include design, construction, land acquisition and all other project related costs.

B. Professional Services Firm (FIRM) Responsibilities - The FIRM shall provide a report to HRSD’s Project Manager for each project that details the projected completion project costs; duration to reach both Substantial Completion and Final Completion; anticipated risks to these updated costs and durations for each project, and a discussion on possible risk mitigation measures for schedule and budget recovery.

1. Each report will reflect the original CIP project schedule and budget, as well as the previous stage report findings on schedule, budget, and risks.
2. This singular report for each CIP project will be modified and updated such that all information throughout the life of the project will be contained in a single document. The document will be in format as approved by the HRSD Project Manager and will accompany the monthly payment request unless otherwise approved by the HRSD Project Manager.

C. An example of a report for a hypothetical CIP in shown in Exhibit A. The FIRM to coordinate with the HRSD Project Manager on proposed format for this type report.

D. A template summary report for Project Estimate History and AACE Classification reporting is included as Exhibit B.
# Exhibit A – Project Costs, Schedule and Risks Report

## CIP Baseline at Activity Start (June 1, 2015)

### Capital Budget:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Costs</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning</td>
<td>$142,885</td>
<td>All project costs prior to start of PER.</td>
</tr>
<tr>
<td>PER:</td>
<td>$196,467</td>
<td>Professional Services costs as well as all other PER phase costs</td>
</tr>
<tr>
<td>Design:</td>
<td>$375,073</td>
<td>Professional Services costs, condition assessment, easements, as well as all other Design Phase costs</td>
</tr>
<tr>
<td>Pre-Construction:</td>
<td>$71,442</td>
<td>Bid stage activities</td>
</tr>
<tr>
<td>Construction:</td>
<td>$5,715,400</td>
<td>Includes CA/CI costs, construction contract, and all other construction phase costs</td>
</tr>
<tr>
<td>Estimated Program Cost:</td>
<td>$6,501,267</td>
<td></td>
</tr>
<tr>
<td>Contingency (20%):</td>
<td>$1,143,080</td>
<td>Contingency set at 20%</td>
</tr>
<tr>
<td>Estimated Project Cost:</td>
<td>$7,644,347</td>
<td></td>
</tr>
</tbody>
</table>

### Schedule:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Schedule</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning start:</td>
<td>June 2015</td>
<td>5 month duration</td>
</tr>
<tr>
<td>PER start:</td>
<td>November 2015</td>
<td>8 month duration</td>
</tr>
<tr>
<td>Design start:</td>
<td>July 2016</td>
<td>21 month duration</td>
</tr>
<tr>
<td>Pre-Construction start:</td>
<td>April 2018</td>
<td>4 month duration</td>
</tr>
<tr>
<td>Construction start:</td>
<td>August 2018</td>
<td>21 month duration</td>
</tr>
<tr>
<td>Project Completion:</td>
<td>May 2020</td>
<td></td>
</tr>
</tbody>
</table>

### Risk Assessment and Mitigation Discussion:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Risk Assessment</th>
<th>Risk Mitigation Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning:</td>
<td>Professional Services Selection delayed from original schedule by 1 month. Likely impact to remainder of schedule.</td>
<td>Evaluate compressing PER or Design phase to account for lost time.</td>
</tr>
<tr>
<td>PER:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Construction:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Completion:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Updated Capital Budget:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Revised Costs</th>
<th>% Change from CIP Baseline</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning:</td>
<td>$0</td>
<td>-100%</td>
<td>Delta: -$142,885. The earlier anticipated costs for this phase were reassigned under Design.</td>
</tr>
<tr>
<td>PER:</td>
<td>$250,000</td>
<td>+27%</td>
<td>Delta: +$53,533. Negotiated PER work including Additional Services for SUE and meetings with Virginia Beach, Norfolk, and other stakeholders.</td>
</tr>
<tr>
<td>Design:</td>
<td>$550,000</td>
<td>+47%</td>
<td>Delta: +$174,927. Incorporation of additional pipe condition assessment and hydraulic modeling for alternate pipe diameters.</td>
</tr>
<tr>
<td>Pre-Construction:</td>
<td>$25,000</td>
<td>-65%</td>
<td>Delta: -$46,442. Closer estimate of costs to be expended during Construction bid and award stage.</td>
</tr>
<tr>
<td>Construction:</td>
<td>$7,000,000</td>
<td>+20%</td>
<td>Delta: +$1,284,600. Complexity of construction along corridor and alternatives.</td>
</tr>
<tr>
<td>Estimated Program Cost:</td>
<td>$7,825,000</td>
<td>+20%</td>
<td>Delta: +$1,323,733.</td>
</tr>
<tr>
<td>Contingency (20%):</td>
<td>$1,565,000</td>
<td>+37%</td>
<td>Delta: +$421,920.</td>
</tr>
<tr>
<td>Estimated Project Cost:</td>
<td>$9,393,000</td>
<td>+23%</td>
<td>Delta: +$1,745,653.</td>
</tr>
</tbody>
</table>

### Updated Schedule:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Revised Schedule</th>
<th>% Change from CIP Baseline</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning start:</td>
<td>July 2015</td>
<td>0%</td>
<td>Delta: +1 month from baseline date.</td>
</tr>
<tr>
<td>PER start:</td>
<td>December 2015</td>
<td>0%</td>
<td>Delta: +1 month from baseline date. Same duration as baseline between pre-planning and PER start.</td>
</tr>
<tr>
<td>Design start:</td>
<td>August 2016</td>
<td>0%</td>
<td>Delta: +1 month from baseline date. Same duration as baseline for PER phase.</td>
</tr>
<tr>
<td>Pre-Construction start:</td>
<td>October 2017</td>
<td>-28%</td>
<td>Delta: -6 months from baseline date. Duration reduced to 15 months from baseline duration of 21 months for Design phase to reach bid ready stage.</td>
</tr>
<tr>
<td>Construction start:</td>
<td>February 2018</td>
<td>0%</td>
<td>Delta: -6 months from baseline date. Same duration as baseline for pre-construction phase.</td>
</tr>
<tr>
<td>Project Completion:</td>
<td>February 2020</td>
<td>+14%</td>
<td>Delta: -3 months from baseline date. Duration is 3 months longer than the baseline Construction phase of 21 months due to constructability issues.</td>
</tr>
</tbody>
</table>
## Risk Assessment and Mitigation Discussion:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Risk Assessment</th>
<th>Risk Mitigation Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>PER:</td>
<td>Several alternative routes identified in the PER that have higher projected construction costs and longer construction schedules as compared to the preliminary recommended route and pipe length.</td>
<td>Explore alternate construction means and methods to reduce cost.</td>
</tr>
<tr>
<td>Design:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Construction:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction:</td>
<td>Depending on the pipe alignment selected by HRSD, the construction could result in higher traffic disruption and therefore limited work hours / days by either Norfolk or Virginia Beach.</td>
<td>Coordinate with locality traffic maintenance group to clarify expectations and collaborate on construction duration reducing opportunities.</td>
</tr>
<tr>
<td>Project Completion:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Final PER (July 1, 2016)

Updated Capital Budget:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Revised Costs</th>
<th>% Change from CIP Baseline</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning:</td>
<td>$0</td>
<td>-100%</td>
<td>Delta: -$142,885. The earlier anticipated costs for this phase were reassigned under Design.</td>
</tr>
<tr>
<td>PER:</td>
<td>$250,000</td>
<td>+27%</td>
<td>Delta: +$53,533. Negotiated PER work including Additional Services for SUE and meetings with Virginia Beach, Norfolk, and other stakeholders.</td>
</tr>
<tr>
<td>Design:</td>
<td>$550,000</td>
<td>+47%</td>
<td>Delta: +$174,927. Incorporation of additional pipe condition assessment and hydraulic modeling for alternate pipe diameters.</td>
</tr>
<tr>
<td>Pre-Construction:</td>
<td>$25,000</td>
<td>-65%</td>
<td>Delta: -$46,442. Closer estimate of costs to be expended during Construction bid and award stage.</td>
</tr>
<tr>
<td>Construction:</td>
<td>$7,200,000</td>
<td>+26%</td>
<td>Delta: +$1,484,600. A pipe alignment selected by HRSD from PER alternatives that added more length to avoid future O&amp;M issues.</td>
</tr>
<tr>
<td>Estimated Program Cost:</td>
<td>$8,025,000</td>
<td>+23%</td>
<td>Delta: +$1,523,733.</td>
</tr>
<tr>
<td>Contingency (15%):</td>
<td>$1,203,750</td>
<td>+5%</td>
<td>Delta: +$60,670. Contingency adjusted to 15%.</td>
</tr>
<tr>
<td>Estimated Project Cost:</td>
<td>$9,228,750</td>
<td>+21%</td>
<td>Delta: +$1,584,403.</td>
</tr>
</tbody>
</table>

Updated Schedule:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Revised Schedule</th>
<th>% Change from CIP Baseline</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning start:</td>
<td>July 2015</td>
<td>0%</td>
<td>Delta: +1 month from baseline date.</td>
</tr>
<tr>
<td>PER start:</td>
<td>December 2015</td>
<td>0%</td>
<td>Delta: +1 month from baseline date. Same duration as baseline between pre-planning and PER start.</td>
</tr>
<tr>
<td>Design start:</td>
<td>August 2016</td>
<td>0%</td>
<td>Delta: +1 month from baseline date. Same duration as baseline for PER phase.</td>
</tr>
<tr>
<td>Pre-Construction start:</td>
<td>October 2017</td>
<td>-28%</td>
<td>Delta: -6 months from baseline date. Duration reduced to 15 months from baseline duration of 21 months for Design phase to reach bid ready stage.</td>
</tr>
<tr>
<td>Construction start:</td>
<td>February 2018</td>
<td>0%</td>
<td>Delta: -6 months from baseline date. Same duration as baseline for pre-construction phase.</td>
</tr>
</tbody>
</table>
Project Completion: February 2020  +14%  Delta: -3 months from baseline date. Duration is 3 months longer than the baseline Construction phase of 21 months due to constructability concerns.

Risk Assessment and Mitigation Discussion:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Risk Assessment</th>
<th>Risk Mitigation Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>PER:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>Design:</td>
<td>The timing for construction of the new Outlet Mall and access road may create coordination issues and adjustments for the design phase.</td>
<td></td>
</tr>
<tr>
<td>Pre-Construction:</td>
<td></td>
<td>Coordinate with Developer and Locality to clarify expectations and collaborate on construction duration reductions and ways to lessen anticipated disruptive construction impacts.</td>
</tr>
<tr>
<td>Construction:</td>
<td>The timing for construction of the new Outlet Mall and access road may create coordination issues and adjustments for the construction phase. Construction could result in higher traffic disruption and therefore limited work hours / days by either Norfolk or Virginia Beach.</td>
<td></td>
</tr>
<tr>
<td>Project Completion:</td>
<td>Issues discussed above may delay project completion.</td>
<td></td>
</tr>
</tbody>
</table>
90% Design (August 1, 2017)

Updated Capital Budget:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Revised Costs</th>
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<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning:</td>
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<td>-100%</td>
<td>Delta: -$142,885. The earlier anticipated costs for this phase were reassigned under Design.</td>
</tr>
<tr>
<td>PER:</td>
<td>$250,000</td>
<td>+27%</td>
<td>Delta: +$53,533. Negotiated PER work including Additional Services for SUE and meetings with Virginia Beach, Norfolk, and other stakeholders.</td>
</tr>
<tr>
<td>Design:</td>
<td>$580,000</td>
<td>+55%</td>
<td>Delta: +$204,927. Incorporation of additional pipe condition assessment, hydraulic modeling for alternate pipe diameters, detailed traffic maintenance plans for both Norfolk and Va Beach.</td>
</tr>
<tr>
<td>Pre-Construction</td>
<td>$25,000</td>
<td>-65%</td>
<td>Delta: -$46,442. Closer estimate of costs to be expended during Construction bid and award stage.</td>
</tr>
<tr>
<td>Construction:</td>
<td>$7,200,000</td>
<td>+26%</td>
<td>Delta: +$1,484,600. A pipe alignment selected by HRSD from PER alternatives that added more length to avoid future O&amp;M issues.</td>
</tr>
<tr>
<td>Estimated Program Cost:</td>
<td>$8,055,000</td>
<td>+24%</td>
<td>Delta: +$1,553,733.</td>
</tr>
<tr>
<td>Contingency (10%):</td>
<td>$805,500</td>
<td>-30%</td>
<td>Delta: -$337,580. Contingency adjusted to 10%.</td>
</tr>
<tr>
<td>Estimated Project Cost:</td>
<td>$8,860,500</td>
<td>+16%</td>
<td>Delta: +$1,216,153.</td>
</tr>
</tbody>
</table>

Updated Schedule:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Revised Schedule</th>
<th>% Change from CIP Baseline</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning start:</td>
<td>July 2015</td>
<td>0%</td>
<td>Delta: +1 month from baseline date.</td>
</tr>
<tr>
<td>PER start:</td>
<td>December 2015</td>
<td>0%</td>
<td>Delta: +1 month from baseline date. Same duration as baseline between pre-planning and PER start.</td>
</tr>
<tr>
<td>Design start:</td>
<td>August 2016</td>
<td>0%</td>
<td>Delta: +1 month from baseline date. Same duration as baseline for PER phase.</td>
</tr>
<tr>
<td>Pre-Construction start:</td>
<td>October 2017</td>
<td>-24%</td>
<td>Delta: -5 months from baseline date. One month added to Design duration evaluated at Final PER for total of 16 months for additional review times for Norfolk and Virginia Beach.</td>
</tr>
<tr>
<td>Construction start:</td>
<td>March 2018</td>
<td>0%</td>
<td>Delta: -5 months from baseline date. Same duration as baseline for pre-construction phase.</td>
</tr>
</tbody>
</table>
**Project Completion:**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Risk Assessment</th>
<th>Risk Mitigation Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>PER:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>Design:</td>
<td>Final review and approval by cities of Norfolk and Virginia Beach.</td>
<td>Clarify with locality the plan approval process.</td>
</tr>
<tr>
<td>Pre-Construction:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction:</td>
<td>The timing for construction of the new Outlet Mall and access road will create coordination issues during the construction phase if changes by either HRSD contractor or developer of outlet mall from current state. Construction could result in higher traffic disruption and therefore limited work hours / days by either Norfolk or Virginia Beach.</td>
<td>Consider frequent meetings between locality, developer team, and HRSD team to heighten opportunities for early knowledge of conflicting matters and schedules for collaboration decisions.</td>
</tr>
<tr>
<td>Project Completion:</td>
<td>Issues discussed above may delay project completion.</td>
<td></td>
</tr>
</tbody>
</table>
PreConstruction (October 1, 2017)

Updated Capital Budget:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Revised Costs</th>
<th>% Change from CIP Baseline</th>
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<tbody>
<tr>
<td>Pre-planning:</td>
<td>$0</td>
<td>-100%</td>
<td>Delta: -$142,885. The earlier anticipated costs for this phase were reassigned under Design.</td>
</tr>
<tr>
<td>PER:</td>
<td>$250,000</td>
<td>+27%</td>
<td>Delta: +$53,533. Negotiated PER work including Additional Services for SUE and meetings with Virginia Beach, Norfolk, and other stakeholders.</td>
</tr>
<tr>
<td>Design:</td>
<td>$580,000</td>
<td>+55%</td>
<td>Delta: +$204,927. Incorporation of additional pipe condition assessment, hydraulic modeling for alternate pipe diameters, detailed traffic maintenance plans for both Norfolk and Va Beach.</td>
</tr>
<tr>
<td>Pre-Construction</td>
<td>$21,000</td>
<td>-71%</td>
<td>Delta: -$50,442. Actual expenditures.</td>
</tr>
<tr>
<td>Construction:</td>
<td>$7,003,000</td>
<td>+23%</td>
<td>Delta: +$1,287,600. New figures based on OPCC and construction schedule.</td>
</tr>
<tr>
<td>Estimated Program Cost:</td>
<td>$7,854,000</td>
<td>+20%</td>
<td>Delta: +$1,352,733.</td>
</tr>
<tr>
<td>Contingency (5%):</td>
<td>$392,700</td>
<td>-64%</td>
<td>Delta: -$750,380. Contingency adjusted to 5%.</td>
</tr>
<tr>
<td>Estimated Project Cost:</td>
<td>$8,246,700</td>
<td>+8%</td>
<td>Delta: +$602,353.</td>
</tr>
</tbody>
</table>

Updated Schedule:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Revised Schedule</th>
<th>% Change from CIP Baseline</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning start:</td>
<td>July 2015</td>
<td>0%</td>
<td>Delta: +1 month from baseline date.</td>
</tr>
<tr>
<td>PER start:</td>
<td>December 2015</td>
<td>0%</td>
<td>Delta: +1 month from baseline date. Same duration as baseline between pre-planning and PER start.</td>
</tr>
<tr>
<td>Design start:</td>
<td>August 2016</td>
<td>0%</td>
<td>Delta: +1 month from baseline date. Same duration as baseline for PER phase.</td>
</tr>
<tr>
<td>Pre-Construction start:</td>
<td>October 2017</td>
<td>-24%</td>
<td>Delta: -5 months from baseline date. One month added to Design duration evaluated at Final PER for total of 16 months for additional review times for Norfolk and Virginia Beach.</td>
</tr>
<tr>
<td>Construction start:</td>
<td>March 2018</td>
<td>0%</td>
<td>Delta: -5 months from baseline date. Same duration as baseline for pre-construction phase.</td>
</tr>
<tr>
<td>Project Completion:</td>
<td>December 2019</td>
<td>+5%</td>
<td>Delta: -5 months from baseline date. Duration is 1 month longer than the baseline Construction phase of 21 months due to Bid Document allowable duration.</td>
</tr>
</tbody>
</table>

Section 5  5-10  January 2020
### Risk Assessment and Mitigation Discussion:

<table>
<thead>
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<th>Phase</th>
<th>Risk Assessment</th>
<th>Risk Mitigation Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning:</td>
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<td></td>
</tr>
<tr>
<td>PER:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>Design:</td>
<td>Final review and approval by cities of Norfolk and Virginia Beach.</td>
<td>Clarify with locality the plan approval process.</td>
</tr>
<tr>
<td>Pre-Construction:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction:</td>
<td>The timing for construction of the new Outlet Mall and access road will create coordination issues during the construction phase if changes by either HRSD contractor or developer of outlet mall. Construction could result in higher traffic disruption and therefore limited work hours / days by either Norfolk or Virginia Beach.</td>
<td>Consider frequent meetings between locality, developer team, and HRSD team to heighten opportunities for early knowledge of conflicting matters and schedules for collaboration decisions.</td>
</tr>
<tr>
<td>Project Completion:</td>
<td>Issues discussed above may delay project completion.</td>
<td></td>
</tr>
</tbody>
</table>
Evaluation of Construction Bids  (November 1, 2017)

Updated Capital Budget:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Revised Costs</th>
<th>% Change from CIP Baseline</th>
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<td>$250,000</td>
<td>+27%</td>
<td>Delta: +$53,533. Negotiated PER work including Additional Services for SUE and meetings with Virginia Beach, Norfolk, and other stakeholders.</td>
</tr>
<tr>
<td>Design:</td>
<td>$580,000</td>
<td>+55%</td>
<td>Delta: +$204,927. Incorporation of additional pipe condition assessment, hydraulic modeling for alternate pipe diameters, detailed traffic maintenance plans for both Norfolk and Va Beach.</td>
</tr>
<tr>
<td>Pre-Construction:</td>
<td>$21,000</td>
<td>-71%</td>
<td>Delta: -$50,442. Actual expenditures.</td>
</tr>
<tr>
<td>Construction:</td>
<td>$6,927,150</td>
<td>+21%</td>
<td>Delta: +$1,211,750. Lowest responsible and responsive bid was less than OPCC.</td>
</tr>
<tr>
<td>Estimated Program Cost:</td>
<td>$7,778,150</td>
<td>+20%</td>
<td>Delta: +$1,276,883.</td>
</tr>
<tr>
<td>Contingency (5%):</td>
<td>$388,908</td>
<td>-66%</td>
<td>Delta: -$754,172. Contingency held at 5%.</td>
</tr>
<tr>
<td>Estimated Project Cost:</td>
<td>$8,167,058</td>
<td>+7%</td>
<td>Delta: +$522,711.</td>
</tr>
</tbody>
</table>

Updated Schedule:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Revised Schedule</th>
<th>% Change from CIP Baseline</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning start:</td>
<td>July 2015</td>
<td>0%</td>
<td>Delta: +1 month from baseline date.</td>
</tr>
<tr>
<td>PER start:</td>
<td>December 2015</td>
<td>0%</td>
<td>Delta: +1 month from baseline date. Same duration as baseline between pre-planning and PER start.</td>
</tr>
<tr>
<td>Design start:</td>
<td>August 2016</td>
<td>0%</td>
<td>Delta: +1 month from baseline date. Same duration as baseline for PER phase.</td>
</tr>
<tr>
<td>Pre-Construction start:</td>
<td>October 2017</td>
<td>-24%</td>
<td>Delta: -5 months from baseline date. One month added to Design duration evaluated at Final PER for total of 16 months for additional review times for Norfolk and Virginia Beach.</td>
</tr>
<tr>
<td>Construction start:</td>
<td>March 2018</td>
<td>0%</td>
<td>Delta: -5 months from baseline date. Same duration as baseline for pre-construction phase.</td>
</tr>
<tr>
<td>Project Completion:</td>
<td>December 2019</td>
<td>+5%</td>
<td>Delta: -5 months from baseline date. Duration is 1 month longer than the baseline Construction phase of 21 months due to Bid Document allowable duration.</td>
</tr>
</tbody>
</table>
## Risk Assessment and Mitigation Discussion:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Risk Assessment</th>
<th>Risk Mitigation Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>PER:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>Design:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>Pre-Construction:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>Construction:</td>
<td>The timing for construction of the new Outlet Mall and access road will create coordination issues during the construction phase if changes by either HRSD contractor or developer of outlet mall. Construction could result in higher traffic disruption and therefore limited work hours / days by either Norfolk or Virginia Beach.</td>
<td>Consider frequent meetings between locality, developer team, and HRSD team to heighten opportunities for early knowledge of conflicting matters and schedules for collaboration decisions.</td>
</tr>
<tr>
<td>Project Completion:</td>
<td>Issues discussed above may delay project completion.</td>
<td></td>
</tr>
</tbody>
</table>
Mid Point of Construction  (January 1, 2019)

Updated Capital Budget:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Revised Costs</th>
<th>% Change from CIP Baseline</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning:</td>
<td>$0</td>
<td>-100%</td>
<td>Delta: -$142,885. The earlier anticipated costs for this phase were reassigned under Design.</td>
</tr>
<tr>
<td>PER:</td>
<td>$250,000</td>
<td>+27%</td>
<td>Delta: +$53,533. Negotiated PER work including Additional Services for SUE and meetings with Virginia Beach, Norfolk, and other stakeholders.</td>
</tr>
<tr>
<td>Design:</td>
<td>$580,000</td>
<td>+55%</td>
<td>Delta: +$204,927. Incorporation of additional pipe condition assessment, hydraulic modeling for alternate pipe diameters, detailed traffic maintenance plans for both Norfolk and Va Beach.</td>
</tr>
<tr>
<td>Pre-Construction:</td>
<td>$21,000</td>
<td>-71%</td>
<td>Delta: -$50,442. Actual expenditures.</td>
</tr>
<tr>
<td>Construction:</td>
<td>$7,027,150</td>
<td>+23%</td>
<td>Delta: +$1,311,750. Approved Change Orders of $30,000 (Owner Requested) and $70,000 (field changes).</td>
</tr>
</tbody>
</table>

Updated Program Cost: $7,878,150 +21% Delta: +$1,376,883.

Contingency (5%): $393,908 -65% Delta: -$749,172. Contingency held at 5%.

Estimated Project Cost: $8,272,058 +8% Delta: +$627,711.

Updated Schedule:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Revised Schedule</th>
<th>% Change from CIP Baseline</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning start:</td>
<td>July 2015</td>
<td>0%</td>
<td>Delta: +1 month from baseline date.</td>
</tr>
<tr>
<td>PER start:</td>
<td>December 2015</td>
<td>0%</td>
<td>Delta: +1 month from baseline date. Same duration as baseline between pre-planning and PER start.</td>
</tr>
<tr>
<td>Design start:</td>
<td>August 2016</td>
<td>0%</td>
<td>Delta: +1 month from baseline date. Same duration as baseline for PER phase.</td>
</tr>
<tr>
<td>Pre-Construction start:</td>
<td>October 2017</td>
<td>-24%</td>
<td>Delta: -5 months from baseline date. One month added to Design duration evaluated at Final PER for total of 16 months for additional review times for Norfolk and Virginia Beach.</td>
</tr>
<tr>
<td>Construction start:</td>
<td>March 2018</td>
<td>0%</td>
<td>Delta: -5 months from baseline date. Same duration as baseline for pre-construction phase.</td>
</tr>
<tr>
<td>Project Completion:</td>
<td>January 2020</td>
<td>+10%</td>
<td>Delta: -4 months from baseline date. Duration is 2 month longer than the baseline Construction phase of 21 months due to Bid Document allowable duration + 30 day CO time extension.</td>
</tr>
</tbody>
</table>
Risk Assessment and Mitigation Discussion:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Risk Assessment</th>
<th>Risk Mitigation Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>PER:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>Design:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>Pre-Construction:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>Construction:</td>
<td>Likelihood of addition change orders for</td>
<td>Evaluation of additional subsurface explorations ahead of Contractor's installation crews to</td>
</tr>
<tr>
<td></td>
<td>time extension and costs due to conflicts</td>
<td>heighten efficiency.</td>
</tr>
<tr>
<td></td>
<td>with undocumented private utilities along</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the force main corridor.</td>
<td></td>
</tr>
<tr>
<td>Project Completion:</td>
<td>Issues discussed above may delay project</td>
<td></td>
</tr>
<tr>
<td></td>
<td>completion.</td>
<td></td>
</tr>
</tbody>
</table>
Construction Closeout (February 1, 2020)

Updated Capital Budget:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Revised Costs</th>
<th>% Change from CIP Baseline</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning:</td>
<td>$0</td>
<td>-100%</td>
<td>Delta: -$142,885. The earlier anticipated costs for this phase were reassigned under Design.</td>
</tr>
<tr>
<td>PER:</td>
<td>$250,000</td>
<td>+27%</td>
<td>Delta: +$53,533. Negotiated PER work including Additional Services for SUE and meetings with Virginia Beach, Norfolk, and other stakeholders.</td>
</tr>
<tr>
<td>Design:</td>
<td>$580,000</td>
<td>+55%</td>
<td>Delta: +$204,927. Incorporation of additional pipe condition assessment, hydraulic modeling for alternate pipe diameters, detailed traffic maintenance plans for both Norfolk and Va Beach.</td>
</tr>
<tr>
<td>Pre-Construction:</td>
<td>$21,000</td>
<td>-71%</td>
<td>Delta: -$50,442. Actual expenditures.</td>
</tr>
<tr>
<td>Construction:</td>
<td>$7,127,150</td>
<td>+25%</td>
<td>Delta: +$1,411,750. Additional approved Change Orders of $60,000 (field changes) plus additional $40,000 in CA/CI for approved time extension.</td>
</tr>
<tr>
<td>Contingency (0%):</td>
<td>$0</td>
<td>-100%</td>
<td>Delta: -$1,143,080. No contingencies.</td>
</tr>
</tbody>
</table>

Updated Schedule:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Revised Schedule</th>
<th>% Change from CIP Baseline</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning start:</td>
<td>July 2015</td>
<td>0%</td>
<td>Delta: +1 month from baseline date.</td>
</tr>
<tr>
<td>PER start:</td>
<td>December 2015</td>
<td>0%</td>
<td>Delta: +1 month from baseline date. Same duration as baseline between pre-planning and PER start.</td>
</tr>
<tr>
<td>Design start:</td>
<td>August 2016</td>
<td>0%</td>
<td>Delta: +1 month from baseline date. Same duration as baseline for PER phase.</td>
</tr>
<tr>
<td>Pre-Construction start:</td>
<td>October 2017</td>
<td>-24%</td>
<td>Delta: -5 months from baseline date. One month added to Design duration evaluated at Final PER for total of 16 months for additional review times for Norfolk and Virginia Beach.</td>
</tr>
<tr>
<td>Construction start:</td>
<td>March 2018</td>
<td>0%</td>
<td>Delta: -5 months from baseline date. Same duration as baseline for pre-construction phase.</td>
</tr>
</tbody>
</table>
Project Completion: February 2020  
+14%  
Delta: -3 months from baseline date. Duration is 3 month longer than the baseline Construction phase of 21 months due to Bid Document allowable duration + 60 day CO time extension.

Risk Assessment and Mitigation Discussion:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Risk Assessment</th>
<th>Risk Mitigation Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-planning:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>PER:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>Design:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>Pre-Construction:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>Construction:</td>
<td>Closed out</td>
<td></td>
</tr>
<tr>
<td>Project Completion:</td>
<td></td>
<td>Document and incorporate lessons learned for planned and future projects.</td>
</tr>
</tbody>
</table>
Exhibit B – Project Estimate History and AACE Classification Report

CIP Project Name
CIP Project Number – Cost History and AACE Report

<table>
<thead>
<tr>
<th>Stage of Estimate</th>
<th>PER Costs</th>
<th>Design Costs</th>
<th>Bid Phase Costs</th>
<th>Construction Administration Costs</th>
<th>Construction Inspection Costs</th>
<th>Construction Costs</th>
<th>Total Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Budget Development [Class 5]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final PER [Class 4]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preliminary Design [Class 3]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Final Design [Class 2]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction Bid Advertisement [Class 1]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Round all estimates to nearest $1000.

End of Section
Section 6 - Drawings, Record Drawings and Valve Guides

A. Introduction – HRSD has in excess of 24,000 Record Drawings in an electronic form which are archived in a records management system based on the BlueCielo Meridian software program. Many drawings are in scanned (raster) format. Most of the recent drawings and all valve guides are in vector format. Some drawings are hybrid images. HRSD accepts Record Drawings only in AutoCAD format unless otherwise approved by the HRSD GIS Manager. Record Drawings must be provided in full-scale paper copy, Adobe Acrobat (PDF), and AutoCAD format up to the latest release used by HRSD at the time Record Drawings are received. The latest release is provided in each Request For Proposal (RFP). To provide some uniformity and to assist HRSD with its records management system, certain criteria have been established as described in the Section. The FIRM must submit an electronic copy of the conformed plans in both .DWG and .PDF to HRSD at the time of pre-construction meeting. This will allow HRSD to enter the plans into the records management system, verify compliance with HRSD standards and print copies for internal use during the construction phase of the project. HRSD has not adopted a comprehensive layering system for contract drawings. However, the FIRM must submit a listing of the proposed layering system to HRSD for review prior to beginning drawing preparation. Layers containing new or improved HRSD infrastructure must only contain such infrastructure and must be clearly identified in the layer listing (the FIRM is encouraged to use a prefix of HRSD_ for layers representing new or improved HRSD infrastructure). Due to the frequent need to modify valve guides, the layering system listed in the Valve Guide section below must be used in the preparation of valve guides. Once Record Drawings are received, approved and inputted, the advertised set will be deleted from the records management system.

B. Drawings

1. Size - Use 24 inch x 36 inch sheets. Prefer to limit actual area used to 22 inches x 34 inches to allow for true scale half size printing on an 11 inch x 17 inch page.

2. Scale - Use a scale for the plan view of gravity sewers and force mains of one inch equals 20 feet for urban areas and one inch equals 40 feet for rural areas or as appropriate. Indicate vertical scale on each profile view.

   a. Pipelines
      
      i. 1 inch = 40 feet in rural or low development areas
      ii. 1 inch = 20 feet in urban or high development areas
      iii. Use small scale for details

   b. Pump Stations and Treatment Plants – Site plans shall be at one inch = 20 feet

   c. Fonts - Use minimum letter size of one-tenth (1/10) inch to allow for good resolution when viewing drawings and for drawing use at half-size.

   d. Units - Drawings shall be prepared using English units (non-metric).
3. Title Block
   
   a. Locate across the bottom or right hand margin with the sheet number in the extreme lower right hand corner.
   
   b. Information – Include:
      
      i. Project title
      ii. Drawing title
      iii. Sheet number
      iv. FIRM's name
      v. Scale and graphical scale reference for one inch
      vi. Revision block
   
4. Required Sheets - Provide required sheets in the order listed as follows:
   
   a. Cover Sheet – Refer to Standard Details section in this manual.
   
   b. Location and Vicinity Map Sheet – Include datum and coordinate system used for design.
   
   c. Drawing Index Sheet – Index may be placed on cover or location sheet if the project includes less than 20 drawings. The Index Sheet must include the drawing number (ex: C-1), sheet number (a consecutive numbering scheme beginning with 1), and a drawing description (ex: “Yard Piping – Demolition Plan”).
   
   d. Legend Sheet – Include of all abbreviations and symbols used for design. Refer to Section 29 Treatment Plant in this manual for required plant process abbreviations.
   
   e. Schedule Sheets – Compile equipment schedules, door schedules, hardware schedules, cable and conduit schedules, panel board schedules etc., and place schedule sheets at front of respective sections of work.
   
   f. Electrical point to point diagrams – refer to Section 30 Electrical and Instrumentation in this manual.
   
   g. Hydraulic Profile – For treatment plant projects plot the hydraulic grade line for each condition considered during design.
   
   h. Detail Sheets – Compile civil details, electrical details, mechanical details, structural details, etc., and place detail sheets at end of respective sections of work.
   
5. Electronic Drawing Format
a. All design drawings shall be prepared in an electronic format using AutoCAD (.DWG) format. The release number is identified in the Request for Proposals (RFP). The FIRM shall review with HRSD any proposed deviation in the version of AutoCAD to be used and any other third party or proprietary software programs which will be used to prepare the design drawings. HRSD reserves the right to reject any variation in the version of AutoCAD to be used, non-standard AutoCAD format or specialty software program proposed by the FIRM.

Exceptions to this requirement will be considered for projects where 3D modeling has been approved in accordance with Section 7 – “HRSD Building Information Model (BIM) Requirements”.

b. HRSD does not require the use of a standard layering scheme for the preparation of electronic Record Drawings. The FIRM shall provide a file listing each layer name, description and color (pen weight) with each electronic file provided. Layers containing new or improved HRSD infrastructure must only contain such infrastructure, and must be clearly identified in the layer listing (the FIRM is encouraged to use a prefix of HRSD_ for layers representing new or improved HRSD infrastructure). Line widths shall be designated by layer and not by color. Provide the associated .CTB file with each project/drawing.

Exceptions to this requirement will be considered for projects where 3D modeling has been approved in accordance with Section 7 – “HRSD Building Information Model (BIM) Requirements”.

c. The use of x-referencing when preparing electronic drawings is acceptable. Prior to the submission of any electronic drawing to HRSD, each x-referenced dwg file associated with a drawing shall be bound to that file. Unbound electronic drawings will be returned to the FIRM for revision. Referenced images within the electronic drawing can include TIFF Group 4 or JPEG. The use of OLE and BMP images shall not be accepted. Any x-referenced image files must be named as described herein.

d. The use of stick-on maps, diagrams or sketches shall not be allowed. All information shown on the paper copy drawing should correspond to the electronic file provided as part of the Record Drawing submission.

e. The FIRM shall provide to HRSD all font files used within the electronic drawings. The use of non-standard AutoCAD fonts is strongly discouraged.

f. For pipeline projects, the FIRM shall provide to HRSD a single AutoCAD file containing the complete proposed HRSD infrastructure, referencing a minimum of two State Plane Coordinates (as specified herein).

6. Drawing and Electronic File Naming
a. Each drawing shall be provided with both a sheet number and a drawing number. A sheet number is a consecutive numbering scheme beginning with 1. A drawing number is an alphanumeric numbering scheme beginning with the discipline designation and a consecutive number (i.e.; C-1, M-12, S-93, etc.)

b. Each electronic drawing file shall be named as follows:

i. Index sheet – Index.dwg
ii. All other sheets – SHEETNUMBER.dwg (i.e., Sheet 05 of 35.dwg)

c. Each referenced file shall be named in correspondence to the drawing within which it is referenced. (i.e., a referenced image file would be named “Sheet 05 of 35 A.tiff” if it is x-referenced in Sheet 05 of 35.dwg)

7. Miscellaneous

a. Labels and Symbols

i. Identify and label all existing facilities and underground utilities.
ii. Use standard symbols and terminology consistently throughout drawings.
iii. Shading, stippling or cross-hatching is acceptable only if drawing clarity on half size prints is approved by HRSD. The use of solid fills for shading is not acceptable.

b. Drawing Orientation

i. North arrow orientation should be up or to the right on each drawing.
ii. Pipeline stationing should be left to right on each drawing.

c. Piping and Hydraulic Structures

i. Indicate pipe sizes and materials at transitions between different pipe sizes and materials.
ii. Indicate elevations and grades of gravity sewers including pipe inverts at manholes, manhole rims, and other key points along the gravity sewer.
iii. Indicate elevations of force mains including pipe inverts at changes in grade and other key points along the force main.
iv. Indicate elevations of hydraulic structures including floor elevations and water surface elevations.
v. Prepare line diagrams for process systems and isometric schematics for complicated piping systems.
vi. For pipeline projects tying into existing pipelines, such as repairs or relocations, the connecting point between the new and existing pipelines must reference the stationing from the original drawings.
vii. Indicate pipeline stationing based on the pipeline centerline. Stations should be indicated on both the plan and profile views.
viii. For pipeline projects, a profile and related data should be shown on the bottom half of the plan sheet, indicating the pipeline stationing on accented vertical grid lines. The profile should be shown at true pipeline centerline length and projected above to the plan view in as close a relationship as possible.

d. Electrical – FIRM to confirm that these requirements are included in the Bid Documents for Contractors.

i. Process and Instrumentation Diagrams (P&IDs) – The FIRM shall prepare the P&IDs.

ii. Loop Drawings – The Contractor shall be required to provide loop drawings.

iii. Conduit and Cable Schedules – The FIRM shall provide on the drawings or in the specifications. Contractor shall provide as-built conduit and cable schedules.

iv. Point to Point Drawings – Contractor to provide.

e. Horizontal and Vertical Controls

i. For all outfalls provide the following:

a) Longitude and latitude for the beginning and end of the diffuser.

b) Longitude and latitude for the point where the outfall enters the body of water.

c) Longitude and latitude at all pipe deflections.

d) Distance in feet from the end of the diffuser to the shoreline.

e) Provide layout information tied to the Virginia State Plane coordinate system. For pipeline projects a minimum of two Virginia State Plane coordinates should be indicated on the drawing. Horizontal datum including the realization (also known as the adjustment) used should be referenced on the cover sheet. (e.g. NAD83(1986), NAD83(HARN), NAD83(CORS96)).

f) Indicate location of bench marks and use elevations based on the NAVD88 vertical datum, unless otherwise approved. Vertical datum reference should be indicated on each profile view.

g) Provide Virginia State Plane horizontal coordinates and NAVD88 elevations for valve boxes, air vents, manholes, pipeline bends, and other critical items.

8. Drawing Designations – The following drawing designations shall be used:

a. General

b. Index

c. Civil

d. Structural

e. Architectural

f. Electrical

g. I & C
h. Mechanical
i. HVAC – Plumbing

C. Record Drawings

1. General

a. Indicate revised dimensions, annotations, coordinates, and elevations as specified in this section. Only dimensions, coordinates, and elevations depicting as-built conditions to appear on the final Record Drawings. Record Drawings are not to contain “mark-ups”, text strikethrough, etc. (only final as-built conditions).

b. Indicate added and/or revised construction details. Only final version of construction details are to be included in the Record Drawings.

c. Remove wording and annotations on drawings that do not relate to the as-built conditions (such as "Proposed") as appropriate.

d. Revise all drawings to reflect as built conditions of all equipment or other schedules.

e. Label drawings as "Record Drawings" and indicate last revision date.

f. Prepare and submit a full-scale set of black line drawings.

g. Submit CAD drawing files (including the listing of all layer names as specified herein, and font files) compatible with AutoCAD Release (as specified in the RFP) software. Later editions cannot be accepted without prior written agreement from HRSD.

Exceptions to this requirement will be considered for projects where 3D modeling has been approved in accordance with Section 7 – “HRSD Building Information Model (BIM) Requirements”.

h. Submit PDF format file copies of the CAD drawing files.

i. An engineer’s seal is not required on the Record Drawings.

j. A single drawing file shall be provided for each sheet of the Record Drawings. Delete all extraneous parts of the project from the drawing file except what pertains to the immediate sheet. This reduces the file size and works better in HRSD’s records management system.

Exceptions to this requirement will be considered for projects where 3D modeling has been approved in accordance with Section 7 – “HRSD Building Information Model (BIM) Requirements”.
2. Construction Information
   a. List Contractor name, address, telephone number and point of contact on the cover sheet.
   b. For pipeline projects list suppliers and model numbers/designations of all major items of construction.

D. Bid Documents
1. Provide final Bid Documents with all incorporated addenda in a PDF format file for incorporation into Blue Cielo Meridian Software.

E. Valve Guides
1. Introduction
   a. HRSD uses Valve Guides to locate critical facilities in the interceptor system. The goal of each Valve Guide is to provide a location diagram and valve information for operations, maintenance and emergency shutdowns.
   b. Valve Guides are prepared for valves, air vents, leak detectors, meter installations, cathodic protection test stations, and other corrosion control equipment. Manholes used in sanitary sewer systems do not require the preparation of a Valve Guide.
   c. Valve Guides are prepared in an electronic drawing format for records management and internal use by HRSD.

2. Specific Instructions
   a. Valve Guides shall be prepared at 8.5 inch x 11 inch size drawings with the drawing limits set to 8.5 inch x 11 inch (See Attachment A in this section for examples). All elements to be drawn in model space. A Valve Guide Template file including the appropriate paper space layout to be provided by HRSD.
   b. Pipeline size and material to be annotated. Abandoned pipelines/valves/etc. that remain in place to be indicated as abandoned.
   c. Provide only enough information to locate the valve(s) and/or air vent(s). Additional information should not be provided.
   d. Provide a minimum of two (2) and preferably three (3) tie-down dimensions, from the valve or air vent to an adjacent, permanent fixture.
e. Valve Guides are identified using a sequential numbering system. The FIRM must coordinate with HRSD for the determination of interim and final Valve Guide numbers. Each valve, air vent, etc. are also numbered using a sequential numbering system within each Valve Guide. In cases where an existing Valve Guide is being updated, the FIRM must coordinate with HRSD for the determination of interim and final valve numbers.

f. Valve Guide drawings shall be prepared in an AutoCAD (.DWG) format (release as referenced in the RFP). Any associated files (font, compression, etc.) should be included with the drawings.

g. A single drawing file shall be provided with each individual Valve Guide.

3. CAD Standards

a. 0 Layer - Information appearing on the 0 layer shall conform to the following established standards:

   i. Layer Color - White (No. 7)
   ii. Valve Guide Drawing Sheet/Information Block
   iii. North Arrow (North Arrow HRSD Standard)
   iv. Pen Width = 0.012 inches

b. Text Layer - Information appearing on the Text Layer shall conform to the following established standards:

   i. Layer Color - Cyan (No. 4)
   ii. Valve Guide Information
      a) VG Number
         • Height - .20
         • Font - Romand
      b) Location (General area of valve)
         • Height - .10
         • Font - Romand
      c) Drawing (Line no., contract title and sheet no.)
         • Height - .10
         • Font - Romand
      d) Line Number Symbol (Place in or near Drawing Title)
   iii. General
      a) Dimensions are considered to be text and shall be drawn on the text layer.
      b) Text font and height for valve information (Valve No., Size, Turns, etc.) is established in information block and operator shall be prompted for insertion of data.
      c) Street Names
         • Height - .20
         • Font - Romand
d) Stations Number (0+00)
   - Height - Minimum .08
   - Font - Romand

e) Notes
   - Height - Minimum .08
   - Font - Romand

f) Distance Table (If required on VG)
   - Height - Minimum .08
   - Font - Simplex

g) Dimension Text
   - Height - Minimum .08
   - Font - Simplex
   - Location - (Place dimension text on top if space allows; otherwise use a break.)

c. Topo Layer - Information appearing on the Topo Layer shall conform to the following established standards:

   i. Layer Color - Dark Gray (No. 8)
   ii. General – Information drawn on the Topo Layer shall include the following:
      a) Power Poles (Include identifying numbers)
      b) Fire Hydrants
      c) Other utilities only if they are relevant to the location of the valve or air vents, such as gravity manholes when used as a measurement marker.
      d) Pavement limits, edge of pavement symbols, sidewalks, residences when such use will assist in location, trees and shrubbery, fences, HRSD easements, property lines if at PS locations, cross streets, dirt roads, and other pertinent data which will aid the locating of valve or air vent. A minimum number of symbols should be used where trees or shrubbery lines exist.

e) Text
   - Height - Minimum .08
   - Font - Simplex

f) Line Types
   - Continuous - Pavement limits, sidewalks, cross street roadway limits, building limits.
   - Hidden 2 - Dirt Roads
   - Phantom - Property and Easements
   - - - - - - - Ditch
   - -x - x - Fences

   iii. Pen Width = 0.002 inches

d. FM Layer - Information appearing on the FM Layer shall conform to the following established standards:
i. Layer Color – Green (No. 3)

ii. General – Information drawn on the FM Layer shall include the following.
   a) HRSD force mains, air vents, valves, other force mains which connect directly to valved outlets or tapping saddles, valve vaults, pipe encasements, leak detectors, cathodic protection symbols, and check valves.
   b) Line type
      - HRSD FM - Continuous Polyline
      - Other FM - As indicated.
   c) Line width
      - HRSD FM - .047" (for largest diameter on VG sheet. Vary width where FM reduces in size.)
      - Others - Size smaller than HRSD according to difference in diameter.
   d) Symbols - Standard HRSD symbols for valves, air vents, leak detectors, etc. Size valves relevant to diameter of force main.

iii. Pen Width = 0.016 inches

e. Detail Layer - Information appearing on the Detail Layer will conform to the following established standards:
   i. Layer Color - White (No. 7)
   ii. General
      a) Information drawn on the Detail Layer should include:
         - If required, a more detailed drawing of connection to the HRSD force main showing fittings, changes in elevation, and any special related conditions.
         - Text related to the detail shall be drawn on the detail layer. Text shall be minimum .08".
      b) Line Types as indicated in the above CAD Standards.
      c) Font - Romand (Use Simplex if contrast in style is necessary.)
   iii. Pen Width = 0.012 inches

4. Abbreviation, Fonts and Standard Symbols

   a. Abbreviations - The following list of abbreviations are required for use on all HRSD Valve Guides.

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Vent</td>
<td>AV</td>
</tr>
<tr>
<td>Asbestos Cement Pipe</td>
<td>AC</td>
</tr>
<tr>
<td>Bulkhead</td>
<td>Bhd</td>
</tr>
<tr>
<td>Building</td>
<td>Bldg</td>
</tr>
<tr>
<td>Boulevard</td>
<td>Blvd</td>
</tr>
<tr>
<td>Cast Iron</td>
<td>CI</td>
</tr>
<tr>
<td>Cast Iron Mechanical Joint</td>
<td>CIMJ</td>
</tr>
<tr>
<td>Cable Antenna Television</td>
<td>CATV</td>
</tr>
<tr>
<td>Item Description</td>
<td>Abbreviation</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Chemical</td>
<td>Chem</td>
</tr>
<tr>
<td>Clockwise</td>
<td>CW</td>
</tr>
<tr>
<td>Concrete</td>
<td>Conc</td>
</tr>
<tr>
<td>Corner</td>
<td>Cor</td>
</tr>
<tr>
<td>Corporation</td>
<td>Corp</td>
</tr>
<tr>
<td>Counterclockwise</td>
<td>CCW</td>
</tr>
<tr>
<td>Center</td>
<td>Ctr</td>
</tr>
<tr>
<td>Concrete Pipe</td>
<td>CP</td>
</tr>
<tr>
<td>Department</td>
<td>Dept</td>
</tr>
<tr>
<td>Department of Public Works</td>
<td>DPW</td>
</tr>
<tr>
<td>Diameter</td>
<td>Diam</td>
</tr>
<tr>
<td>Drive</td>
<td>Dr</td>
</tr>
<tr>
<td>Ductile Iron</td>
<td>DI</td>
</tr>
<tr>
<td>Ductile Iron Mechanical Joint</td>
<td>DIMJ</td>
</tr>
<tr>
<td>Fire Hydrant</td>
<td>FH</td>
</tr>
<tr>
<td>Elevation</td>
<td>Elev</td>
</tr>
<tr>
<td>Electric</td>
<td>Elec</td>
</tr>
<tr>
<td>Flanged</td>
<td>Flg</td>
</tr>
<tr>
<td>Force Main</td>
<td>FM</td>
</tr>
<tr>
<td>Interceptor Force Main</td>
<td>IntFM</td>
</tr>
<tr>
<td>Foot</td>
<td>Ft</td>
</tr>
<tr>
<td>Gallon</td>
<td>Gal</td>
</tr>
<tr>
<td>Government</td>
<td>Govt</td>
</tr>
<tr>
<td>Gravity</td>
<td>Grav</td>
</tr>
<tr>
<td>Height</td>
<td>Hgt</td>
</tr>
<tr>
<td>High Density Polyethylene Pipe</td>
<td>HPDE</td>
</tr>
<tr>
<td>Highway</td>
<td>Hwy</td>
</tr>
<tr>
<td>High School</td>
<td>HS</td>
</tr>
<tr>
<td>Horizontal</td>
<td>Horz</td>
</tr>
<tr>
<td>Horizontal Gate Valve</td>
<td>HGV</td>
</tr>
<tr>
<td>Inch</td>
<td>In</td>
</tr>
<tr>
<td>Invert</td>
<td>Inv</td>
</tr>
<tr>
<td>Light Pole</td>
<td>LP</td>
</tr>
<tr>
<td>Limit</td>
<td>Lim</td>
</tr>
<tr>
<td>Maximum</td>
<td>Max</td>
</tr>
<tr>
<td>Mechanical</td>
<td>Mech</td>
</tr>
<tr>
<td>Mechanical Joint</td>
<td>MJ</td>
</tr>
<tr>
<td>Mile</td>
<td>Mi</td>
</tr>
<tr>
<td>Minimum</td>
<td>Min</td>
</tr>
<tr>
<td>Outside Diameter</td>
<td>O.D.</td>
</tr>
<tr>
<td>Overhead Electric</td>
<td>OHE</td>
</tr>
<tr>
<td>Private</td>
<td>Priv</td>
</tr>
<tr>
<td>Property</td>
<td>Prop</td>
</tr>
<tr>
<td>Polyvinyl Chloride</td>
<td>PVC</td>
</tr>
<tr>
<td>Item Description</td>
<td>Abbreviation</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Power</td>
<td>Pwr</td>
</tr>
<tr>
<td>Power Pole</td>
<td>PP</td>
</tr>
<tr>
<td>Reinforced Concrete</td>
<td>RC</td>
</tr>
<tr>
<td>Reinforced Concrete Cylinder Pipe</td>
<td>RCCP</td>
</tr>
<tr>
<td>Restrained Joint</td>
<td>RJ</td>
</tr>
<tr>
<td>River</td>
<td>Riv</td>
</tr>
<tr>
<td>Residence</td>
<td>Res</td>
</tr>
<tr>
<td>Right Of Way</td>
<td>ROW</td>
</tr>
<tr>
<td>Railway</td>
<td>Rwy</td>
</tr>
<tr>
<td>Railroad</td>
<td>RR</td>
</tr>
<tr>
<td>School</td>
<td>Sch</td>
</tr>
<tr>
<td>Sheet</td>
<td>Sht</td>
</tr>
<tr>
<td>Station</td>
<td>Sta</td>
</tr>
<tr>
<td>Steel Pipe</td>
<td>SP</td>
</tr>
<tr>
<td>Welded Steel Pipe</td>
<td>WSP</td>
</tr>
<tr>
<td>Surface</td>
<td>Sur</td>
</tr>
<tr>
<td>Valve Guide</td>
<td>VG</td>
</tr>
<tr>
<td>Vertical</td>
<td>Vert</td>
</tr>
<tr>
<td>Vertical Gate Valve</td>
<td>VGV</td>
</tr>
<tr>
<td>Underground</td>
<td>U/G</td>
</tr>
<tr>
<td>Underground Electrical</td>
<td>UGE</td>
</tr>
<tr>
<td>Without</td>
<td>W/O</td>
</tr>
</tbody>
</table>
Exhibit A

VALVE GUIDE FORMAT AND EXAMPLES

1. Standard Font
2. Valve Guide Example – AT-1019
3. Valve Guide Example – NA-3029
4. Valve Guide Example – VIP-7012
<table>
<thead>
<tr>
<th>LOCATION</th>
<th>SHIPPS CORNER PRS 143</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRAWING</td>
<td>LINE 171 DAM NECK TO SHIPPS CORNER F.M./SHIPPS CORNER B.P.S. FOR F.M. 171 SEE SHT 5 OF 8/FOR B.P.S. SITE SEE SHT 2 OF 10</td>
</tr>
<tr>
<td>VALVE No.</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13</td>
</tr>
<tr>
<td>SIZE</td>
<td>6&quot; 8&quot; 12&quot; 12&quot; 16&quot; 16&quot; 24&quot; 24&quot; 36&quot; 36&quot; 36&quot; 36&quot; 36&quot;</td>
</tr>
<tr>
<td>OPENS</td>
<td>LEFT LEFT LEFT LEFT LEFT LEFT LEFT LEFT LEFT LEFT LEFT LEFT</td>
</tr>
<tr>
<td>TURNS</td>
<td>19 19 348 19 223 19 223 19 223 19 223 19 223</td>
</tr>
<tr>
<td>NUT SIZE</td>
<td>2&quot; 5&quot; 10&quot; 10&quot; 10&quot; 10&quot; 10&quot; 10&quot; 10&quot; 10&quot; 10&quot; 10&quot; 10&quot;</td>
</tr>
<tr>
<td>NUT TO GRID</td>
<td>6 6 6 6 6 6 6 6 6 6 6 6 6</td>
</tr>
<tr>
<td>COVER SIZE</td>
<td>10&quot; 10&quot; 10&quot; 10&quot; 10&quot; 10&quot; 10&quot; 10&quot; 10&quot; 10&quot; 10&quot; 10&quot; 10&quot;</td>
</tr>
<tr>
<td>COVER MARK</td>
<td>HRSD HRSD HRSD HRSD HRSD HRSD HRSD HRSD HRSD HRSD HRSD HRSD HRSD</td>
</tr>
<tr>
<td>POSITION</td>
<td>HOR HOR HOR HOR HOR HOR HOR HOR HOR HOR HOR HOR</td>
</tr>
<tr>
<td>GEARED</td>
<td>NO NO NO NO NO NO NO NO NO NO NO NO NO</td>
</tr>
<tr>
<td>Gear Ratio</td>
<td>37-1 37-1 37-1 37-1 37-1 37-1 37-1 37-1 37-1 37-1 37-1 37-1 37-1</td>
</tr>
<tr>
<td>OWNED BY</td>
<td>HRSD HRSD HRSD HRSD HRSD HRSD HRSD HRSD HRSD HRSD HRSD HRSD HRSD</td>
</tr>
<tr>
<td>REVISED</td>
<td>1/93 1/93 1/93 1/93 1/93 1/93 1/93 1/93 1/93 1/93 1/93 1/93 1/93</td>
</tr>
</tbody>
</table>

Diagram:
- **DAM NECK RD.**
  - HERS 42° RCCP FM
  - STA 214+68
  - STA 214+93
  - STA 215+80
  - STA 219+96
  - 1000' TO NEXT STA

- **Shipp's Corner PRS #143**
  - 16" ACFS
  - 16" ACFM
  - CORR. PAD
  - CONG. PAD
  - CORR. PAD

Note:Vaults removed & 2-36" G.V.'s Install-
ed - 8/16/90

Chain Link Fence Encloses P.S.
End of Section
Section 7 - HRSD Building Information Model (BIM) Requirements

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  1.2 Overview ........................................................................................................................................... 2

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1.0 Introduction

1.1 Preface

This document presents HRSD’s BIM Requirements with a focus on Revit. These requirements and associated Revit template set a minimum standard to establish consistency throughout projects. This document provides guidance on setting up and executing a project using Revit.

These requirements shall be used in conjunction with each project specific BIM Execution Plan. The BIM Execution Plan includes project specific planning including: team members and roles, software and releases to be used, file hosting location, model sharing methods, deliverable dates, client presentation methods, project specific LOD requirements, etc. and shall be set up by the project BIM lead in close coordination with the HRSD project manager and consultant project manager.

1.2 Overview

This manual will serve as a HRSD style guide for the use of Revit BIM software, and defines the practice common to all drawings produced for HRSD projects. This manual is intended to be used alongside HRSD, project template and shared parameter file.

2.0 Level of Development (LOD) Tables

The following LOD (Level of Development) tables are based on the AIA Level of Development definitions. These tables shall be used in conjunction with the project BIM Execution Plan to coordinate BIM model development with individual project goals and milestones. These tables provide general LOD outlines and may not fully represent individual project requirements or specific mentions of required components. The designer shall use his/her best judgment, based on these tables and coordination with the project team, to meet project goals and/or milestones outlined in the Project BIM Execution Plan. All components in a specific discipline model shall be represented at similar LOD, and special care must be taken when importing models from third parties (vendor websites). These models are often detailed to a much higher level than content created by the modeling standards established in this document. Refer to Family Creation Requirements - Paragraph 6.0 for more information.

The LOD definitions below are written to dictate the production of individual model elements (mechanical equipment, walls, framing, etc.) represented within discipline project model files. These definitions contribute the project file as a whole but are not an indication of project milestones. Refer to Paragraph 2.1 for information about level of development of project model files at various project milestones.
<table>
<thead>
<tr>
<th>Basic LOD Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LOD 100</strong></td>
</tr>
<tr>
<td><strong>LOD 200</strong></td>
</tr>
</tbody>
</table>
| **LOD 300** | Model element satisfies LOD 200 and lower requirements. Model element represents accurate size, location, orientation and count of specified/proposed equipment. This information can be obtained directly from the element without the need to refer to non-model elements such as annotations, dimensions or notes.  

**LOD 300 model requirements as it pertains to the creation of HRSD contract drawings:**  
- The model element should be easily identifiable from any view when placed on a contract drawing at a scale of 1/4”=1'-0” and printed half size (11”x17”).  
- No part of the model should print as an unidentifiable black mass.  
- No part of the real-world object, represented by the model, that does not contribute to the easy identification of the model should be represented, i.e., nuts, bolts, heat sinks, dials, etc.  
- Model contains IFC data parameters established in HRSD template when applicable.  
- Model includes non-graphical information required for the population of tags, tables and other annotation elements. |
| **LOD 350** | Model element satisfies LOD 300 and lower requirements. Model element contains elements necessary for connections and coordination with other attached or nearby model elements.  

**LOD 350 model requirements as it pertains to the creation of HRSD contract drawings:**  
- All LOD 300 requirements and elements necessary for connection to other objects. Pipe, duct, electrical connectors, etc. |
LOD 400  |  Model element satisfies LOD 350 and lower requirements. Model element contains detailed components sufficient for fabrication and assembly.

LOD 400 model requirements as it pertains to the creation of HRSD contract drawings:

- These models would be used for the fabrication of equipment and building components and would contain more information than necessary to produce contract drawings.
- Models developed to this LOD are beyond the scope of HRSD project work.

LOD 500  |  Model satisfies LOD 400 requirements. Model incorporates field verified measurements.

LOD 500 model requirements as it pertains to the creation of HRSD contract drawings:

- Models developed to this LOD are beyond the scope of HRSD project work.

### 2.1 Model and Contract Drawing Content by Project Milestone

The following tables outline the content required for various project milestones. These milestones offer basic guidelines and may not address the requirements of all projects. It is the responsibility of the design team and the HRSD project manager to determine the development of project models and contract drawings to suit the needs of individual projects. Project specific LOD requirements shall be defined in the project BIM Execution Plan.

#### Process Mechanical

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>PER Draft</td>
<td>The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description. Model includes:</td>
</tr>
<tr>
<td></td>
<td>- Schematic representation of existing conditions if applicable</td>
</tr>
<tr>
<td></td>
<td>- If an existing model is available, it should be used as a background/starting point.</td>
</tr>
<tr>
<td></td>
<td>- Schematic layout of major process mechanical equipment represented at LOD 100 or 200</td>
</tr>
<tr>
<td></td>
<td>- Major equipment includes but is not limited to: large containment vessels (tanks, bins, etc.), pumps, centrifuges, screens, etc.</td>
</tr>
<tr>
<td></td>
<td>- Layout dimensions and equipment orientations are approximate and may change upon further model development</td>
</tr>
</tbody>
</table>
Process Mechanical

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>PER Final</td>
<td>The PER model and drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand its basic function and processes. All process equipment represented at PER and beyond shall be modeled to LOD 350. Model includes:</td>
</tr>
</tbody>
</table>
|                   | • Existing conditions if applicable  
|                   |   o Existing conditions shall be modeled to the same level as proposed items at every project milestone.  
|                   |   o Additional equipment may need to be modeled to represent interactions with proposed process mechanical items.  
|                   |   o If existing process mechanical model exists, there is no need to remove or hide content for the sake of consistency.  
|                   | • Preliminary process mechanical equipment:  
|                   |   o Layout of process mechanical equipment shall accurately represent size, quantity, shape and location.  
|                   |   o Process mechanical equipment models (families) represent possible selection of proposed/specifieed equipment but may not represent equipment that will ultimately be installed  
|                   |     ▪ When multiple manufactures are specified for any given equipment, the largest and/or most challenging to install of the possible selections should be represented.  
|                   |   o Appropriate maintenance and access/code clearance requirements represented as well as considerations for placement of items relating to other disciplines which may not be present at this stage  
|                   |   o Space allocations for small diameter piping and content related to other disciplines not shown: HVAC ductwork, control panels, structural framing, etc.  
|                   | • Preliminary process mechanical piping, fittings and accessories:  
|                   |   o Process flow conveying piping 3” diameter and greater, valves, fittings and pipe accessories sized per process engineer’s calculations  
|                   |   o Layout of process mechanical piping equipment shall accurately represent size, quantity, shape and location  
|                   |   o Accurate dimensional, piping system, pipe size and pipe elevation data can be pulled from the model for production of contract drawings  
|                   | Contract drawings include:  
|                   | • Plans and sections:  
|                   |   o Plans (overall and enlarged when required)  
|                   |   o Overall sections  
|                   |   o Refer to Paragraph 8.6 for general information about plans and sections |
## Process Mechanical

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>• <strong>Basic annotation:</strong>&lt;br&gt;Tags representing information pulled directly from model elements should be used whenever possible.&lt;br&gt; o Size, system abbreviation and centerline elevation (CL) for all process flow conveying piping&lt;br&gt; o Descriptive tags of valves and pipe accessories, i.e., “8” BUTTERFLY VALVE”&lt;br&gt; o Descriptive text relating to process mechanical equipment, i.e., “POLYMER TRANSFER PUMP”&lt;br&gt; o Overall dimensions of rooms and/or tank and channel dimensions&lt;br&gt; o Elevations of all major floors</td>
<td></td>
</tr>
</tbody>
</table>
| **50%** | The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD’s PER design review.  
A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan.
|  | Model includes:<br> • Further development of process mechanical piping:<br> o Ancillary piping and associated valves and fittings not conveying process flow<br> o Ancillary pipe accessories represented (Dismantling joints, expansion couplings, flushing connections, sample ports, etc.)<br> o Small diameter piping 1” - 3” diameter and all associated fittings and valves<br> o Final pipe size diameter representation requirements will vary by project. Consult with HRSD Project Manager for specific project requirements<br> • Instrumentation associated with all represented equipment:<br> o This would mostly apply to instrumentation items that require power, i.e., temperature elements and transmitters, flow elements and transmitters, level sensors and transmitters, etc.<br> o Instrument designation and description can be pulled from model elements<br> • Additional process mechanical equipment not represented in PER documents<br> • Further refinement of process mechanical equipment and piping layout representing further design<br> • Chemical storage and distribution systems including but not limited to bulk chemical storage tanks, day tanks, metering pumps, skid mounted make-up units, major supply and distribution piping, and associated valves<br> • Inter-discipline coordination and conflict resolution (clash detection) |
### Process Mechanical

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contract drawings Include:</strong></td>
<td></td>
</tr>
<tr>
<td>• Updates to any annotation present in PER documents reflecting model changes</td>
<td></td>
</tr>
<tr>
<td>o Much of this should be automated if tags are used in lieu of simple text.</td>
<td></td>
</tr>
<tr>
<td>• Additional section and plan views, if additional plan views are necessary, generally at a larger scale than those present in PER drawings further detailing design</td>
<td></td>
</tr>
<tr>
<td>• Dimensions of major pipe penetrations, pipe headers and equipment</td>
<td></td>
</tr>
<tr>
<td>• Standard details and standard detail callouts</td>
<td></td>
</tr>
<tr>
<td>• Additional callouts of any additional equipment, piping or pipe accessories</td>
<td></td>
</tr>
<tr>
<td>• Instrumentation tags for all process mechanical equipment (pumps, motor operated valves, sensors, etc.) that require power</td>
<td></td>
</tr>
<tr>
<td>• Descriptive tags relating to instrumentation elements</td>
<td></td>
</tr>
<tr>
<td><strong>90%</strong></td>
<td>The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD’s 50% design review.</td>
</tr>
<tr>
<td><strong>Model includes:</strong></td>
<td></td>
</tr>
<tr>
<td>• Equipment control panels and local control stations located and coordinated with Electrical and Instrumentation</td>
<td></td>
</tr>
<tr>
<td>• Seal water assemblies located if applicable</td>
<td></td>
</tr>
<tr>
<td>• Pipe supports, to the extent specified by the project BIM Execution Plan, but in particular, supports for pipe systems that experience substantial force due to expansion and contraction during operation</td>
<td></td>
</tr>
<tr>
<td>• Further refinement of process mechanical equipment and piping layout as well as any related equipment representing further design.</td>
<td></td>
</tr>
<tr>
<td>• Further refinement of chemical storage and distribution systems, associated piping and valves</td>
<td></td>
</tr>
<tr>
<td>• Inter-discipline coordination and conflict resolution (clash detection)</td>
<td></td>
</tr>
<tr>
<td><strong>Contract drawings Include:</strong></td>
<td></td>
</tr>
<tr>
<td>• Updates to any annotation present in 50% documents reflecting model changes</td>
<td></td>
</tr>
<tr>
<td>o Much of this should be automated if tags are used in lieu of simple text</td>
<td></td>
</tr>
<tr>
<td>• Details of unique process mechanical equipment, equipment configurations or equipment connections</td>
<td></td>
</tr>
<tr>
<td>• Detailed notes dictating the specifics of construction that may not be clearly represented graphically</td>
<td></td>
</tr>
</tbody>
</table>
# Process Mechanical

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% - Issued for Construction</td>
<td>The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD’s 90% design review. Model includes:</td>
</tr>
<tr>
<td></td>
<td>• Final routing of all process piping 1” diameter and greater with all necessary pipe accessories, fittings and valves</td>
</tr>
<tr>
<td></td>
<td>o Final pipe size diameter representation requirements will vary by project. Consult with HRSD Project Manager for specific project requirements</td>
</tr>
<tr>
<td></td>
<td>• Final placement of process mechanical equipment developed to LOD 350</td>
</tr>
<tr>
<td></td>
<td>• All process mechanical equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD</td>
</tr>
<tr>
<td></td>
<td>o All equipment operations and maintenance data parameters are preloaded into the HRSD process mechanical Revit template and will automatically be applied into any appropriate families loaded into projects created from this template, provided they are categorized correctly.</td>
</tr>
<tr>
<td></td>
<td>o All equipment operations and maintenance data parameters can also be found in the HRSD shared parameter file (HRSD-Shared Parameter File.txt).</td>
</tr>
<tr>
<td></td>
<td>• Accurate representations of proposed process mechanical equipment, piping, valves and pipe accessories developed to LOD 350</td>
</tr>
<tr>
<td></td>
<td>• Appropriate maintenance and access/code clearance requirements accounted for with specific care to ensure no encroachment of these areas by any discipline</td>
</tr>
<tr>
<td></td>
<td>• Inter-discipline coordination and conflict resolution (clash detection) completed with all conflicts resolved</td>
</tr>
<tr>
<td></td>
<td>Contract drawings include:</td>
</tr>
<tr>
<td></td>
<td>• Dimensions and annotation sufficient for the construction of all process mechanical equipment and piping</td>
</tr>
</tbody>
</table>
## Process Mechanical

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substantial Completion</td>
<td>Model includes:</td>
</tr>
<tr>
<td></td>
<td>• All discipline elements modeled to as-built size, type and location</td>
</tr>
<tr>
<td></td>
<td>o All elements shall be model to correct dimensions and positional accuracy to the nearest ½” relative to major structural components (walls, column lines, etc.).</td>
</tr>
<tr>
<td></td>
<td>o It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition.</td>
</tr>
<tr>
<td></td>
<td>• Model reflects specific equipment installed which may differ from the proposed model and drawings</td>
</tr>
<tr>
<td></td>
<td>• Model reflects all changes made to proposed process mechanical design during construction</td>
</tr>
<tr>
<td></td>
<td>• All Process Mechanical equipment models include all operations and maintenance data parameters (IFC parameters) as required by HRSD.</td>
</tr>
<tr>
<td></td>
<td>o All operations and maintenance data parameters are populated with correct data as provided by contractor</td>
</tr>
<tr>
<td>Contract drawings</td>
<td>include:</td>
</tr>
<tr>
<td></td>
<td>• Dimensions and annotation sufficient for the construction of all process mechanical equipment and piping</td>
</tr>
<tr>
<td></td>
<td>• Dimensions and annotation modified to reflect as-built conditions</td>
</tr>
</tbody>
</table>
## Structural Model

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
</table>
| PER Draft         | The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description.  
Model includes:  
- Schematic representation of existing conditions if applicable  
  - If an existing model is available, it should be used as a background/starting point.  
- Schematic layout of major structural elements represented at LOD 100 or 200  
  - Major structural elements include but are not limited to: wall, floor slabs, columns and column grids, etc.  
Layout dimensions, element sizes and orientations are approximate and may change upon further model development. |
| PER Final         | Structural drawings may not be required at this project milestone. Coordinate HRSD project manager about the production of drawings and modeling effort for PER Final Submittal.  
The PER model and drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand the basic structural layout. All structural elements represented for the PER and beyond shall be modeled to LOD 300.  
Model includes:  
- Existing conditions if applicable  
  - Existing conditions shall be modeled to the same level as proposed items at every project milestone.  
  - If existing structural model exists, there is no need to remove or hide content for the sake of consistency.  
- Major load bearing walls and floors sized based standard practice  
- Major structural framing based on standard practice  
  - Any column grids associated with preliminary columns  
- Conceptual layout of access stairs and platforms with any framing that may impact accessibility to equipment or equipment areas  
  - Framing that does not meet that criteria does not need to be modeled.  
  - Input from structural engineer may be required  
- Equipment pads under all present equipment as required  
- Openings for any required equipment access  
- Grated openings and access hatches/doors |
## Structural Model

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Drawings include:</strong></td>
<td>Consult HRSD project manager regarding the inclusion of structural drawings for the Final PER.</td>
</tr>
</tbody>
</table>
| **Plans and sections:** | - Plans and sections:  
  - Plans (overall and enlarged when required)  
  - Overall sections  
  - Refer to Paragraph 8.6 for general information about plans and sections. |
| **Overall out-to-out dimensions** | - Overall out-to-out dimensions |
| **Interior-to-interior dimensions of spaces** | - Interior-to-interior dimensions of spaces  
  - Thicknesses of walls and floors is not required at this stage |
| **Dimensions between column grids and from grids to walls where applicable** | - Dimensions between column grids and from grids to walls where applicable |
| **Elevations of all major floors shown in sections with spot elevations shown in plan only when elevations cannot be called out in sections** | - Elevations of all major floors shown in sections with spot elevations shown in plan only when elevations cannot be called out in sections |

### 50%

The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD’s PER design review.

A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan.

**Model includes:**

- Major load bearing walls and floors updated to reflect structural engineer’s calculations
- Minor framing sized per design engineer’s calculations  
  - Platform framing and other minor supports
- Foundation elements:  
  - Spread footings, slab turn downs, trench and sump build-downs, etc.
- Roof support systems:  
  - Precast panels, metal decking, metal decking with concrete, trusses, bar joists, embedded grating seats, etc.
- Expansion joints in concrete where required
- Inter-discipline coordination and conflict resolution (clash detection)

**Contract drawings include:**

- All requirements defined in the PER Final milestone and those defined in this section
- Updates to any annotation present in the PER documents reflecting model changes, if applicable
- Additional dimensions indicating thicknesses of structural elements
## Structural Model

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Plans and sections:</td>
</tr>
<tr>
<td></td>
<td>o Plans (overall and enlarged when required)</td>
</tr>
<tr>
<td></td>
<td>o Overall sections</td>
</tr>
<tr>
<td></td>
<td>o Partial sections detailing elements not clearly detailed in overall sections</td>
</tr>
<tr>
<td></td>
<td>o Refer to Paragraph 8.6 for general information about plans and sections.</td>
</tr>
<tr>
<td></td>
<td>• Standard details and standard detail callouts</td>
</tr>
<tr>
<td></td>
<td>• General structural notes</td>
</tr>
<tr>
<td>90%</td>
<td>The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 50% design review.</td>
</tr>
<tr>
<td></td>
<td>Model includes:</td>
</tr>
<tr>
<td></td>
<td>• All structural walls, floors slabs, framing, bracing and other support members required for the construction the facility present and modeled to LOD 300</td>
</tr>
<tr>
<td></td>
<td>• Inter-discipline coordination and conflict resolution (clash detection)</td>
</tr>
<tr>
<td></td>
<td>Contract drawings include:</td>
</tr>
<tr>
<td></td>
<td>• Updates to any annotation present in 50% documents reflecting model changes.</td>
</tr>
<tr>
<td></td>
<td>o All structural elements dimensioned or otherwise located</td>
</tr>
<tr>
<td></td>
<td>• Structural framing elevations if applicable</td>
</tr>
<tr>
<td></td>
<td>• Rebar sizes and spacing represented on drawings</td>
</tr>
<tr>
<td></td>
<td>• Framing connection details</td>
</tr>
<tr>
<td></td>
<td>• Detailed notes dictating the specifics of construction that may not be clearly represented graphically</td>
</tr>
<tr>
<td>100% Construction</td>
<td>The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 90% design review.</td>
</tr>
<tr>
<td></td>
<td>Model includes:</td>
</tr>
<tr>
<td></td>
<td>• All structural walls, floors slabs, framing, bracing and other support members required for the construction the facility present, sized per the structural engineer’s final calculations and modeled to LOD 300</td>
</tr>
<tr>
<td></td>
<td>• Inter-discipline coordination and conflict resolution (clash detection) completed with all conflicts resolved</td>
</tr>
<tr>
<td></td>
<td>Contract drawings include:</td>
</tr>
<tr>
<td></td>
<td>• Dimensions and annotation sufficient for the construction of all structural elements reflecting the design intent of the structural engineer</td>
</tr>
</tbody>
</table>
## Structural Model

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substantial Completion</td>
<td><strong>Model includes:</strong></td>
</tr>
<tr>
<td></td>
<td>• All discipline elements modeled to as-built size, type and location.</td>
</tr>
<tr>
<td></td>
<td>o All elements shall be model to correct dimensions and positional accuracy to the nearest ½” relative to other structural elements.</td>
</tr>
<tr>
<td></td>
<td>o It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition.</td>
</tr>
<tr>
<td></td>
<td>• Any changes made to the proposed structural design during construction</td>
</tr>
<tr>
<td></td>
<td><strong>Contract drawings include:</strong></td>
</tr>
<tr>
<td></td>
<td>• Dimensions and annotation sufficient for the construction of all structural elements reflecting the as-built condition of the structure</td>
</tr>
<tr>
<td></td>
<td>o Dimensions and annotation modified to reflect as-built conditions</td>
</tr>
</tbody>
</table>
## Architectural Model

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
</table>
| PER Draft         | The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description.  
Model includes:  
- Schematic representation of existing conditions if applicable  
  - If an existing model is available, it should be used as a background/starting point.  
- Schematic layout of major architectural elements represented at LOD 100 or 200  
  - Major architectural elements include but are not limited to: masonry walls (interior and exterior), roofs, doors, etc.  
Layout dimensions, element sizes and orientations are approximate and may change upon further model development. |
| PER Final         | Architectural drawings may not be required at this project milestone. Coordinate HRSD project manager about the production of drawings and modeling effort for PER Final Submittal.  
The PER model and drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand the basic architectural layout. All architectural elements represented for the PER and beyond shall be modeled to LOD 300.  
Model includes:  
- Existing conditions if applicable  
  - Existing conditions shall be modeled to the same level as proposed items at every project milestone.  
  - If existing architectural model exists and is developed beyond current milestone, there is no need to remove or hide content for the sake of consistency.  
- Major walls sized based on standard practice  
  - Wall construction materials can be assumed to be standard masonry or actual material where known at this milestone  
- Preliminary architectural items  
  - Basic doors representing proposed size and type  
  - Basic roofs representing shape and type  
- Rooms with associated room names  
- Egress and code requirements |
**Architectural Model**

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawings include:</td>
<td>Consult HRSD project manager regarding the inclusion of architectural drawings for the Final PER.</td>
</tr>
<tr>
<td></td>
<td>• Plans, Elevations, and Sections:</td>
</tr>
<tr>
<td></td>
<td>o Plans (overall and enlarged when required)</td>
</tr>
<tr>
<td></td>
<td>o Overall Elevations</td>
</tr>
<tr>
<td></td>
<td>o Overall Building Sections</td>
</tr>
<tr>
<td></td>
<td>o Refer to Paragraph 8.6 for general information about plans, elevations and sections.</td>
</tr>
<tr>
<td></td>
<td>• Overall out-to-out dimensions</td>
</tr>
<tr>
<td></td>
<td>• Interior-to-interior dimensions of spaces</td>
</tr>
<tr>
<td></td>
<td>o Thicknesses of walls and floors is not required at this stage</td>
</tr>
<tr>
<td></td>
<td>• Room names</td>
</tr>
<tr>
<td></td>
<td>• Simple descriptions of visible architectural items</td>
</tr>
<tr>
<td>50%</td>
<td>The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD’s PER design review.</td>
</tr>
<tr>
<td></td>
<td>A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan.</td>
</tr>
<tr>
<td></td>
<td>Model includes:</td>
</tr>
<tr>
<td></td>
<td>• Walls</td>
</tr>
<tr>
<td></td>
<td>o Size and composition updated to reflect architect’s input</td>
</tr>
<tr>
<td></td>
<td>• Doors</td>
</tr>
<tr>
<td></td>
<td>o Type and size updated to reflect architect’s input</td>
</tr>
<tr>
<td></td>
<td>• Ceiling Systems</td>
</tr>
<tr>
<td></td>
<td>• Casework and built in items</td>
</tr>
<tr>
<td></td>
<td>• Finish and Opening Schedules</td>
</tr>
<tr>
<td></td>
<td>• Life safety data including: maximum travel distances, adequate exits, fire rated walls, and appropriate fire warning systems per local building code</td>
</tr>
<tr>
<td></td>
<td>• Door properties entered as BIM data</td>
</tr>
<tr>
<td></td>
<td>• Window and louver properties entered as BIM data</td>
</tr>
<tr>
<td></td>
<td>Contract drawings include:</td>
</tr>
<tr>
<td></td>
<td>• Updates to any annotation present in PER documents reflecting model changes, if applicable</td>
</tr>
<tr>
<td></td>
<td>• Plans and sections:</td>
</tr>
<tr>
<td></td>
<td>o Plans (overall and enlarged when required)</td>
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</tbody>
</table>
### Project Milestone Requirements

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall sections</strong>&lt;br&gt;<strong>Partial sections detailing elements not clearly detailed in overall sections</strong>&lt;br&gt;<strong>Refer to Paragraph 8.6 for general information about plans and sections.</strong>&lt;br&gt;- Casework and built-in items identified and detailed on drawings&lt;br&gt;- Standard details and standard detail callouts&lt;br&gt;- Room and opening schedules to define all finishes and materials</td>
<td><strong>90%</strong>&lt;br&gt;The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD’s 50% design review.&lt;br&gt;&lt;br&gt;Model includes:&lt;br&gt;- All exterior and interior wall materials updated to reflect architect’s design intent&lt;br&gt;- Ceiling systems updated&lt;br&gt;- Roof drainage system&lt;br&gt;- Toilet accessories&lt;br&gt;- Furniture&lt;br&gt;- ADA compliant building components&lt;br&gt;- Room finish data updated&lt;br&gt;- Inter-discipline coordination and conflict resolution (clash detection)&lt;br&gt;&lt;br&gt;Contract drawings include:&lt;br&gt;- Updates to any annotation present in 50% documents reflecting model changes&lt;br&gt;- Schedules for architectural components populated by BIM data&lt;br&gt;- Wall sections&lt;br&gt;- Ceiling system identified and detailed&lt;br&gt;- Roof, wall and other architectural details&lt;br&gt;- Interior elevations&lt;br&gt;- Detailed notes dictating the specifics of construction that may not be clearly represented graphically</td>
</tr>
<tr>
<td><strong>100% Construction</strong>&lt;br&gt;The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD’s 90% design review.&lt;br&gt;&lt;br&gt;Model includes:&lt;br&gt;- All walls, ceilings, and roofs modeled to LOD 300&lt;br&gt;- All doors, windows, casework and additional architectural items modeled to LOD 350&lt;br&gt;- Inter-discipline coordination and conflict resolution (clash detection) completed with all conflicts resolved</td>
<td></td>
</tr>
</tbody>
</table>
### Architectural Model

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract drawings include:</td>
<td>• Dimensions and annotation sufficient for the construction of all architectural elements reflecting the design intent of the structural engineer</td>
</tr>
</tbody>
</table>
| Substantial Completion Model includes: | • All discipline elements shall be modeled to as-built size, type and location.  
  o All elements shall be model to correct dimensions and positional accuracy to the nearest ½”.  
  o It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition.  
• Any changes made to the proposed architectural design during construction |
| Contract drawings include: | • Dimensions and annotation sufficient for the construction of all architectural elements reflecting the design intent of the structural engineer  
• Dimensions and annotation modified to reflect as-built conditions |
## HVAC Model

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
</table>
| **PER Draft**     | The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description. Model includes:  
  - Schematic representation of existing conditions if applicable.  
    - If an existing model is available, it should be used as a background/starting point.  
  - Schematic layout of major HVAC equipment represented at LOD 100 or 200  
    - Major equipment includes but is not limited to: condensing units, VAV boxes, air handling units, etc.  
  Layout dimensions and equipment orientations are approximate and may change upon further model development. |
| **PER Final**     | HVAC drawings may not be required at this project milestone. Coordinate HRSD project manager about the production of drawings and modeling effort for the PER Final submittal. The PER model and drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand its basic function and process. All HVAC equipment represented for the PER and beyond shall be modeled to LOD 350. Model includes:  
  - Existing conditions if applicable  
    - Existing conditions shall be modeled to the same level as proposed items at every project milestone.  
    - Additional equipment may need to be modeled to represent interactions with proposed HVAC items.  
  - If existing HVAC model exists, there is no need to remove or hide content for the sake of consistency.  
  - Preliminary HVAC equipment:  
    - Large HVAC equipment:  
      - Air Handling units, Condensers, VAV Boxes, etc.  
      - Pumps  
    - Layout of HVAC equipment shall accurately represent size, quantity, shape and location.  
    - HVAC equipment models (families) represent possible selection of proposed/specifed equipment but may not represent equipment that will ultimately be installed. |
## HVAC Model

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
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</thead>
</table>
|                   | • When multiple manufactures are specified for any given equipment, the largest and/or most challenging to install of the possible selections should be represented.  
  o Appropriate maintenance and access/code clearance requirements represented as well as considerations for placement of items relating to other disciplines which may not be present at this stage  
  o Space allocations for small diameter piping and content related to other disciplines not shown: process mechanical piping, control panels, structural framing, etc.  
• Areas reserved for the future locations/routing of ductwork and HVAC equipment not shown in the HVAC model  

Drawings include:  
Consult HRSD project manager regarding the inclusion of HVAC drawings for the Final PER.  
• Plans and sections:  
  o Plans (overall and enlarged when required)  
  o Overall sections  
  o Refer to Paragraph 8.6 for general information about plans and sections.  
• Basic annotation:  
  Tags representing information pulled directly from model elements should be used whenever possible.  
  o Basic descriptions of all HVAC equipment present in the model  
• Dimensions locating HVAC equipment relative to major structural or architectural walls  

| 50% | The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD’s PER design review.  
A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan.  
Model includes:  
• Ductwork for supply and exhaust/return air  
• HVAC related piping 1” diameter and greater  
• Additional HVAC equipment:  
  o Fans, unit heaters  
• Inter-discipline coordination and conflict resolution (clash detection)  

## HVAC Model

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Contract drawings Include:</strong></td>
<td></td>
</tr>
<tr>
<td>• Plans and sections:</td>
<td></td>
</tr>
<tr>
<td>○ Plans (overall and enlarged when required)</td>
<td></td>
</tr>
<tr>
<td>○ Overall sections</td>
<td></td>
</tr>
<tr>
<td>○ Partial sections detailing elements not clearly detailed in overall sections</td>
<td></td>
</tr>
<tr>
<td>○ Refer to Paragraph 8.6 for general information about plans and sections.</td>
<td></td>
</tr>
<tr>
<td>• Updates to any annotation present in PER documents reflecting model changes, if applicable</td>
<td></td>
</tr>
<tr>
<td>• Descriptive tags of HVAC equipment and control equipment</td>
<td></td>
</tr>
<tr>
<td>• Descriptive tags of HVAC ductwork including size and elevation</td>
<td></td>
</tr>
<tr>
<td>• Size, system abbreviation and centerline elevation (CL) for all major piping</td>
<td></td>
</tr>
<tr>
<td>• Standard details and standard detail callouts</td>
<td></td>
</tr>
<tr>
<td><strong>90%</strong></td>
<td></td>
</tr>
<tr>
<td>The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD’s 50% design review.</td>
<td></td>
</tr>
<tr>
<td><strong>Model includes:</strong></td>
<td></td>
</tr>
<tr>
<td>• Equipment control panels located and coordinated with Electrical and Instrumentation</td>
<td></td>
</tr>
<tr>
<td>• Duct and Pipe supports, to the extent specified by the project BIM Execution Plan, but in particular, supports for pipe systems that experience substantial expansion and contraction during normal process, including Chilled and Hot Water</td>
<td></td>
</tr>
<tr>
<td>• Inter-discipline coordination and conflict resolution (clash detection)</td>
<td></td>
</tr>
<tr>
<td><strong>Contract drawings Include:</strong></td>
<td></td>
</tr>
<tr>
<td>• Updates to any annotation present in 50% documents reflecting model changes</td>
<td></td>
</tr>
<tr>
<td>○ Much of this should be automated if tags are used in lieu of simple text.</td>
<td></td>
</tr>
<tr>
<td>• Details of unique HVAC equipment, equipment configurations or equipment connections</td>
<td></td>
</tr>
<tr>
<td>• Detailed notes dictating the specifics of construction that may not be clearly represented graphically</td>
<td></td>
</tr>
<tr>
<td><strong>100% Construction</strong></td>
<td></td>
</tr>
<tr>
<td>The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD’s 90% design review.</td>
<td></td>
</tr>
<tr>
<td><strong>Model includes:</strong></td>
<td></td>
</tr>
<tr>
<td>• Final routing of all ductwork with all necessary fittings, control and distribution devices</td>
<td></td>
</tr>
<tr>
<td>• Final placement of HVAC equipment modeled to LOD 350</td>
<td></td>
</tr>
</tbody>
</table>
## HVAC Model

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• All HVAC equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD</td>
</tr>
<tr>
<td></td>
<td>o All equipment operations and maintenance data parameters are preloaded into the HRSD HVAC Revit template and will automatically be applied into any appropriate families loaded into projects created from this template, provided they are categorized correctly.</td>
</tr>
<tr>
<td></td>
<td>o All equipment operations and maintenance data parameters can also be found in the HRSD shared parameter file (HRSD-Shared Parameter File.txt).</td>
</tr>
<tr>
<td></td>
<td>• Appropriate maintenance and access/code clearance requirements accounted for with specific care to ensure no encroachment of these areas by any discipline</td>
</tr>
<tr>
<td></td>
<td>• Inter-discipline coordination and conflict resolution (clash detection) completed with all conflicts resolved</td>
</tr>
<tr>
<td></td>
<td>Contract drawings include:</td>
</tr>
<tr>
<td></td>
<td>• Dimensions and annotation sufficient for the construction of all HVAC equipment, ductwork and piping</td>
</tr>
<tr>
<td>Substantial Completion</td>
<td>Model includes:</td>
</tr>
<tr>
<td></td>
<td>• All discipline elements modeled to as-built size, type and location.</td>
</tr>
<tr>
<td></td>
<td>o All elements shall be model to correct dimensions and positional accuracy to the nearest ½” relative to major structural components (walls, column lines, etc.).</td>
</tr>
<tr>
<td></td>
<td>o It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition.</td>
</tr>
<tr>
<td></td>
<td>• Model reflects specific equipment installed which may differ from the proposed model and drawings</td>
</tr>
<tr>
<td></td>
<td>• Model reflects all changes made to proposed HVAC design during construction</td>
</tr>
<tr>
<td></td>
<td>• All HVAC equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD.</td>
</tr>
<tr>
<td></td>
<td>o All operations and maintenance data parameters are populated with correct data as provided by contractor</td>
</tr>
<tr>
<td></td>
<td>Contract drawings include:</td>
</tr>
<tr>
<td></td>
<td>• Dimensions and annotation sufficient for the construction of HVAC equipment, ductwork and piping</td>
</tr>
<tr>
<td></td>
<td>o Dimensions and annotation modified to reflect as-built conditions</td>
</tr>
</tbody>
</table>
# Plumbing Model

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
</table>
| PER Draft         | The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description.  
Model includes:  
  • Schematic representation of existing conditions if applicable.  
    o If an existing model is available, it should be used as a background/starting point.  
  • Schematic layout of major plumbing equipment represented at LOD 100 or 200  
    o Major equipment includes but is not limited to: water heaters, sinks, toilets, safety showers, etc.  
  • Layout dimensions and equipment orientations are approximate and may change upon further model development |
| PER Final         | Plumbing drawings may not be required at this project milestone. Coordinate with HRSD project manager about the production of drawings and modeling effort at PER Final.  
The PER model and contract drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand its basic function and process. All plumbing fixtures and equipment represented for the PER and beyond shall be modeled to LOD 350.  
Model includes:  
  • Existing conditions if applicable  
    o Existing conditions shall be modeled to the same level as proposed items at every project milestone.  
    o Additional equipment may need to be modeled to represent interactions with proposed plumbing items.  
    o If existing plumbing model exists, there is no need to remove or hide content for the sake of consistency.  
  • Preliminary plumbing fixtures and equipment:  
    o Large plumbing fixtures and equipment:  
      ▪ Sinks, toilets, safety showers, water heaters, etc.  
    o Layout of plumbing equipment shall accurately represent size, quantity, shape and location  
    o Appropriate maintenance and access/code clearance requirements represented as well as considerations for placement of items relating to other disciplines which may not be present at this stage |
**Plumbing Model**

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>o Space allocations for small diameter piping and content related to other disciplines not shown: HVAC ductwork, control panels, structural framing, etc.</td>
</tr>
</tbody>
</table>
| 50%               | The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD’s PER design review. A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan. Model includes:  
  - Further development of plumbing fixtures, equipment and piping:  
    o Piping 1/2” and greater diameter and all associated fittings and valves  
    o Final pipe size diameter representation requirements will vary by project. Consult with HRSD project manager for specific project requirements  
  - Additional plumbing fixtures not represented in PER drawings  
  - Inter-discipline coordination and conflict resolution (clash detection)  
|                   | Drawings Include:  
  - Plans and sections:  
    o Plans (overall and enlarged when required)  
    o Overall sections  
    o Partial sections detailing elements not clearly detailed in overall sections  
    o Refer to Paragraph 8.6 for general information about plans and sections.  
|                   | Consult HRSD project manager regarding the inclusion of plumbing drawings for the Final PER.  
  - Plans and sections:  
    o Plans (overall and enlarged when required)  
    o Overall sections  
    o Refer to Paragraph 8.6 for general information about plans and sections.  
  - Basic annotation:  
    Tags representing information pulled directly from model elements should be used whenever possible.  
    o Descriptive tags of plumbing fixtures and equipment. |

Drawings include:  
  - Plans (overall and enlarged when required)  
  - Overall sections  
  - Refer to Paragraph 8.6 for general information about plans and sections.
# Plumbing Model

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
</table>
|                   | • Updates to any annotation present in PER documents reflecting model changes, if applicable  
|                   |   o Much of this should be automated if tags are used in lieu of simple text.  
|                   | • Dimensions of major pipe penetrations and locations of fixtures  
|                   | • Standard details and standard detail callouts  
|                   | • Additional callouts of any additional fixtures and equipment, piping or pipe accessories  
|                   | • Instrumentation tags for all plumbing equipment that require power  

## 90%

The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 50% design review.  

Model includes:  

• Further refinement of plumbing fixtures, equipment and piping layout as well as any related equipment representing further design  
• Inter-discipline coordination and conflict resolution (clash detection)  

Contract drawings include:  

• Updates to any annotation present in 50% documents reflecting model changes  
  o Much of this should be automated if tags are used in lieu of simple text.  
• Details of unique plumbing fixtures and equipment configurations or equipment connections.  
• Piping system riser diagrams  
• Detailed notes dictating the specifics of construction that may not be clearly represented graphically  

## 100% - Issued for Construction

The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 90% design review.  

Model includes:  

• Final locations of plumbing fixtures and equipment  
• All process plumbing equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD.  
  o All equipment operations and maintenance data parameters are preloaded into the HRSD plumbing Revit template and will automatically be applied into any appropriate families loaded into projects created from this template, provided they are categorized correctly.  
  o All equipment operations and maintenance data parameters can also be found in the HRSD shared parameter file (HRSD-Shared Parameter File.txt).
## Plumbing Model

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Final routing of plumbing piping</td>
</tr>
<tr>
<td></td>
<td>Contract drawings include:</td>
</tr>
<tr>
<td></td>
<td>Dimensions and annotation sufficient for the construction of all plumbing fixtures, equipment and piping</td>
</tr>
<tr>
<td>Substantial Completion</td>
<td>Model includes:</td>
</tr>
<tr>
<td></td>
<td>All discipline elements modeled to as-built size, type and location.</td>
</tr>
<tr>
<td></td>
<td>All elements shall be model to correct dimensions and positional accuracy to the nearest $\frac{1}{2}''$ relative to major structural components (walls, column lines, etc.).</td>
</tr>
<tr>
<td></td>
<td>It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition.</td>
</tr>
<tr>
<td></td>
<td>Model reflects specific equipment installed which may differ from the proposed model and drawings</td>
</tr>
<tr>
<td></td>
<td>Model reflects all changes made to proposed plumbing design during construction</td>
</tr>
<tr>
<td></td>
<td>All plumbing equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD.</td>
</tr>
<tr>
<td></td>
<td>All operations and maintenance data parameters are populated with correct data as provided by contractor</td>
</tr>
<tr>
<td></td>
<td>Contract drawings include:</td>
</tr>
<tr>
<td></td>
<td>Dimensions and annotation sufficient for the construction of all plumbing fixtures, equipment and piping.</td>
</tr>
<tr>
<td></td>
<td>Dimensions and annotation modified to reflect as-built conditions</td>
</tr>
</tbody>
</table>
### Electrical Model

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
</table>
| PER Draft         | The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description.  
Model includes:  
- Schematic representation of existing conditions if applicable.  
  - If an existing model is available, it should be used as a background/starting point.  
- Schematic layout of major electrical equipment represented at LOD 100 or 200  
  - Major equipment includes but is not limited to: generators and service entrance equipment, switchgear, switchboards, motor control centers and/or large motor controllers, etc.  
Layout dimensions and equipment orientations are approximate and may change upon further model development. |
| Final PER         | Electrical model and drawings may not be required at this project milestone. Coordinate with HRSD project manager about the production of drawings and modeling effort for the Final PER.  
The PER model and drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand its basic function and process. All electrical fixtures and equipment represented for the PER and beyond shall be modeled to LOD 350.  
Model includes:  
- Existing conditions if applicable  
  - Existing conditions shall be modeled to the same level as proposed items at every project milestone.  
  - Additional equipment may need to be modeled to represent interactions with proposed electrical items.  
  - If existing plumbing model exists, there is no need to remove or hide content for the sake of consistency.  
- Preliminary electrical equipment:  
  - Layout of electrical equipment shall accurately represent size, quantity, shape and location.  
  - Electrical equipment models (families) represent possible selection of proposed/specifed equipment but may not represent equipment that will ultimately be installed.  
    - When multiple manufactures are specified for any given equipment, the largest and/or most challenging to install of the possible selections should be represented. |
## Electrical Model

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Appropriate maintenance and access/code clearance requirements represented as well as considerations for placement of items relating to other disciplines which may not be present at this stage</td>
</tr>
<tr>
<td></td>
<td>• Space considerations for placement of conduit and/or cable tray</td>
</tr>
<tr>
<td>Drawings include:</td>
<td>Consult HRSD project manager regarding the inclusion of electrical drawings for the Final PER.</td>
</tr>
<tr>
<td></td>
<td>• Plans:</td>
</tr>
<tr>
<td></td>
<td>o Plans (overall and enlarged when required)</td>
</tr>
<tr>
<td></td>
<td>o Refer to Paragraph 8.6 for general information about plans</td>
</tr>
<tr>
<td></td>
<td>• Basic annotation:</td>
</tr>
<tr>
<td></td>
<td>Tags representing information pulled directly from model elements should be used whenever possible.</td>
</tr>
<tr>
<td></td>
<td>o Descriptive tags of electrical equipment</td>
</tr>
<tr>
<td>50%</td>
<td>The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD’s PER design review.</td>
</tr>
<tr>
<td></td>
<td>A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan.</td>
</tr>
<tr>
<td>Model includes:</td>
<td>• Instrumentation and electrical equipment associated with electrical not included in PER model</td>
</tr>
<tr>
<td></td>
<td>• Additional electrical equipment not present in the PER</td>
</tr>
<tr>
<td></td>
<td>• Inter-discipline coordination and conflict resolution (clash detection)</td>
</tr>
<tr>
<td>Contract drawings Include:</td>
<td>• Plans and sections:</td>
</tr>
<tr>
<td></td>
<td>o Plans (overall and enlarged when required)</td>
</tr>
<tr>
<td></td>
<td>o Overall sections</td>
</tr>
<tr>
<td></td>
<td>o Partial sections detailing elements not clearly detailed in overall sections</td>
</tr>
<tr>
<td></td>
<td>o Refer to Paragraph 8.6 for general information about plans and sections.</td>
</tr>
<tr>
<td></td>
<td>• Updates to any annotation present in PER documents reflecting model changes, if applicable</td>
</tr>
</tbody>
</table>
## Electrical Model

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>o Much of this should be automated if tags are used in lieu of simple text.</td>
</tr>
<tr>
<td></td>
<td>• Standard details and standard detail callouts</td>
</tr>
<tr>
<td></td>
<td>• Additional callouts of any additional equipment</td>
</tr>
<tr>
<td></td>
<td>• Instrumentation tags for all equipment (pumps, motor operated valves, sensors, etc.) that require power</td>
</tr>
<tr>
<td>90%</td>
<td>The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD’s 50% design review.</td>
</tr>
<tr>
<td></td>
<td>Model includes:</td>
</tr>
<tr>
<td></td>
<td>• Equipment control panels and local control stations located and coordinated with all other required disciplines</td>
</tr>
<tr>
<td></td>
<td>• Further refinement of electrical equipment layout as well as any related equipment representing further design</td>
</tr>
<tr>
<td></td>
<td>• Lighting and other electrical fixtures</td>
</tr>
<tr>
<td></td>
<td>• Inter-discipline coordination and conflict resolution (clash detection).</td>
</tr>
<tr>
<td></td>
<td>• Conduit embedded in slabs and walls.</td>
</tr>
<tr>
<td></td>
<td>Contract drawings Include:</td>
</tr>
<tr>
<td></td>
<td>• Updates to any annotation present in 50% documents reflecting model changes</td>
</tr>
<tr>
<td></td>
<td>o Much of this should be automated if tags are used in lieu of simple text.</td>
</tr>
<tr>
<td></td>
<td>• Details of unique electrical equipment, equipment configurations or equipment connections.</td>
</tr>
<tr>
<td></td>
<td>• Single line diagrams, panel schedules, riser diagrams, conduit and wire schedules lighting plans and other electrical equipment single lines</td>
</tr>
<tr>
<td>100% - Issued for Construction</td>
<td>The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD’s 90% design review.</td>
</tr>
<tr>
<td></td>
<td>Model includes:</td>
</tr>
<tr>
<td></td>
<td>• Accurate representations of proposed electrical equipment developed to LOD 350</td>
</tr>
<tr>
<td></td>
<td>• All applicable electrical equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD.</td>
</tr>
<tr>
<td></td>
<td>o All equipment operations and maintenance data parameters are preloaded into the HRSD electrical Revit template and will automatically be applied into any appropriate families loaded into projects created from this template, provided they are categorized correctly.</td>
</tr>
</tbody>
</table>
# Electrical Model

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Project Milestone Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>o All equipment operations and maintenance data parameters can also be found in the HRSD shared parameter file (HRSD-Shared Parameter File.txt).</td>
</tr>
<tr>
<td></td>
<td>• Inter-discipline coordination and conflict resolution (clash detection) completed with all conflicts resolved</td>
</tr>
<tr>
<td></td>
<td>Contract drawings include:</td>
</tr>
<tr>
<td></td>
<td>• Dimensions and annotation sufficient for the construction of all electrical equipment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substantial Completion</th>
<th>Model includes:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• All discipline elements modeled to as-built size, type and location.</td>
</tr>
<tr>
<td></td>
<td>o All elements shall be model to correct dimensions and positional accuracy to the nearest ½”.</td>
</tr>
<tr>
<td></td>
<td>o It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition.</td>
</tr>
<tr>
<td></td>
<td>• Model reflects specific equipment installed which may differ from the proposed model and drawings</td>
</tr>
<tr>
<td></td>
<td>• Model reflects all changes made to proposed electrical design during construction</td>
</tr>
<tr>
<td></td>
<td>• All electrical equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD.</td>
</tr>
<tr>
<td></td>
<td>o All operations and maintenance data parameters are populated with correct data as provided by contractor</td>
</tr>
<tr>
<td></td>
<td>Contract drawings include:</td>
</tr>
<tr>
<td></td>
<td>• Dimensions and annotation sufficient for the construction of all electrical equipment</td>
</tr>
<tr>
<td></td>
<td>• Dimensions and annotation modified to reflect as-built conditions</td>
</tr>
</tbody>
</table>
3.0 BIM Execution Plan

These requirements shall be used in conjunction with the project specific BIM Execution Plan. The BIM Execution Plan includes project specific planning including: team members and roles, software and releases to be used, file hosting location, model sharing methods, deliverable dates, client presentation methods, project LOD requirements, etc. and shall be set up by the project BIM lead in close coordination with the HRSD project manager.

4.0 Model File Creation

4.1 Project Templates

All HRSD project model files shall be created using HRSD’s project template. Reference the BIM Execution Plan for software version requirements.

4.2 Orientation and Project Base Point

Project files should be modeled in the same orientation as they will be shown on contract drawing plan views. Refer to Paragraph 8.6 for more information on plan views. All project files shall be modeled such that the project base point is at the inside bottom left corner or the center of a round structure. The project base point shall be located at the finished floor elevation of the structure. The project base point must never be moved unclipped and should always be located at the project origin.

4.3 Revit Model Linking

All Revit models shall be linked origin to origin or by shared coordinates once shared coordinates have been established.

4.4 Level and Grids

All column grids and levels associated with main floors shall be copy-monitored from the structural model.
4.5 Model Naming Convention

Project files names shall contain the project number, contract number, area number and category abbreviation. The “Area Number” and “Area Abbreviation” shall correspond area numbers established in the BIM Execution Plan. The following is an example of a project file name: 12345-123-100-ABC-M.rvt. In this example, the project number is “12345-123,” the area number is 100, the structure (area abbreviation) is a “ABC” and it is a Mechanical file “M” (See discipline abbreviation table below). Most Revit files should fall into one of the categories below.
# Discipline Abbreviation Table

<table>
<thead>
<tr>
<th>Discipline Abbreviation</th>
<th>Discipline</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Civil/Site</td>
</tr>
<tr>
<td>M</td>
<td>Process Mechanical</td>
</tr>
<tr>
<td>S</td>
<td>Structural</td>
</tr>
<tr>
<td>A</td>
<td>Architectural</td>
</tr>
<tr>
<td>H</td>
<td>HVAC</td>
</tr>
<tr>
<td>P</td>
<td>Plumbing</td>
</tr>
<tr>
<td>FP</td>
<td>Fire Protection</td>
</tr>
<tr>
<td>E</td>
<td>Electrical</td>
</tr>
<tr>
<td>I</td>
<td>Instrumentation</td>
</tr>
</tbody>
</table>

## SINGLE DISCIPLINE MODEL

```
PROJECT NUMBER
  ↓
1 2 3 4 5

CONTRACT NUMBER
  ↓
1 2 3

AREA NUMBER
  ↓
1 0 0

AREA ABBREVIATION
  ↓
A B C

DISCIPLINE ABBREVIATION
  ↓
M
```

## SITE PLANS

```
PROJECT NUMBER
  ↓
1 2 3 4 5

CONTRACT NUMBER
  ↓
1 2 3

AREA NUMBER
  ↓
0 0 0

CATEGORY ABBREVIATION
  ↓
SITE
```

1 2 3 4 5 - 1 2 3 - 1 0 0 - A B C - M

1 2 3 4 5 - 1 2 3 - 0 0 0 - SITE
5.0 Shared Coordinates

A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier in the project life cycle per the directions specified in the Project BIM Execution Plan.

Care should be taken to ensure that all model geometry is within a 20-mile radius of the model’s internal origin to ensure model accuracy. It should be noted that this requirement does not hold the location of a shared coordinate system to that 20-mile limit as this is related to the Virginia State Plane Coordinate System and is not model geometry.

5.1 State Plan Coordinate System


5.2 Federated Site Model

A federated site model (a single model containing all discipline models for all areas within the scope of the project linked as references) shall be created before the 50% submittal unless specified otherwise in the BIM Execution Plan. The federated site model shall include all linked files of all structures/processes for all disciplines. All discipline models shall be located per the established shared coordinate system.

6.0 Family Creation

The HRSD template files contain general annotation and tags but do not contain equipment models. Equipment models created for project needs shall meet the criterial defined in this document and any criteria detailed in the Project BIM Execution Plan. All equipment families shall be created as the appropriate category type. Equipment families should never be categorized as “Generic Models” but rather as what they represent: “Mechanical Equipment”, “Pipe Accessories”, “Electrical Equipment”, etc.

Families representing maintainable assets must be modeled in such a way that all independently maintainable assets within the family are also independently addressable. For example, a progressive cavity pump may have maintenance data requirements that differ from the electric motor attached to it. In such a case, the pump and attached motor would each need to be unique elements capable of hosting independent and different data. This is most easily accomplished by making individual maintainable assets within a family separate nested and “Shared” families.
6.1 **Family Naming Convention**

All families will be named using the following requirements:

- Keep file names as short as possible.
- All family names must be unique.
- File names will use ‘title casing’.
- When adding descriptors (e.g., “Plug Valve Flanged 4-12in”), consider the order of the descriptors and the order they will appear in the project browser. Descriptors that would appear in several similar families should be the first of the descriptors if there are more than one.
- All family names shall adhere to the following format:

  Functional Type-Subtype-Manufacturer-Descriptor1-Descriptor 2

<table>
<thead>
<tr>
<th>Component</th>
<th>Required or optional</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional Type</td>
<td>Required</td>
<td>Names the element that the part will represent. For example, MCC or Door.</td>
</tr>
<tr>
<td>Subtype</td>
<td>As needed</td>
<td>Names the part type, for example, “Flanged” on a flanged valve.</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>As needed</td>
<td>Manufacturer information not necessary when dimensions are governed by an industry standard (ANSI) or when the family is a generic component.</td>
</tr>
<tr>
<td>Descriptor</td>
<td>As needed</td>
<td>Examples: Size ranges (4-12in), Material (PVC, Steel, etc.)</td>
</tr>
</tbody>
</table>

6.2 **Family Level of Detail**

To maintain consistency and drawing clarity families must be created using the following requirements:

- Families shall be drawn with sufficient detail to clearly visually identify them from any view and will accurately represent overall size and key features of an object (LOD 300). Items too fine to be clearly represented when printed at a given drawing scale should not be included in a family. These items include but are not limited to bolts, buttons, hinges, etc. The inclusion of such items increases the time required to model a family without adding any needed clarity.
  - Simply put, a progressing cavity pump family should look like a progressing cavity pump when printed but should not print as an indistinct black blob on contract drawings.
- Families should feature enough visual information to convey features that impact the design of the project. For example, access hatches or manways on equipment that must be clear from obstruction or lifting hooks that must align with a monorail.

- Dimensions taken from manufacturers’ literature should be rounded to the nearest minimum unit of measurement. See table below:

<table>
<thead>
<tr>
<th>Minimum Units*</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/16”</td>
<td>Annotation symbols</td>
</tr>
<tr>
<td>1/4”</td>
<td>Small diameter pipe accessories (1” to 6”), Small equipment (occupying less than 2’-0”³)</td>
</tr>
<tr>
<td>1/2”</td>
<td>Pipe accessories greater than 6” diameter, medium size equipment (small pumps, small control panels...)</td>
</tr>
<tr>
<td>1”</td>
<td>Large equipment (large pumps, large equipment...)</td>
</tr>
</tbody>
</table>

Flanged pipe connections or any other connection size dictated by an industry standard should be drawn to the nearest .01” per the standard. This includes any connectors associated with a family of any size. Pipe fittings that adhere to an industry standard, ANSI, should be drawn to those dimensions.

### 7.0 Shared Parameter File

The HRSD shared parameter file is provided as a repository for the IFC parameters present in the template as well as other standard parameters. It is not be necessary for all parameters to be present in all families. The shared parameter file is provided simply to facilitate adding parameters to families as needed.

#### 7.1 Shared Parameters in Models

Project needs may require the addition of shared parameters. Any project specific shared parameter file shall always start with the provided HRSD Shared Parameter file and all parameters unique to that project will be added to that file. The Project Shared parameter file contains all family and project parameters as well as all standard HRSD parameters.

#### 7.2 Shared Parameters, Equipment Data and Asset ID

The provided HRSD shared parameter file contains parameters relating to HRSD equipment record standards. These parameters must be included in all project files. These parameters are present in the HRSD template files as well as the HRSD Shared Parameter.txt file. The parameters shall be applied to all equipment requiring regular maintenance. This will occur automatically, provided equipment is categorized properly and the appropriate HRSD template was used to create the project file. See paragraph 6.0 for more information.

All equipment requiring regular maintenance shall be assigned a unique asset ID. This asset ID shall match the asset ID found on the corresponding equipment data sheet. All data sheet information shall be applied to the corresponding equipment in the BIM model. Equipment data shall be applied to the completed as-built model prior to it being turned over to HRSD.
8.0 **Contract Drawings**

8.1 **Sheet Size**

All sheets created for HRSD shall be produced on ANSI D 22”x34” when printed full size.

8.2 **Sheet Numbering**

Sheets numbers shall consist of a discipline designator, an area number and a sequential individual sheet number as shown in the example below.

**Area Number**: project areas, structures or areas starting with 000. (Refer to project’s BIM Execution Plan)

**Discipline Designator**

**Drawing sequence within category**

Every sequence starts with #0 consisting of a 2-digit number sequence. Example: the 12th drawing in the mechanical discipline of structure area #200 would be numbered M212
8.3 View Templates and Filters

View templates are predefined templates with view overrides in HRSD templates. View templates will be used in plans, section, tables, and detail views, to show consistency in all project drawings. With that in mind, understand that view templates will not do all the work for every element in every model; a good understanding of the graphic overrides that need to take place is a must. View templates should be used in all views. Presentation changes should be made in view templates, never in individual Visibility/Graphics Overrides on individual views.

A key portion of view templates are filters. Filters allow graphic overrides for elements that differ from the category in which it’s modeled. Filters override elements based on different parameters, such as type name, family name, comments, etc. It is critical that all users familiarize themselves with information filters require to model elements properly. It is imperative that all modeling be consistent with the information that view filters require. When additional filters are required, filter names will use the following requirements:

- All filter names must be unique.
- Filter names will be case sensitive and use ‘title casing’.
- Keep filter names as short as possible.

8.4 Text and Labels

HRSD project template files contain all text styles needed for annotating drawings. All annotation shall be created using the text styles provided in the template. See the table below for text style names and uses:

<table>
<thead>
<tr>
<th>HRSD Text Styles</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Text Style Name</td>
<td>Actual Text Height</td>
<td>Text Font</td>
<td>Drawing Use</td>
</tr>
<tr>
<td>HRSD-06pt</td>
<td>1/16&quot;</td>
<td>Arial</td>
<td>Annotation on figures</td>
</tr>
<tr>
<td>HRSD-08pt</td>
<td>5/64&quot;</td>
<td>Arial</td>
<td>Annotation on figures</td>
</tr>
<tr>
<td>HRSD-10pt</td>
<td>3/32&quot;</td>
<td>Arial</td>
<td>General contract drawing text</td>
</tr>
<tr>
<td>HRSD-14pt</td>
<td>9/64&quot;</td>
<td>Arial</td>
<td>Titles, room names...</td>
</tr>
<tr>
<td>HRSD-18pt</td>
<td>3/16&quot;</td>
<td>Arial</td>
<td>Label text</td>
</tr>
<tr>
<td>HRSD-20pt</td>
<td>13/64&quot;</td>
<td>Arial</td>
<td>Titles, tables...</td>
</tr>
</tbody>
</table>

All annotation shall be placed per the following requirements:

- All leaders shall use a 15 Degree Filled Arrow
- All text with leaders shall be left aligned with leaders coming from the top left or bottom right of text strings.
- Labels shall be used wherever possible. “Dumb” text should only be used when the presented information cannot be pulled from the model element itself with the use of a label.
- All labels shall adhere to the same requirements and properties as regular text.
8.5 Schedules

Schedules shall be created per the following requirements:

- All tables or schedules shall use the HRSD-Schedule View Template.
- All schedule or table data shall be generated from project BIM data when possible.
- Unique parameters can be added for scheduling purposes. Refer to Paragraph 7.0.

8.6 Plans, Sections and Details

Plan views presented on contract drawings shall be at a preferred scale of $1/4''=1'-0''$ or $3/16''=1'-0''$ if necessary. Larger structures may need to be displayed at larger scales to fit on standard ANSI D sheets. In this case, enlarged plans should be used in conjunction with overall plans. Overall plans may be displayed at the minimum scale necessary for them to fit on sheets. Plan views shall be orientated such that plant or true north point up or to the left. It is acceptable for plant or true north to point to the right when necessary. Plan views should never be oriented such that plant or true north point down the page. Use the HRSD Plan Viewport callout option when placing plan views on sheets.

All sections and details in the same project or drawing series (i.e. 100, 200, etc.) shall have unique letters (sections) or numbers (details). In other words, the mechanical drawing series for area 200 may contain sections: A, B, C, etc. and details: 1, 2, 3, etc. and the mechanical drawing series for area 300 may also contain sections: A, B, C, etc. and details: 1, 2, 3, etc., but these letters and numbers shall not repeat within a series. This rule only applies to a single discipline. For example, Architectural, Structural and Mechanical can all have a section “A” and a Detail “1” within the same drawing series. The sections and details only need to be unique per discipline and drawings series. Section letters “I” and “O” shall not be used because of their similar appearance to numbers “1” and “0.” If a drawing series exceeds the number of available letters for sections, it is correct to number sections “AA,” “BB,” etc. When sections are cut in a detail view, they are considered minor sections. Minor Sections shall be Section A-A, B-B, etc. The numbering is sheet dependent, meaning you can have a minor section A-A on more than one sheet, but there cannot be two minor sections A-A on the same sheet.

Sections should be cut to the right or, when necessary, left. Sections should be cut looking up a page on a plan view. Sections should only be cut looking down a page only when required.

8.7 Drawing Submittal Format

All drawings shall be provided to HRSD as vector pdfs, printed directly to pdf, and not scanned. Drawings shall be printed full size (22x34in). Drawings shall be signed and sealed in accordance with the Commonwealth of Virginia DPOR requirements.
Section 8 - PER, Design, and Construction Submittal Requirements

A. **Introduction** - In an effort to reduce paper and to further implement the Oracle Unifier Project Management System (Unifier), the Engineering Department has implemented standards for storage of plans, Bid Documents, Operations and Maintenance (O&M) manuals, and shop drawings. It is critical that Engineering’s Project archival systems maintain the official records of shop drawings, O&M manuals, and all other project related correspondence until such time as the project is closed out. Paper submittals from FIRM will continue for staff review and use with the number of copies detailed within this Section.

B. **Requirements for Submittals** – FIRM shall following the requirements detailed in the listed paragraphs.

1. Provide all stages of PER, plan, and specification submittals in Portable Document Format (PDF) in addition to the traditional or desired number of paper copies for review. PDF files shall be formatted with bookmarks and each submittal shall be a single PDF as opposed to a collection of PDF files for individual chapters, plan sheets, etc.

2. For pipeline projects, seamless AutoCAD files (a seamless file is an individual file containing the entire proposed pipeline improvements) to be prepared and submitted to HRSD for the purpose of populating the GIS with new / relocated / rehabilitated pipelines. Show locations of pipeline alignment, pump stations, metering valves, gate/plug valves, air vents, etc. in support of establishing a numbering scheme for Valve Guides. The timing and content of submittals follow:

   a. Prepare and submit a “seamless” CAD file showing the proposed improvement limits at the 50% design stage. This information will be used to show the overall limits and alignment of the project.

   b. Prepare and submit a “seamless” CAD file with the proposed improvements and delineations for proposed Valve Guides at the Conformed Drawing submittal stage. The GIS/CAD Division will review the proposed Valve Guide locations and layouts and will assign numbers for Interim and Final Valve Guides. The HRSD Project Manager will coordinate with the FIRM to incorporate these assigned asset numbers into the generated Valve Guides.

   c. Submit to HRSD Project Manager unless otherwise detailed in the Professional Services Agreement / Amendment the following:

      i. One (1) AutoCAD seamless file of the project limits on CD at the 50% design stage.

      ii. One (1) AutoCAD seamless file of proposed improvements and proposed Valve Guide delineations on CD at the Conformed Documents stage.

      iii. The Project Manager shall submit to the Engineer the assigned Valve Guide numbering scheme for production of Interim and Final Valve Guides.
3. Interim Record Drawing submittals must be submitted to HRSD Project Manager a minimum of 5 business days in advance of the scheduled tie-in for force main project or HRSD taking operational possession of the constructed facility. FIRM to incorporate this requirement into the Construction Bid Documents.

   a. Interim Record Drawings shall be prepared by the FIRM and transmitted to the HRSD Project Manager along with the tie-in plan. The Project Manager shall review a paper copy of the Interim Record Drawings for accuracy and completeness. Any required revisions shall be coordinated with the FIRM and the corrected version resubmitted back to the HRSD Project Manager.

   b. Interim Record Drawings shall be the following formats: (a) full size paper prints redlined with legible marks indicating changes, additions, or deletions; (b) PDF scan of the Interim Record Drawings.

   c. Refer to Section 6 - Drawings, Record Drawings, and Valve Guides in this manual for the latest information to be included with Record Drawings.

   d. Submit to HRSD Project Manager unless otherwise detailed in the Professional Services Agreement / Amendment the following:

      i. Four (4) 24” x 36” full size paper copies of Interim Record Drawings.
      ii. One (1) PDF scan of the Interim Record Drawings on CD or in Unifier.

4. Interim Valve Guide submittal must be a minimum of 5 business days in advance of the scheduled tie-in for force main project or HRSD taking operational possession of the constructed facility. FIRM to incorporate this requirement into the Construction Bid Documents.

   a. Interim Valve Guides shall be prepared by the FIRM and transmitted to the HRSD Project Manager along with the tie-in plan. The Project Manager shall review a paper copy of the Interim Valve Guides for accuracy and completeness. Any required revisions shall be coordinated with the Engineer and the corrected version resubmitted back to the HRSD Project Manager.

   b. Interim Valve Guides shall be the following formats (a) AutoCAD “dwg”, (b) PDF, and (c) 8½” x 11” paper copies.

   c. Submit to HRSD Project Manager unless otherwise detailed in the Professional Services Agreement / Amendment the following:

      i. Four (4) 8½” x 11” paper copies of each Interim Valve Guide.
      ii. One (1) AutoCAD dwg file of each Interim Valve Guide in Unifier.
      iii. One (1) PDF file of each Interim Valve Guide in Unifier.
5. Final Record Drawings submittal at project Final Completion stage. Refer to the Section 6 – “Drawings, Record Drawings, and Valve Guides” in this manual for the latest information to be included with Record Drawings.

   a. Final Record Drawings to be prepared by the FIRM and transmitted to the HRSD Project Manager. The Project Manager shall review a paper copy of the Final Record Drawings for accuracy and completeness. Any required revisions shall be coordinated with the FIRM and the corrected version resubmitted back to the HRSD Project Manager.

   b. Final Record Drawings shall be the following formats:

      i. AutoCAD dwg for each plan sheet,

      ii. A single PDF file for each volume of Record Drawings,

      iii. Full size paper prints (HRSD Project Manager to determine the need).

   c. Submit to HRSD Project Manager unless otherwise detailed in the Professional Services Agreement / Amendment the following:

      i. Four (4) 24” x 36” full size paper copies of Final Record Drawings. (HRSD Project Manager to determine the need)

      ii. One (1) PDF file of each volume of Final Record Drawings in Unifier.

      iii. One (1) AutoCAD dwg file of each Final Record Drawing sheet in Unifier.

6. Final Valve Guides shall be prepared by the FIRM and submitted at project Final Completion stage. Refer to Section 6 – “Drawings, Record Drawings, and Valve Guides” in this manual the latest information to be included with Valve Guides.

   a. Final Valve Guides to be transmitted to the Project Manager. The Project Manager shall review a paper copy of the Final Valve Guides for correct numbering assignment as determined by HRSD GIS/CAD Division and completeness. Any required revisions shall be coordinated with the FIRM and the corrected version resubmitted back to the HRSD Project Manager.

   b. Final Valve Guides shall be the following formats (a) AutoCAD “dwg”, (b) PDF, and (c) 8½” x 11” paper copies.

   c. Submit to HRSD Project Manager unless otherwise detailed in the Professional Services Agreement / Amendment the following:

      i. Four (4) 8½” x 11” paper copies of each Final Valve Guide. (HRSD Project Manager to determine the need)

      ii. One (1) AutoCAD dwg file of each Final Valve Guide in Unifier.

      iii. One (1) PDF file of each Final Valve Guide in Unifier.
7. Shop Drawings for each project shall be submitted to HRSD’s Project Manager. Refer to Master Specification 01340 Submittals in Section 40 in this manual for further information. The following is in addition to Unifier submittals. The format for Shop Drawings are to be PDF and distributed by the Project Manager as follows:

a. For force mains and gravity sewers – portable media containing PDF files at Substantial Completion stage to appropriate Chief of Interceptor Systems or in Unifier.

b. For pump stations, PRS, flow meters, pressure sensors and other mechanical systems for Interceptor Systems – portable media containing PDF files prior to Substantial Completion stage to appropriate Chief of Interceptor Systems, to Operations Support Systems Manager, and Chief of Electrical and Energy Management or in Unifier.

c. For treatment plants and outfalls – portable media containing PDF files prior to Substantial Completion or before taking operational ownership of a process or component to Operations Support Systems Manager, Chief of Electrical and Energy Management, and to appropriate Plant Manager or in Unifier.

8. Operations and Maintenance (O&M) Manuals for each project shall be submitted to HRSD’s Project Manager. Refer to Master Specification 01340 Submittals in Section 40 in this manual for further information. Operation & Maintenance Manual Equipment List (Exhibit C1) shall be prepared and submitted in Excel format to HRSD at the 100% design stage. HRSD Asset Management and Operations will review and approve the proposed list of equipment that would require O&M Manual submittal. Exhibit C1 will provide HRSD with the data to populate the Computerized Maintenance Management System (CMMS) and establish the system and process hierarchy. Updated Exhibit C1 and Exhibits C2 and C3 shall be submitted in Excel format prior to substantial completion in accordance with Master Specification 01340 Submittals. The following is in addition to Unifier submittals. The format for O&M manuals are to be PDF and distributed by the Project Manager as follows:

a. For pump stations, PRS, flow meters, pressure sensors and other mechanical systems for Interceptor Systems – portable media containing PDF files prior to Contractor / FIRM component training or operational ownership to appropriate Chief of Interceptor Systems, Operations Support Systems Manager, and Chief of Electrical and Instrumentation.

b. For treatment plants – portable media containing PDF files prior to Contractor / FIRM component training or operational ownership to Operations Support Systems Manager, Chief of Electrical and Instrumentation, and to appropriate Chief of Treatment.

9. Conformed Documents specifics are defined in Section 16 – “Preparation of and Format for Conformed Documents”. The following is in addition to Unifier submittals. HRSD’s
Project Manager shall make the necessary copies of the received PDF version of Conformed Documents for each project and distribute as follows:

a. For force mains and gravity sewers – portable media containing PDF files prior to Pre-Construction Meeting to appropriate Chief of Interceptor Systems.

b. For pump stations, PRS, flow meters, pressure sensors and other mechanical systems for Interceptor Systems – portable media containing PDF files prior to Pre-Construction Meeting to appropriate Chief of Interceptor Systems, Operations Support Systems Manager, and Chief of Electrical and Instrumentation.

c. For treatment plants and outfalls – portable media containing PDF files prior to Pre-Construction Meeting to Operations Support Systems Manager, and Chief of Electrical and Instrumentation, appropriate Chief of Treatment.

C. Attachment A summarizes the major list of submittals to HRSD.

D. Attachment B is the Equipment Records template Excel file.
## Attachment A - Summary of Major Submittals to HRSD

<table>
<thead>
<tr>
<th>Submittal Description</th>
<th>Submittal Format</th>
<th>Number of Copies</th>
<th>Distribution List</th>
<th>Reference Section</th>
</tr>
</thead>
</table>
| **PER Draft**         | PDF upload to Unifier | N/A              | • Engineering Library  
                                      • Operations Department  | Section 8 - PER, Design, and Construction Submittal Requirements |
| **PER Draft**         | 8 ½” x 11” double sided paper bound copy | TBD              | • Project Manager  
                                      • Operations Department  
                                      • Engineering Director | {Number of copies defined in Professional Services Agreement / Amendment} |
| **Infrastructure Condition Assessment Plan** | Incorporated into PER draft and final | TBD              | • Project Manager  
                                      • Chief of Asset Management | Section 20 – Condition Assessment Protocol for Replaced or Abandoned Pipelines |
| **Building Information Model (BIM) Execution Plans** | PDF uploaded to Unifier | TBD              | • Project Manager  
                                      • Chief of Asset Management | Section 7 – HRSD Building Information Model (BIM) Requirements |
| **PER Final**         | PDF upload to Unifier | N/A              | • Project Manager  
                                      • Engineering Library  
                                      • Engineering Director  
                                      • Operations Department | Section 8 - PER, Design, and Construction Submittal Requirements |
| **PER Final**         | 8 ½” x 11” double sided paper bound copy | 3                | • Project Manager  
                                      • Engineering Director | {Number of copies defined in Professional Services Agreement / Amendment} |
| **50% Design Drawings** | PDF and DWG upload to Unifier | N/A              | • Engineering Library  
                                      • Project Manager  
                                      • Operations Department  
                                      • GIS/CAD Group | Section 8 - PER, Design, and Construction Submittal Requirements |
## Attachment A - Summary of Major Submittals to HRSD

<table>
<thead>
<tr>
<th>Submittal Description</th>
<th>Submittal Format</th>
<th>Number of Copies</th>
<th>Distribution List</th>
<th>Reference Section</th>
</tr>
</thead>
</table>
| 50% Design Drawings   | Full size and/or true half scale prints | TBD              | • Project Manager  
• Chief of D&C  
• Operations Department  
  o Chief of Facility Support (1 copy)  
  o Electrical (3 copies)  
  o Instrumentation (2 copies)  
  o Automotive (1 copy)     | {Number of copies defined in Professional Services Agreement / Amendment} |
| 50% Design Seamless AutoCAD file | AutoCAD dwg upload to Unifier | N/A              | • GIS/CAD Group  
• Engineering Library  
• Project Manager  
• Operations Department  
• GIS/CAD Group     | Section 8 - PER, Design, and Construction Submittal Requirements |
| 90% Design Drawings   | PDF and DWG upload to Unifier | N/A              | • Engineering Library  
• Project Manager  
• Operations Department  
• GIS/CAD Group     | Section 8 - PER, Design, and Construction Submittal Requirements |
| 90% Design Drawings   | Full size and/or true half scale prints | TBD              | • Project Manager  
• Chief of D&C  
• Operations Department  
  o Chief of Facility Support (1 copy)  
  o Electrical (3 copies)  
  o Instrumentation (2 copies)  
  o Automotive (1 copy)     | {Number of copies defined in Professional Services Agreement / Amendment} |
| 90% Design Specifications | PDF upload to Unifier | N/A              | • Engineering Library  
• Project Manager  
• Operations Department     | Section 8 - PER, Design, and Construction Submittal Requirements |
Attachment A - Summary of Major Submittals to HRSD

<table>
<thead>
<tr>
<th>Submittal Description</th>
<th>Submittal Format</th>
<th>Number of Copies</th>
<th>Distribution List</th>
<th>Reference Section</th>
</tr>
</thead>
</table>
| 90% Design Specifications | 8 ½” x 11” double sided paper bound copy | TBD | • Project Manager  
• Chief of D&C  
• Operations Department  
  o Electrical (3 copies)  
  o Instrumentation (2 copies)  
  o Automotive (1 copy) | {Number of copies defined in Professional Services Agreement / Amendment} |
| 100% Design Drawings | PDF and DWG upload to Unifier | N/A | • Engineering Library  
• Project Manager  
• Operations Department  
• GIS/CAD Group | Section 8 - PER, Design, and Construction Submittal Requirements |
| 100% Design Drawings | Full size and/or true half scale prints | TBD | • Project Manager  
• Chief of D&C  
• Operations Department  
  o Electrical (3 copies)  
  o Instrumentation (2 copies)  
  o Automotive (1 copy) | {Number of copies defined in Professional Services Agreement / Amendment} |
| 100% Design Specifications | PDF upload to Unifier | N/A | • Engineering Library  
• Project Manager  
• Operations Department | Section 8 - PER, Design, and Construction Submittal Requirements |
| 100% Design Specifications | 8 ½” x 11” double sided paper bound copy | TBD | • Project Manager  
• Chief of D&C  
• Operations Department  
  o Electrical (3 copies)  
  o Instrumentation (2 copies)  
  o Automotive (1 copy) | {Number of copies defined in Professional Services Agreement / Amendment} |
<table>
<thead>
<tr>
<th>Submittal Description</th>
<th>Submittal Format</th>
<th>Number of Copies</th>
<th>Distribution List</th>
<th>Reference Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation &amp; Maintenance Manual Equipment List – Exhibit C1 (Review / Approval) at 100% Design Stage</td>
<td>Excel upload to Unifier</td>
<td>• Project Manager • Asset Management • Operations Department</td>
<td>Section 8 - PER, Design, and Construction Submittal Requirements</td>
<td></td>
</tr>
<tr>
<td>Bid Documents (Drawings)</td>
<td>PDF upload to Unifier</td>
<td>N/A</td>
<td>• Engineering Library • Project Manager</td>
<td>Section 8 - PER, Design, and Construction Submittal Requirements</td>
</tr>
<tr>
<td>Bid Documents (Drawings)</td>
<td>Full size prints</td>
<td>2</td>
<td>• Project Manager • Chief of D&amp;C</td>
<td>Section 8 - PER, Design, and Construction Submittal Requirements</td>
</tr>
<tr>
<td>Bid Documents (Specifications)</td>
<td>PDF upload to Unifier</td>
<td>N/A</td>
<td>• Engineering Library • Project Manager</td>
<td>Section 8 - PER, Design, and Construction Submittal Requirements</td>
</tr>
<tr>
<td>Bid Documents (Specifications)</td>
<td>8 ½” x 11” double sided paper bound copy</td>
<td>2</td>
<td>• Contract Specialist • Project Manager</td>
<td>Section 16 - Preparation of and format for Conformed Documents</td>
</tr>
<tr>
<td>Conformed Documents (Drawings)</td>
<td>PDF upload to Unifier</td>
<td>N/A</td>
<td>• Engineering Library • Project Manager • GIS/CAD Group • Operations Department</td>
<td>Section 16 - Preparation of and format for Conformed Documents</td>
</tr>
<tr>
<td>Conformed Documents (Drawings)</td>
<td>Full size and/or true half scale prints</td>
<td>TBD</td>
<td>• Operations Department • Full size set for Electrical staff</td>
<td>Section 16 - Preparation of and format for Conformed Documents</td>
</tr>
</tbody>
</table>
## Attachment A - Summary of Major Submittals to HRSD

<table>
<thead>
<tr>
<th>Submittal Description</th>
<th>Submittal Format</th>
<th>Number of Copies</th>
<th>Distribution List</th>
<th>Reference Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conformed Documents (Seamless AutoCAD file with identified Valve Guide boundaries)</td>
<td>AutoCAD DWG upload to Unifier</td>
<td>N/A</td>
<td>• GIS/CAD Group</td>
<td>Section 8 - PER, Design, and Construction Submittal Requirements</td>
</tr>
<tr>
<td>Conformed Documents (Specifications)</td>
<td>PDF upload to Unifier</td>
<td>N/A</td>
<td>• Engineering Library • Project Manager • Operations Department</td>
<td>Section 16 - Preparation of and format for Conformed Documents</td>
</tr>
<tr>
<td>Conformed Documents (Specifications)</td>
<td>8 ½” x 11” double sided paper bound copy</td>
<td>TBD</td>
<td>• Project Manager • Admin • Operations Department • Chief of D&amp;C</td>
<td>Section 16 - Preparation of and format for Conformed Documents <em>(Number of copies defined in Professional Services Agreement / Amendment)</em></td>
</tr>
<tr>
<td>Shop Drawings (Review / Approval)</td>
<td>PDF of each submitted shop drawing upload to Unifier</td>
<td>N/A</td>
<td>• Project Manager</td>
<td>Section 8 - PER, Design, and Construction Submittal Requirements</td>
</tr>
<tr>
<td>Operation &amp; Maintenance Manuals (Review / Approval)</td>
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### BREAK- IN MAINTENANCE REQUIREMENT (INITIAL OIL CHANGES, ETC.)

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### PREVENTIVE MAINTENANCE REQUIREMENTS

None required

### RECOMMENDED SPARE PARTS

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Use multiple tabs of Exhibit C2 as needed.
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Section 9 - Real Estate Acquisition and Plat Guidelines

A. Introduction - Professional Services firms (FIRM) and staff involved with design and construction projects often must obtain permanent and temporary easements or land acquisition to accommodate new pipelines, new or rehabilitated pump stations, storage tanks, and treatment plant expansions. This guideline identifies steps and timing for coordination with HRSD’s Real Estate Manager during a typical project. It is important for FIRM and staff to properly account for the duration of time that a typical land acquisition process will take when preparing for bid advertisement of construction projects.

B. Real Estate Schedule vs. Project Schedule

1. Exhibit A in this Section shall be used as a template for the timing and stage for submittals related to real estate matters to HRSD’s Real Estate Manager.

2. The FIRM is to build sufficient time into design and approval schedules to account for real estate acquisition prior to advertising a project for construction bids.

C. Easements

1. Plat – Refer to the Standard Details section in this manual for sample plats showing critical information required to meet HRSD needs.

2. The FIRM shall prepare plats for all required easements, permanent and temporary, in a manner to meet the needs of HRSD and to be in accordance with Virginia State Library and Archives Standards for Plats and be recordable in the appropriate jurisdiction. The FIRM shall provide a list of the names and addresses of the current property owners for each plat.

3. Plat shall not exceed 8-½ inch x 14 inch without prior agreement.

4. FIRM shall provide HRSD with an electronic copy in pdf format and three paper copies of the final plats.

5. FIRM shall coordinate with HRSD’s Real Estate Manager as necessary to resolve any issues uncovered in the title search or other phases of the process.

6. For plats, minimum permanent easement width shall be 30-feet with centerline of pipe at the one-third point. For pipelines in easements along the right of way, permanent easement shall provide a minimum of ten feet from centerline of pipe to the edge of easement away from the right of way. Provide temporary easement widths as required for construction purposes.

7. An electronic copy of the plats shall be provided in AutoCAD (.DWG) format at the release indicated in the RFP, or otherwise approved format. Two Virginia State Plane Coordinates shall be provided to tie the easement and/or property boundary to the Virginia State Plane grid. A reference to the horizontal datum including the realization (e.g. NAD83(1986), NAD83(HARN), NAD83(CORS96) ) shall be included on the plat.
Exhibit A

Real Estate Schedule vs. Project Schedule

- **PLATS**
- **Appraisal Services Title Reports**
- **65% Project Design**
- **Negotiation**
- **90% - 95% Project Design**
- **Public Hearing**
- **Final Design Review**
- **File Certificate of Take**
- **Bid Project**
- **Begin Construction**

**Note:**
* Federal, State, Local Jurisdictions, and/or Railroads may require additional time.

End of Section
Section 10 - Flood Elevation Requirements

A. **Introduction** - Localities in Hampton Roads have adopted flood elevation freeboard design criteria that exceed FEMA flood elevations. The required freeboard affects finished floor elevation in these localities, including those on HRSD projects. To comply with the Locality requirements and to consider Sea Level Rise, this standard will cover the process to determine the finished floor elevation for HRSD projects.

B. **Definitions**
   - Freeboard - the calculated difference between the finished floor elevation and the FEMA Base Flood Elevation for the 100-year storm
   - BFE - Base Flood Elevation
   - EWL (100yr) - Extreme Water Level for the 100 year storm event

Flood Zone definitions can be found on the FEMA website, [https://www.fema.gov](https://www.fema.gov) under “Flood Zones”

C. **Locality Code Requirements**
   The freeboard and finished floor elevation requirements should be verified with the locality in question for each project when initiated. Localized drainage conditions should also be considered for each project when setting the elevation for new buildings or structures.

The following example is for freeboard construction requirement in the City of Hampton at the HRSD Bridge St. PS Location. Note that it may not represent the current construction standards for the example Locality.

   Hampton Freeboard, Zone AE: FEMA Base Flood + 3'

D. **Steps for Determining Construction Elevation**
   The following procedure shall be used to determine the finished floor elevation:
   1. Using Table 1 below, plot the following:
      i. Sea Level Rise, Intermediate
      ii. Sea Level Rise with an Extreme Water Level for the 100 year storm event
      iii. FEMA Base Flood Elevation ([https://msc.fema.gov](https://msc.fema.gov))
      iv. Locality Freeboard Requirement
Table 1 – NOAA 2017 Sea Level Rise

<table>
<thead>
<tr>
<th>Year</th>
<th>Intermediate</th>
<th>EWL (100yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>0.46</td>
<td>7.46</td>
</tr>
<tr>
<td>2030</td>
<td>0.82</td>
<td>7.82</td>
</tr>
<tr>
<td>2040</td>
<td>1.21</td>
<td>8.21</td>
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<tr>
<td>2050</td>
<td>1.64</td>
<td>8.64</td>
</tr>
<tr>
<td>2060</td>
<td>2.13</td>
<td>9.13</td>
</tr>
<tr>
<td>2070</td>
<td>2.62</td>
<td>9.62</td>
</tr>
<tr>
<td>2080</td>
<td>3.21</td>
<td>10.21</td>
</tr>
<tr>
<td>2090</td>
<td>3.77</td>
<td>10.77</td>
</tr>
<tr>
<td>2100</td>
<td>4.39</td>
<td>11.39</td>
</tr>
</tbody>
</table>

2. The design life for all new HRSD buildings is 50 years.

3. Calculate the elevation design year by adding 50 years to the year of site plan approval. Read the graph vertically from the elevation design year. The highest intersecting elevation line is the design finished floor elevation. See example below.

E. Elevation Requirement Example - The following example is based upon HRSD’s Bridge Street Pump Station project located in Hampton.

   FEMA Base Flood Elevation: 8’
   Hampton Freeboard, FEMA BFE + 3’: 11’
   Year of Site Plan Approval: 2015
   Design Year: 2065

   From the graph, read Finished Floor Elevation of 11’, as indicated by the circled point.
End of Section
Section 11 - Public Participation Program

PLEASE NOTE: The Public Information Specialist does not utilize Unifier. If PR-related information is required to be entered into Unifier, please also email the information to the Public Information Specialist at LBolen@hrsd.com.

A. Introduction – HRSD’s Public Participation Program, outlined below, is intended to develop public awareness of planned projects and define the roles of project partners in engaging the community. This program includes standards; however, parts of this program may not be implemented if the HRSD Communication Department’s staff determines a project will have minor public impact.

The following forms/formats shall be used in the administration of the project. Most are available in electronic format. The Project Manager (PM) and FIRM will provide a detailed project briefing to HRSD’s Director of Communications and HRSD’s Public Information Specialist and, utilizing the aide of the Public Participation Program Checklist, will determine the extent of the program’s implementation and customize the forms/formats for each project. The FIRM may be requested to assist with additional documentation or public outreach needs deemed appropriate for a project or locality.

1. Public Participation Program Checklist (Attachment A)

B. Public Participation Program - Below are detailed explanations and forms/formats to be used for each step in the program.

1. Engage with Locality Staff - HRSD representatives (staff and/or FIRM) shall meet with representatives of the locality in which a project will occur to discuss the project and the method of delivery. The PM shall ensure appropriate information is forwarded to and received from a single point of contact throughout the project’s life. This individual will be known as our locality partner (LP) or their designee. The FIRM shall attend these meetings throughout the design and/or construction phases.

2. Identify project stakeholders – The FIRM shall identify and compile a list of all parties or entities that may be affected by construction activities located along the project route requiring outreach/coordination during the project. This list shall include but is not limited to: civic leagues, residents, businesses, schools, school bus routes, churches, trash collection, road detours/closures, and mass transportation routes. The list shall contain the following: contact information, full address (physical and mailing, if different), phone, impact, and operating hours. This initial list shall be provided to the Public Information Specialist during the first design submittal (e.g. 30% design) for review and comment. The FIRM shall then log this list into HRSD’s Unifier Enterprise Project Management System - Stakeholders List located under Reports.

   a. Stakeholder List - Template (Attachment B)

3. Participate in Public Open House/Community Meetings – In a cooperative effort, HRSD will assist each locality in fulfilling their public participation guidelines. If an informational public meeting is required by a locality, HRSD will request the locality to establish a date and time and secure a location for the meeting. Utilizing the advertisement

Section 11 11-1 January 2020
submission schedule, ensure the specific advertisement deadlines outlined in the
submission schedule will be met allowing time for public response. HRSD’s Public
Information Specialist or the Director of Communications, in the Specialist’s absence,
will advertise a Willingness to Hold an Informational Public Meeting (Open House) for a
project when a locality requests it. If an additional notification is to be mailed, at the
request of the locality, the expectation will be that the locality will print and mail the
project notice provided by HRSD to the addresses identified by the locality and in the
locality’s records (as resident and property owner, if different). HRSD’s staff and the
FIRM will attend and present the project information in an Open House format. If needed,
HRSD representatives (staff and/or FIRM) will also meet with civic leagues or business
associations at their request to discuss the project.

a. Sample – Willingness to Hold (Attachment C)
b. Sample – Informational Public Meeting Advertisement (Attachment D)
c. Open House Notice to the Public – Template* (Attachment E)
d. Informational Public Meeting Requirements (Attachment F)
e. Sample - Project Sign-In Sheet (Attachment G)
f. Sample - Project Comment Sheet (Attachment H)
g. Project Display Board – see Public Information Specialist for sample boards
h. Advertisement Submission Schedule (Attachment I)

4. Alert Public Officials – HRSD’s PM or their designee will be responsible for ensuring
project information is provided to our assigned LP. The LP will then provide the
information in accordance with their internal process. The FIRM may be requested to
provide additional information and or respond by phone or in person for this effort
throughout the design and construction phases.

5. Distribute Project Introductory Notice to Neighbors – HRSD’s Public Information
Specialist, PM and FIRM will work collectively to draft project notices to be distributed
to businesses and residences affected by a project. The FIRM is responsible for ensuring
the distribution of the HRSD Communication Department’s approved notice by the
FIRM’s staff a month prior to staging or any construction activities. **Work shall not be
permitted to begin until these notifications have been distributed a minimum of
thirty calendar days in advance.** The FIRM shall log this distribution into HRSD’s
Unifier Enterprise Project Management System - PR Notifications located under Reports.
The coordination of this effort shall occur with the Public Information Specialist, who
will coordinate posting this notice to the HRSD project website.

a. Project Introductory Notice to Neighbors – Template * (Attachment J)
b. Project Introductory Notice to Neighbors – Door Hanger Template * (Attachment K)

6. Post Project Signs – When working on City assets and when required by the locality to
notify the public, standard signs shall be placed at strategic locations in a neighborhood
to notify the public that an HRSD project is underway and provide contact information.
The Public Information Specialist will design the sign display order, and the contractor
shall place the order, pick up, pay for, and install the signage at the site(s) as defined by
the Public Information Specialist or the locality prior to the start of construction.
a. Sample – CIP Project Sign (Attachment L)
b. Sample – HRSD Standard Signage (Attachment M)
c. HRSD Sign & Base Specifications (Attachment N)

7. Post Variable Message Boards (VMB) – VMB's shall be utilized in areas with high traffic counts, main thoroughfares, and cut-throughs or when deemed necessary to reach a larger audience. The VMBs’ shall be set up one to two weeks in advance of any work and located in a manner to advise affected traffic in all directions. In most cases, an accepted three-screen message would detail: [1] the type of work to begin (road work, utility work, overnight work, milling and paving), [2] the expected date range of the work, and [3] additional information if identified (flaggers, lane shift, lane closed). The use of, timing, and messaging of VMBs will be coordinated with the Public Information Specialist and PM.

8. Establish a Project Website – HRSD will establish a page on its website for each project of specific public interest or impact. The FIRM shall be responsible for compiling the information needed using the HRSD provided templates. The information provided shall include an overview, schedule, the project team and contact information, a list of roads affected and separately, a list of project-specific frequently asked questions and a project map. HRSD’s Public Information Specialist and PM will review the information before it is uploaded to the website. **The FIRM shall submit these documents to the Public Information Specialist, the month prior to, and no later than the month of, it being taken to the HRSD Commission for approval.**

   a. New Project Webpage – Template (Attachment O)
   b. New Project FAQs – Template (Attachment P)
   c. New Project Map - Template (Attachment Q)
   d. Wet Weather/Locality Program Neighborhood Map - Template (Attachment R)

9. Issue Media Releases – HRSD’s Director of Communications or the Public Information Specialist, in the Director’s absence, will draft media releases and traffic advisories when needed. These will be coordinated with and forwarded to the locality’s media contact or designee for their internal distribution and use.

   a. Sample – Media Release – Traffic Advisory (Attachment S)

10. Response to Public and Media Inquiries – All media inquiries received shall be directed to contact HRSD’s Director of Communications or Public Information Specialist, in the Director’s absence. The FIRM shall address any public inquiry with courtesy and then forward to the Public Information Specialist for additional assistance, if needed. HRSD and the FIRM will strive for same day response during business hours and to reply no later than the next business day to after-hours inquiries. The FIRM will be requested to provide information and/or respond to the inquiring party by phone, email, or in person for this effort and to track and log these inquiries using HRSD’s Unifier Enterprise Project Management System – Citizen Inquiry Log located under Reports. The FIRM shall verify all inquiries or concerns have been resolved, recorded, and marked as closed in Unifier Enterprise Project Management System before closing out the project.
Media guidance will be provided to the project team by the Director of Communications at the beginning of each project or as requested from the project team. HRSD wallet size media/project inquiry cards will be provided for field staff to carry and provide to the media or any public inquiry beyond their expertise or, are uncomfortable responding to.

a. Sample – Media Card (Media/ Project Inquiries) (Attachment T)

11. Provide Project Updates

a. Website updates shall be completed by the 24th of each month or when there is significant information to share. Coordinate with the Public Information Specialist and HRSD’s PM for an alternate frequency of updates based upon the individual project type and activity. The FIRM shall upload this information using HRSD’s Unifier Enterprise Project Management System – Website Update Log located under Reports. HRSD staff will then complete the process.

b. Website/Social Media Mini Updates may be requested throughout a project during sensitive and highly visible work or once reaching large milestones or completion. Coordinate with the Public Information Specialist and HRSD’s PM for the need for these updates and deliverables. When requested by HRSD, these updates shall consist of several photos of the relevant work at the job site, corresponding captions, and a brief (150 words or less), non-technical, simplified explanation of the activity taking place within the photos. This is a non-technical update intended for the general public to keep them informed of the project and shall be worded so the activity can easily be understood by the public.

1) Sample - Website Update – Unifier (Attachment U)

c. Construction Update Notices/Flyers shall be developed by the FIRM, utilizing HRSD’s approved templates, and provided to the Communications Department for review fourteen days prior to any work commencing in the affected area. The FIRM shall ensure the distribution of notices to all affected residences and businesses, by the contractor, seven days prior to any work occurring in the affected work area. Work shall not be permitted to begin until these notices have been distributed, confirmed by HRSD, and the FIRM has logged the notice into HRSD’s Unifier Enterprise Project Management System – PR Notifications located under Reports. HRSD staff will post the notices to HRSD’s website. Coordination of this effort will take place with the Public Information Specialist and requires HRSD’s Communication Department’s approval and, if requested, an additional 5 business days to prepare notices.

1) Construction Update Notices – Template (Attachment V)
2) Construction Update Notices – Door Hanger Template (Attachment W)

Additional Notices – Notices advising affected properties of disruptive activities shall be distributed seven days before the work begins by the FIRM. These activities include, but are not limited to: water or service disruption, smoke testing, survey work with mailing and tracking log, closed circuit television (CCTV) inspections, evening
construction, or loss of parking. Additional notice may be required 24 hours prior, the morning of work, and once completed as directed by HRSD. The FIRM shall be responsible for drafting the notices, utilizing the HRSD’s approved templates, and providing to the Communications Department for review fourteen days prior to the work beginning.

The contractor will be responsible for distribution of the notices to the public. The FIRM shall ensure work will not begin until these notices have been distributed, confirmed by HRSD, and logged into HRSD’s Unifier Enterprise Project Management System – PR Notifications located under Reports. Coordination of this effort shall take place with the Public Information Specialist.

1) Additional / Specialty Notices – Templates
   a) CCTV Inspection Notice * (Attachment X)
   b) CCTV Notice with cleaning and inspection * (Attachment Y)
   c) Smoke Testing Notice (Attachment Z)
   d) Smoke Testing Notice-Door Knob Hanger (Attachment AA)
   e) Survey Notice * (Attachment BB)
   f) Reminder Notice to Neighbors (one week/48 hour) * (Attachment CC)
   g) Reminder Notice to Neighbors (day of work) (Attachment DD)
   h) Completed Work Notice to Neighbors (Attachment EE)
   i) Project Closeout Notice (Attachment FF)
   j) Survey Notices – Mailing and Tracking Log (Attachment GG)

d. Stakeholder Updates: The website is now equipped with a button for people to sign up to receive notifications whenever a project is updated on the website. Once the project is put on the website, the FIRM shall send an email to the stakeholders notifying them of how to sign up to receive project update notifications. This activity should occur within two business days of being notified by HRSD staff that the project has been placed on the website. The FIRM shall log these email notifications using HRSD’s Unifier Enterprise Project Management System – PR Notifications located under Reports.

1) Stakeholders Notification Updates (Attachment HH)

12. Coordination with Locality Public Information Staff – HRSD’s Director of Communications and the Public Information Specialist will make all project materials available to the locality for use on its outreach platforms and allow links to the HRSD website.

*Note-when using any HRSD letterhead documents, ensure you have the most up-to-date Commission letterhead. If mailing any documents, use the main office’s address on envelopes.
# Public Participation Program - Project Manager Checklist

**Project Name:**

**Project Manager:**

**Design Engineer:**

**Submitted to Engineering:**

**Name:**

**Date:**

**Phone:**

**email**

## Use of Checklist:

- [ ] not needed
- [x] required

**Project Brief:**

This document is intended as an aide or "a trigger" in assisting the project team prepare and fulfill HRSD's Public Participation Program. It is not intended to replace any portion of the full Standards Section.

## Engage Locality Staff

<table>
<thead>
<tr>
<th>Complete these items prior to meeting with HRSD Public Information Specialist</th>
<th>Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtain guidance from your Locality Partner for the following:</td>
<td></td>
</tr>
<tr>
<td>Identify localities single contact person and their contact information</td>
<td></td>
</tr>
<tr>
<td>Determine if Project Signs are required</td>
<td></td>
</tr>
<tr>
<td>Determine if City Council/Board of Supervisor Briefing is required (in person or written briefing)</td>
<td></td>
</tr>
<tr>
<td>Determine if a Public Meeting is required - ask for City assistance with location and mailing list</td>
<td></td>
</tr>
<tr>
<td>Determine if VMBs will be required</td>
<td></td>
</tr>
<tr>
<td>Determine if there are Civic Leagues, residents or businesses we should be aware of/address early</td>
<td></td>
</tr>
<tr>
<td>Determine City's additional PR requirements for this project (copy of notices, mailing lists)</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

## Identify Project Stakeholders

| Stakeholder List - prepare and submit to Real Estate Manager and PM | Completed |
| Plan for Stakeholder Engagement |  |

**Notes:**

## Coordination with Project Team

| Set meeting, if needed, to review expectations during project | Completed |

**Notes:**
### Public Open House/Community Meetings

<table>
<thead>
<tr>
<th>Task</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willingness to Hold</td>
<td></td>
</tr>
<tr>
<td>Public Meeting Advertisement</td>
<td></td>
</tr>
<tr>
<td>Open House Notice to the Public (mailed or door hung - does locality require copies)</td>
<td></td>
</tr>
<tr>
<td>Public Meeting Prep/ Review</td>
<td></td>
</tr>
<tr>
<td>Determine/ Identify if a meeting with large stakeholders are necessary</td>
<td></td>
</tr>
<tr>
<td>Determine/ Identify other one-on-one meetings necessary</td>
<td></td>
</tr>
<tr>
<td>Schedule meetings with large stakeholders</td>
<td></td>
</tr>
<tr>
<td>Schedule other/additional Community or Business Leagues</td>
<td></td>
</tr>
</tbody>
</table>

### Project Notices & Updates

<table>
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<tr>
<th>Task</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 day Introductory Notice to all affected by the project</td>
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</tr>
<tr>
<td>7 day Construction Notice</td>
<td></td>
</tr>
<tr>
<td>Additional Specialty Notices</td>
<td></td>
</tr>
<tr>
<td>Survey Notices</td>
<td></td>
</tr>
<tr>
<td>ROE Notices</td>
<td></td>
</tr>
<tr>
<td>CCTV Notice</td>
<td></td>
</tr>
<tr>
<td>CCTV inspection and cleaning</td>
<td></td>
</tr>
<tr>
<td>Reminder Notices</td>
<td></td>
</tr>
<tr>
<td>Project Closeout Notice</td>
<td></td>
</tr>
<tr>
<td>Stakeholder Email Updates</td>
<td></td>
</tr>
</tbody>
</table>

### Project Website

<table>
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<tr>
<th>Task</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website Required - Review timeline</td>
<td></td>
</tr>
<tr>
<td>Initial Project Upload Documents received by HRSD / uploaded to website</td>
<td></td>
</tr>
<tr>
<td>Review Unifier Monthly Update Process</td>
<td></td>
</tr>
</tbody>
</table>

### Media Guidance / Prep (high profile projects)

<table>
<thead>
<tr>
<th>Task</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the HRSD Project Manager request this service</td>
<td></td>
</tr>
<tr>
<td>Review HRSD's accepted procedures with consultant, inspector, contractor</td>
<td></td>
</tr>
</tbody>
</table>

### Project Closeout Checklist

<table>
<thead>
<tr>
<th>Task</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Signs have been picked up and returned to HRSD - Public Information Specialist</td>
<td></td>
</tr>
<tr>
<td>Customer Inquiry Log has been finalized and closed out in Unifier</td>
<td></td>
</tr>
<tr>
<td>Project Closeout Notices have been sent to residents and businesses</td>
<td></td>
</tr>
<tr>
<td>Project Website Update in Unifier has been updated to reflect a completed project and the approved HRSD thank you notice before marking the project as closed</td>
<td></td>
</tr>
</tbody>
</table>
# STAKEHOLDER LIST

## GOVERNMENT / JURISDICTIONAL ENTITIES

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Address</th>
<th>City</th>
<th>State</th>
<th>Zip Code</th>
<th>Contact Name</th>
<th>Contact Number</th>
<th>Best Contact Hours</th>
<th>Affect to Stakeholder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diamond Springs/Garden Wood Park Neighborhood</td>
<td>5652 Haden Road</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Sue Cipriani</td>
<td>(757) 589-0467</td>
<td>N/A</td>
<td>Access Disrupted and/or Detoured</td>
</tr>
<tr>
<td>Driftwood Apartments</td>
<td>1634 Diamond Springs Rd</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Dorothy Roberts</td>
<td>(757) 460-0519</td>
<td>9 AM - 5PM</td>
<td>Access Disrupted and/or Detoured</td>
</tr>
<tr>
<td>Crescent Square</td>
<td>1333 Diamond Springs Rd</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Unknown</td>
<td>(757) 578-1776</td>
<td>Unknown</td>
<td>Within Construction/ Traffic Control Limits</td>
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## NEIGHBORHOODS (TO INCLUDE CIVIC LEAGUES)

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Address</th>
<th>City</th>
<th>State</th>
<th>Zip Code</th>
<th>Contact Name</th>
<th>Contact Number</th>
<th>Operating Hours</th>
<th>Affect to Stakeholder</th>
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<tbody>
<tr>
<td>Joint Expeditionary Base Little Creek - Fort Story</td>
<td>2600 Tarawa Ct #100</td>
<td>Norfolk</td>
<td>Virginia</td>
<td>23518</td>
<td>Scott Mohr</td>
<td>(757) 402-8425</td>
<td>24 Hours</td>
<td>Traffic</td>
</tr>
<tr>
<td>City of Virginia Beach</td>
<td>2405 Courthouse Drive, Bldg. 2, 2nd Floor</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23456</td>
<td>Erica Roberts</td>
<td>(757) 395-8552</td>
<td>24 Hours</td>
<td>Pump and Haul Operations/Traffic</td>
</tr>
</tbody>
</table>

## BUSINESSES

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Address</th>
<th>City</th>
<th>State</th>
<th>Zip Code</th>
<th>Contact Name</th>
<th>Contact Number</th>
<th>Operating Hours</th>
<th>Affect to Stakeholder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile One Courier</td>
<td>1619 Diamond Springs Rd Suite C</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Unknown</td>
<td>(757) 622-8500</td>
<td>24 Hours</td>
<td>Adjacent to Abandonment Activities</td>
</tr>
<tr>
<td>Care-A-Lot Pet Supply</td>
<td>1924 Diamond Springs Rd</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Denise Clarke</td>
<td>(757) 457-9451</td>
<td>8AM - 5PM</td>
<td>Access Disrupted and/or Detoured</td>
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<tr>
<td>7-Eleven</td>
<td>1900 Diamond Springs Rd</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Unknown</td>
<td>(757) 460-4751</td>
<td>24 Hours</td>
<td>Access Disrupted and/or Detoured</td>
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<tr>
<td>Red Carpet Inn</td>
<td>1808 Diamond Springs Rd</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Jay Patel</td>
<td>(757) 460-3471</td>
<td>24 Hours</td>
<td>Access Disrupted and/or Detoured</td>
</tr>
<tr>
<td>NGK-Locke Polymer Insulators</td>
<td>1609 Diamond Springs Rd</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Dennis Morgan</td>
<td>(757) 460-3649</td>
<td>Unknown</td>
<td>Access Disrupted and/or Detoured</td>
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<tr>
<td>Diamond Springs Citgo</td>
<td>1560 Diamond Springs Rd</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Unknown</td>
<td>(757) 464-0956</td>
<td>6AM - 12AM</td>
<td>Access Disrupted and/or Detoured</td>
</tr>
<tr>
<td>Fire Services Inc</td>
<td>5652 Bayside Rd</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Ed Anderson</td>
<td>(757) 464-9448</td>
<td>8AM - 4:30PM</td>
<td>Access Disrupted and/or Detoured</td>
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<tr>
<td>Complete Automotive Inc</td>
<td>1493 Diamond Springs Rd Suite 100</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Richard Kelly Jr</td>
<td>(757) 460-2277</td>
<td>7:30AM - 6PM</td>
<td>Access Disrupted and/or Detoured</td>
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<td>Public Storage</td>
<td>1409 Diamond Springs Rd</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Unknown</td>
<td>(757) 544-9404</td>
<td>9:30AM - 6PM</td>
<td>Adjacent to Construction/ Traffic Control Limits</td>
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<td>Dominion Interior Supply</td>
<td>5721 Bayside Rd</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Rosa W Kent</td>
<td>(757) 363-2858</td>
<td>7AM - 5PM</td>
<td>Access Disrupted and/or Detoured</td>
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<tr>
<td>Filtech USA</td>
<td>5721 Bayside Rd # B</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Praasah Tailaja</td>
<td>(757) 318-7800</td>
<td>Unknown</td>
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<tr>
<td>CrossFitRifle</td>
<td>5741 Bayside Road Suite #101</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Unknown</td>
<td>(757) 390-3373</td>
<td>6AM - 7PM</td>
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<td>Arai Americas</td>
<td>5878 Bayside Rd</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Marge Crittendon</td>
<td>(757) 363-8101</td>
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<td>Aetna Insulated Wire</td>
<td>1537 Air Rail Avenue</td>
<td>Virginia Beach</td>
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<td>Business Closed</td>
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<td>5740 Bayside Rd</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Unknown</td>
<td>(757) 363-0671</td>
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<td>Sunbelt Supply</td>
<td>5733 Bayside Rd # 107</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Julie Scaff</td>
<td>(757) 318-9108</td>
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<td>Daltile Tile and Stone Showroom</td>
<td>5770 Thorton Ave Ste 102</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Unknown</td>
<td>(757) 460-2900</td>
<td>7AM - 5PM</td>
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<td>Real</td>
<td>1457 Miller Stone Rd #101</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Unknown</td>
<td>(757) 855-3031</td>
<td>7AM - 5PM</td>
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<td>Magnuson Hotel</td>
<td>5708 Northampton Blvd</td>
<td>Virginia Beach</td>
<td>Virginia</td>
<td>23455</td>
<td>Nataliya Gneaud</td>
<td>(757) 460-2205</td>
<td>24 Hours</td>
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<td>Stakeholder</td>
<td>Address</td>
<td>City</td>
<td>Zip Code</td>
<td>Contact Name</td>
<td>Contact Number</td>
<td>Operating Hours</td>
<td>Affect to Stakeholder</td>
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<td><strong>Schools</strong></td>
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<td>Bayside Elementary School</td>
<td>5649 Bayside Rd</td>
<td>Virginia Beach</td>
<td>23455</td>
<td>Catherine Brumn</td>
<td>(757) 648-2080</td>
<td>7:30 AM - 4 PM</td>
<td>Access Disrupted and/or Detoured</td>
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<td>Chalice Christian Church</td>
<td>5612 Haden Rd</td>
<td>Virginia Beach</td>
<td>23455</td>
<td>Rev. Gregory Ott</td>
<td>(757) 464-5650</td>
<td>Includes Evening and Weekend Hours</td>
<td>Access Disrupted and/or Detoured</td>
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<td>Church of Christ Southside</td>
<td>5652 Haden Rd</td>
<td>Virginia Beach</td>
<td>23455</td>
<td>Unknown</td>
<td>(757) 464-4574</td>
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<td>Diamond Springs Baptist Church</td>
<td>5644 Bayside Road</td>
<td>Virginia Beach</td>
<td>23455</td>
<td>Kelly Darnell</td>
<td>(757) 460-0761</td>
<td>Includes Evening and Weekend Hours</td>
<td>Access Disrupted and/or Detoured</td>
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</table>

**SCHOOL BUS, TRASH COLLECTION, AND MASS TRANSPORTATION ROUTES**

*No HRT bus routes down Diamond Springs Road*

*School bus and trash collection not likely to be impacted due to work hour restrictions of night and weekend*
Courthouse Interim Pressure Reducing Station Project

Willingness to Hold a Public Informational Meeting

Project Overview: HRSD, your regional wastewater treatment utility, is planning to install an Interim Pressure Reducing Station (PRS) at 2532 Nimmo Parkway. The facility, which will be across from the City of Virginia Beach Building Maintenance Facility (Building No. 9 in the City Municipal Center), will be designed to coordinate with the area’s architecture and screened from the view of Courthouse Marketplace by existing vegetation. Construction will have minimal impact on traffic, and our contractor will be required to maintain a clean worksite.

Need, Design and Schedule: The project is needed to maintain appropriate pressures in the sanitary sewer pipeline during wet weather and dry weather conditions and to ensure that the system has the capacity required to convey future wastewater flows. The plans call for the installation of pipe, valves and pumps along with a small structure to house electrical equipment and various appurtenances to function as a PRS. Attractive fencing and new landscaping will enhance the appearance. We expect to advertise for bids in August and award the contract in September 2013. Construction is expected to take nine months.

If you have concerns or comments about the project, want to review the plans, or desire for us to hold an informational public meeting, please call HRSD Public Informational Specialist at 757-460-7000 or send an email to lbolen@hrsds.com

You also may visit www.hrsd.com/construction-status for additional information and project updates.
Downtown Norfolk Sanitary Sewer Pipeline Replacement Project

INVITATION TO AN INFORMATIONAL PUBLIC MEETING

HRSD invites you to attend an Open House to learn about the project to install approximately 6,000 linear feet of sanitary sewer pipe and valves in downtown Norfolk. This effort to replace a pipeline constructed in the 1940s is required to minimize the risk of pipe failures. Construction will take place along Plume Street, Atlantic Street, Main Street, Market Street, Waterside Drive, City Hall Avenue, and Saint Paul’s Boulevard. Construction typically will be limited to sections of 300 linear feet, and comprehensive traffic control plans will be implemented to minimize inconvenience.

COME TO THE MEETING AND:

• MEET REPRESENTATIVES OF HRSD AND OUR ENGINEERING CONSULTANT
• SEE THE PROPOSED DESIGN FOR THE PROJECT
• ASK QUESTIONS • OFFER YOUR INPUT

DATE: WEDNESDAY, December 27, 2019
TIME: COME AT YOUR CONVENIENCE BETWEEN 5 P.M. AND 7 P.M.
PLACE: SLOVER LIBRARY COMMUNITY ENGAGEMENT ROOM 650
235 E PLUME STREET• NORFOLK, VIRGINIA 23510

If you have questions about the Open House or comments about the project, please call the Public Information Specialist at 757-460-7000 or send an email to lbolen@hrsd.com. You also may visit www.hrsc.com/construction-status to learn more about the project and for updates after construction begins.
December 27, 2019

Dear Neighbors:

HRSD, your regional wastewater treatment utility, invites you to attend an Open House to learn about the project to rehabilitate 8,200 linear feet of neighborhood pipes and manholes installed in the 1940s. To minimize disruption, the contractor will line the pipes using cured-in-place pipe (CIPP), a rehabilitation method that will require very little digging in the public right of way. The contractor will access the pipes through the existing sewer manholes. This project, which is needed to reduce the possibility of pipeline failures, will take place along portions of Pin Oak Road, Villa Road, James River Drive, River Road, Post Street, Ferguson Avenue, and Randolph Road. Construction areas will typically be limited to sections of 500 linear feet, and comprehensive traffic control plans will be implemented to lessen inconvenience. Representatives of HRSD and its engineering consultant will be available during the Open House to explain the project and respond to questions. Frequently Asked Questions on the back of this page provide more information about the project.

**Project Open House**

**Date:** Thursday, April 28, 2016  
**Time:** Come at your convenience  
**Between 4:30 p.m. – 6:30 p.m.**  
**Place:** Main Street Library  
110 Main Street  
Newport News, VA 23601

**Come at your convenience and**
- See the project route
- Discover more about the less invasive CIPP process to be used
- Discuss the project with representatives of HRSD and our engineering consultant
- Ask questions

**Anticipated Project Schedule**

**Design Completion:** Winter 2016  
**Public Open House:** April 28, 2016  
**Construction:**  
Summer 2016—Winter 2017

If you are unable to attend this public meeting and would like to obtain more information, share your concerns or arrange to speak with project staff, please contact:

Lisa Bolen, HRSD Public Information Specialist  
Phone: 757.460.7000 | Email: lbolen@hrsd.com | www.hrsd.com
**Frequently Asked Questions**

*Why is this project necessary?*
A. This project will rehabilitate infrastructure that has reached the end of its useful life. As a sewer system ages, the connections between pipe joints, around manholes, and at the manhole’s frame and cover weaken. This allows ground water and rain water runoff to enter into the sewer system. Ground water and rain water runoff are known as infiltration and inflow (I&I). This project will provide updated infrastructure that will prevent the I&I from entering the sewer system and help ensure HRSD’s ability to protect public health and the environment for decades to come.

*Will the project affect traffic in the neighborhood?*
A. Disruptions to traffic will be minimized, and in most cases, a single lane of traffic will be maintained. No planned detours are anticipated but flagging will be used to help safely direct traffic as needed. Because a few streets are narrow, small sections of on-street parking will be temporarily prohibited within the work zone while there is active work. You will be notified when on-street parking will not be available if your property is adjacent to one of these areas.

*What sort of noise should I expect during construction?*
A. The typical construction noises such as equipment engines and back-up alarms, bypass pumping and pipe hoses, materials being delivered, diesel generators and air compressors, sawing and the like should be anticipated.

*Why is a bypass system needed?*
A. The bypass piping will run above ground within the city right-of-way as will bypass pumps. These pumps will operate automatically in response to sewage flows to maintain your sewer service while the new pipe lining is being installed. The pumps and pipes will be installed and remain on site for each section of active work until that section is completed. The system will then be disassembled and moved to the next section of active work, throughout the project duration.

*Will access to properties along the route be maintained during construction?*
A. Yes. The contractor will ensure that access to residences and at least one entrance to businesses will be maintained throughout construction. This will be achieved through the temporary installation of bypass ramps rather than burying the temporary pipe across each driveway, ensuring minimal impact. Trash and mail services will not be affected. If necessary, the contractor will move trash containers from within a work zone to an area accessible for pickup, and will be responsible for returning them to each residence.

*What are the general working hours for the project?*
A. Work will typically take place Monday through Friday during daylight hours (7 a.m. - 7 p.m.). However, there may be times when extended hours, work at night, or weekend work may be necessary.

*Will there be any interruptions to my sewer or water service?*
A. Your sewer service will be temporarily interrupted if work is to be performed on the sewer lateral pipe that serves your property. If your lateral is one of the few that requires additional repairs, a member of the project team will contact you to discuss and make any necessary arrangements. The contractor will again notify you just before your lateral is to be rehabilitated so you can plan appropriately. Your sewer service typically will be restored within several hours. Your water service should not be affected by this project.

*Will construction affect the existing pavement?*
A. The work for this project will be located within the city right of way. Much of the construction will be "trenchless," meaning the contractor will not need to dig up the street to perform the work. However, the small areas around manhole frames and covers and lateral pipes that may be disturbed will be restored to the same or better conditions upon completion of the project.

*Will material and equipment be stored on-site? Where will construction workers park?*
A. The contractor will keep some supplies within the active work zone, in the public right-of-way. Construction workers will not be allowed to park their personal vehicles on the public streets. However, work trucks will be allowed to park within the active work zone.
Requirements for:
Informational Public Meeting, Open House or Community Meeting for HRSD projects.

Coordination needed:
- Facility and time of event – work with the locality partner
- Tables / chairs
- Invite / inform the assigned locality partner or relevant department contact(s)
  - HRSD Project Manager will give the name and title of each to the Public Information Specialist
- Who will / should attend
  - HRSD –
  - Consultant –
  - Locality Partner -
- Business cards – each individual shall bring their own

Consultant Team shall provide:
- Project boards & meeting announcement (number and type TBD, portrait or landscape, overall project and segments as needed) – as determined in the prep meeting
- Easels (quantity to match the number of boards and a spare)
- 1-2 set(s) of full size 100% Plans
- Traffic Plans, full size set (if applicable)
- Printed Project Flyers or handouts – as provided by HRSD
- Name Badges for all project team attendees - displaying Name, Position / Title (Design Engineer / Inspector) for this project and company logo centered at the top as shown:
- Animation and laptop to run animation from (if applicable)
- All graphics and video(s) provided to HRSD for handouts and website upload prior to event

HRSD shall provide:
- Sign-in sheet
- Comment Sheet
- Pens
- Give Away Items
- Website Project Page (iPad)
- HRSD welcome sign
- Project type Fact Sheets (CIPP, BYPASS, Trenchless) as needed

Additional project specific items:
*Use this list as part of the monthly stakeholder email notifications - log in Unifier*
What did you think about the information provided during this meeting and the format it was presented?

Questions for the project team about this project:

Comments:

How would you most like to receive information about HRSD projects in your area? Circle one: Mail / Text / Project Website / Email / Phone Alerts? Other:

Name

Mailing Address

City  State  ZIP

Telephone Number

Email Address
**Advertisement Submission Schedule**

1. Build this schedule starting backwards from your desired/proposed meeting date using one of the two options below.
2. **Option 1:** running a *Willingness to Hold a Public Meeting*, build into the schedule enough time to: process advertisement, the 7 calendar day response time allotted to the public to call in requesting the meeting and an additional advertisement for the Public Meeting.

   *Notes: if the Willingness to Hold generates 10 or more inquiries that cannot be satisfied by one-on-one meetings, HRSD will hold a Public Meeting. If no inquiries are received or the inquiries are satisfied by the one-on-one meeting, no Public Meeting is required. This option (number 1) can add over a month into the process.*

3. **Option 2:** directly advertising a Public Meeting, build in enough time to meet the advertising/communications deadlines.

4. Send both Word and PDF files to the media outlet advertising.

5. Use logo w/o tag line. Use the advertisement sample provided within the attachments portion of this document.

6. Holiday Deadlines differ—need to verify deadline prior to placing ad

7. Need to verify deadlines for ads that run on any day other than listed below.

8. All project related advertisements shall be charged to the CIP associated with the project. 200-XXXXX-30-97100-GN0001-Finance

<table>
<thead>
<tr>
<th>Locality</th>
<th>Newspaper</th>
<th>Run Day</th>
<th>Ad deadline</th>
<th>Due to HRSD Communications Staff (review &amp; submission)</th>
<th>Newspaper contact</th>
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<tr>
<td>Metro</td>
<td>Virginian Pilot</td>
<td>Sunday</td>
<td>Noon the business day prior to run date (Friday by noon)</td>
<td>1 week prior to ad deadline</td>
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<td>Metro</td>
<td>Portsmouth Currents &amp; Suffolk Sun</td>
<td>Sunday Only</td>
<td>Wednesdays, at 3pm</td>
<td>1 week prior to ad deadline</td>
<td>Mrs. Rawles Magee <a href="mailto:rawles.magee@pilotonline.com">rawles.magee@pilotonline.com</a>, <a href="mailto:legal@pilotonline.com">legal@pilotonline.com</a> 757.222.5346 Communications Account Leila Rice - Director: AA46585 Public Information Specialist: AA466587</td>
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<td>Metro</td>
<td>Chesapeake Clipper</td>
<td>Publishes Fridays &amp; Sundays</td>
<td>Friday Deadline: Mondays at 3pm Sunday Deadline: Wednesdays at 3pm</td>
<td>1 week prior to ad deadline</td>
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<td>Metro</td>
<td>Virginia Beach Beacon</td>
<td>Publishes Thursdays &amp; Sundays</td>
<td>Thursday deadline: the Friday before, at 3pm Sunday Deadline: Tuesdays at 3pm</td>
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<td>Daily Press</td>
<td>Sunday</td>
<td>Noon the business day prior to run date (Friday by noon)</td>
<td>1 week prior to ad deadline</td>
<td>Hope Askew (<a href="mailto:haskew@dailypress.com">haskew@dailypress.com</a>) Communications Account Leila Rice - Director: CU00613641 Public Information Specialist: CU00613650</td>
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<td>King William</td>
<td>Richmond Times Dispatch</td>
<td>Sunday</td>
<td>3 business days</td>
<td>1 week prior to ad deadline</td>
<td>Bock, Pamela S. <a href="mailto:PBock@timesdispatch.com">PBock@timesdispatch.com</a> 804.649.8716 Communications Account All HRSD: 3589014</td>
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<tr>
<td>Mathews</td>
<td>Gloucester-Mathews Gazette-Journal</td>
<td>Wednesday</td>
<td>Noon Monday</td>
<td>1 week prior to ad deadline</td>
<td>Tina Nelson <a href="mailto:tnelson@gazettejournal.net">tnelson@gazettejournal.net</a> 804-693-3101 Communications Account Leila Rice - Director: 102220 Public Information Specialist: 102602</td>
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<td>Surry</td>
<td>Smithfield Times</td>
<td>Wednesday</td>
<td>Noon Monday</td>
<td>1 week prior to ad deadline</td>
<td>Wendy Kantios <a href="mailto:wendyk@smithfieldtimes.com">wendyk@smithfieldtimes.com</a> 757.357.3288 (o) 757.618.3478 (c – text friendly) Communications Account O’Brien: 2857 Public Information Specialist: 2858</td>
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<tr>
<td>Urbanna</td>
<td>Southside Sentinel</td>
<td>Thursday</td>
<td>10 am Tuesday</td>
<td>1 week prior to ad deadline</td>
<td>Wendy Burch <a href="mailto:wburch@ssentinel.com">wburch@ssentinel.com</a> 804.758.2328 Communications Account Leila Rice - Director: #XXXXXXXXX Public Information Specialist: #XXXXXXXXX</td>
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<td>West Point</td>
<td>Tidewater Review</td>
<td>Wednesday</td>
<td>Friday</td>
<td>1 week prior to ad deadline</td>
<td>O’Brien, Brittany <a href="mailto:bobrien@tidewaterreview.com">bobrien@tidewaterreview.com</a> 804-843-2282 (opt. 2) Communications Account Leila Rice - Director: CU00613641</td>
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January 2019
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<td>Account #s are same as Daily Press</td>
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**Notice to Neighbors**  
**July 29, 2019**

**Huxley Place Sewer Extension**

HRSD, your regional wastewater treatment utility, in coordination with the City of Newport News, is planning a project in your neighborhood to replace the existing HRSD and City sanitary sewer pipelines and public sewer service connections that are nearing the end of their useful life. This replacement project will also improve the system’s performance and ensure continued, reliable sewer service in the future. The answers to some *Frequently Asked Questions (FAQs)* are provided on the back of this notice.

**Project Overview**

The project is located in the neighborhood surrounding Huxley Place from the Carnegie Drive intersection to the northern end of Huxley Place near City Center Boulevard and at certain locations along Alpine Street and Warwick Boulevard. This project includes pipelines, manholes, as well as some public water service and sewer service lateral pipes. These pipes will be repaired or replaced within the city right-of-way. The owner of any private sewer service pipe that is found in need of repair, will be contacted. The contractor will maintain a clean job site and minimize traffic disruption.

**Project Map**

*Huxley Place Sewer Extension*

**Legend**
- Pipe to be Abandoned and filled
- Proposed 36" HRSD Force Main
- Completed 36" HRSD Force Main
- Proposed 15" City Gravity Main
- Completed 15" City Gravity Main
- Current Work Area

The vision of HRSD is that future generations will inherit clean waterways and be able to keep them clean.

**Project Schedule**

**Staging:** September 2019

**Construction:**
- **Phase 1:** (work within the public right-of-way along Huxley Place)  
  Fall 2019 – Fall 2020
- **Phase 2:** (work within the public right-of-way along Alpine Street and Warwick Boulevard)  
  Fall 2020

**Restoration:**
Immediately following construction

Thank you for your support of this effort to help achieve HRSD’s vision: *Future generations will inherit clean waterways and be able to keep them clean.*

You also may visit [www.hrsd.com/huxley-place](http://www.hrsd.com/huxley-place) for additional information and project updates.

If you have any questions, concerns, or comments about the project, please feel free to contact Lisa Bolen, HRSD Public Information Specialist, at 757.460.7000 or [LBolen@hrsd.com](mailto:LBolen@hrsd.com).
**Why is this project necessary?**
A. This project is necessary to increase the reliability of the sewage collection system by replacing aging infrastructure and eliminating unvented high points in the existing force main.

**Will the project affect the flow of traffic in the neighborhood?**
A. Disruptions to traffic will be minimized, and in most cases, a single lane of traffic will be maintained. There may be short durations where detours will occur at the following intersection closures: Marrow Drive, Winterhaven Drive, Alpine Drive, and Carnegie Drive at Huxley Place. These closures will alternate, so other roads will be available for use. Advanced signage will be put in place, and flagging will be used to help direct traffic as needed.

**Will access to properties along the route be maintained during construction?**
A. The contractor will ensure that access to residences, and at least one entrance to businesses, will be maintained throughout construction. Trash and mail services will not be affected. If necessary, the contractor will move trash containers from within a work zone to an area accessible for pickup and will be responsible for returning them to each residence.

**What are the general working hours for the project?**
A. Work will typically take place Monday through Friday during daylight hours (8 a.m. - 4 p.m.). However, there may be times when extended hours, work at night, or weekend work may be necessary.

**Will there be any interruptions to my water or sewer service?**
A. Your sewer service will be temporarily interrupted if work is to be performed on the sewer lateral pipe that serves your property. The contractor will notify you before your lateral is to be replaced so you can plan appropriately. Sewer service typically will be restored within several hours. Your water service should not be affected by this project.

**Will construction affect the existing pavement?**
A. Where sewer and lateral pipes are dug up, asphalt, curb, gutters, driveway aprons, and grass will be removed and then restored upon completion of the project. Final restoration will include milling and paving of Huxley Place from 30 Huxley Place to the intersection of Huxley Place and Carnegie Drive.

**What sort of noise should I expect during construction?**
A. The typical construction noises such as equipment engines and back-up alarms, materials being delivered, diesel generators and air compressors, sawing and the like should be anticipated.

**Will material and equipment be stored on-site?**
A. It is anticipated that the contractor will negotiate with a private property owner for a storage area in the project vicinity, and this site will be used for most of the equipment and supplies. The contractor will keep some supplies within the active work zone, in the public right-of-way.

**Where will construction workers park?**
A. Construction workers will not be allowed to park their personal vehicles on the public streets. However, work trucks will be allowed to park within the active work zone.

**What is the cost of the project?**
A. The estimated cost for the project is approximately $5 million and is financed by the wastewater treatment fees paid by HRSD ratepayers.

**How can I receive regular project updates?**
A. Regular project updates are posted on the HRSD website at www.hrsd.com/construction-status.
Huxley Place Sewer Extension

HRSD, your regional wastewater treatment utility, in coordination with the City of Newport News, is planning a project in your neighborhood to replace the existing HRSD and City sanitary sewer pipelines and public sewer service connections that are nearing the end of their useful life. This replacement project also will improve the system’s performance and ensure continued, reliable sewer service in the future. The answers to some Frequently Asked Questions (FAQs) are provided on the back of this notice.

Project Overview
The project is located in the neighborhood surrounding Huxley Place from the Carnegie Drive intersection to the northern end of Huxley Place near City Center Boulevard and at certain locations along Alpine Street and Warwick Boulevard. This project includes pipelines, manholes, as well as some public water service and sewer service lateral pipes. These pipes will be repaired or replaced within the city right-of-way. The owner of any private sewer service pipe that is found in need of repair, will be contacted. The contractor will maintain a clean job site and minimize traffic disruption.

Project Schedule
Construction:
Phase 1: (work within the public right-of-way along Huxley Place)
Summer 2019 – Summer 2020

Phase 2: (work within the public right-of-way along Alpine Street and Warwick Boulevard)
Summer 2020

Restoration:
Immediately following construction

You also may visit www.hrsd.com/construction-status for additional information and project updates.

If you have any questions, concerns or comments about the project, please feel free to contact Lisa Bolen, HRSD Public Information Specialist, at 757.460.7000 or LBolen@hrsd.com.

Thank you for your support of this effort to help achieve HRSD’s vision: Future generations will inherit clean waterways and be able to keep them clean.
Will the project affect the flow of traffic in the neighborhood?
A. Disruptions to traffic will be minimized, and in most cases, a single lane of traffic will be maintained. There may be short durations where detours will occur at the following intersection closures: Marrow Drive, Winterhaven Drive, Alpine Drive, and Carnegie Drive at Huxley Place. These closures will alternate, so other roads will be available for use. Advanced signage will be put in place, and flagging will be used to help direct traffic as needed.

Will access to properties along the route be maintained during construction?
A. The contractor will ensure that access to residences, and at least one entrance to businesses, will be maintained throughout construction. Trash and mail services will not be affected. If necessary, the contractor will move trash containers from within a work zone to an area accessible for pickup and will be responsible for returning them to each residence.

What are the general working hours for the project?
A. Work will typically take place Monday through Friday during daylight hours (8 a.m. - 4 p.m.). However, there may be times when extended hours, work at night, or weekend work may be necessary.

Will there be any interruptions to my water or sewer service?
A. Your sewer service will be temporarily interrupted if work is to be performed on the sewer lateral pipe that serves your property. The contractor will notify you before your lateral is to be replaced so you can plan appropriately. Sewer service typically will be restored within several hours. Your water service should not be affected by this project.

Will construction affect the existing pavement?
A. Where sewer and lateral pipes are dug up, asphalt, curb, gutters, driveway aprons, and grass will be removed and then restored upon completion of the project. Final restoration will include milling and paving of Huxley Place from 30 Huxley Place to the intersection of Huxley Place and Carnegie Drive.

What sort of noise should I expect during construction?
A. The typical construction noises such as equipment engines and back-up alarms, materials being delivered, diesel generators and air compressors, sawing and the like should be anticipated.

Will material and equipment be stored on-site?
A. It is anticipated that the contractor will negotiate with a private property owner for a storage area in the project vicinity, and this site will be used for most of the equipment and supplies. The contractor will keep some supplies within the active work zone, in the public right-of-way.

Where will construction workers park?
A. Construction workers will not be allowed to park their personal vehicles on the public streets. However, work trucks will be allowed to park within the active work zone.

What is the cost of the project?
A. The estimated cost for the project is approximately $5 million and is financed by the wastewater treatment fees paid by HRSD ratepayers.
Ghent Area Sanitary Sewer Pipeline Replacement

Your investment in protecting your health and area waterways

Design Engineer: O’Brien & Gere
(757) 431-2966

Construction Contractor: T.A. Sheets Mechanical
(757) 627-3000

For Information: www.HRSD.com
(757) 460-7000
Construction work ahead, ensuring future generations inherit clean waterways and can keep them clean

Information: www.HRSD.com or (757) 460-7000
HRSD Project Site - Sign Specifications

Sign layout will be provided by HRSD.

**GRAPHICS:**
The lettering and graphics will be a full sheet, digitally printed white vinyl decal using Orajet 3651 Intermediate Gloss Vinyl (or equivalent rated for 5 years exterior use) with over laminate for UV protection and scratch resistance, applied to the painted substrate. The printed colors are to match Pantone 3005 (blue) and 354 (green). The sign is single faced. Font: Universe Bold Extended 63 (UniverseLTStd-Bold).

Pantone 3005 (blue) RGB 0/132/201, Pantone 354 (green) RBG 0/183/96

**Sign Types/Project Type:**

**WetWeather/Locality Neighborhood Program Signs**
Sign substrate to be 24” x 48” with curved corners and either of the materials below.

**CIP or General Project Signs**
Sign substrate to be 32” x 64” with curved corners and either of the materials below.

One half inch thick, medium density overlay (sign type plywood), good one side with white gloss enamel on the face, one coat of white latex primer on the reverse.

OR

6 mm thick Aluminum Composite Material composed of solid thermoplastic core of low density polyethylene, bonded between two sheets of .008” aluminum. The painted surface of the aluminum sheet is coated with a white polyester coating.

**INSTALLATION:**
Each sign shall be installed using two (2) U.S. Barricades (equivalent or better) temporary traffic sign stands (Model TD8400, manufactured by Three D Traffic Works) consisting of a 18”x 27” x 4.5”, 37 lb. rubber, Universal Sign Stand Base & Insert, a 1¼” x 1¾” x 72”, 16-Gauge galvanized steel upright post and safety D-clip lock pins (ensuring a breakaway feature is utilized).

Two 5ft upright posts shall be secured to the backside of the sign using two 5/16” x 3” galvanized hex-head bolts with washers, set on the centerline of the sign, 16” on center, 4” from top and bottom of sign.
**Universal Rubber Base System**

Model #: TD8400

Weighted Base for Uprights

- Made in the USA. Made from 100% Post-Consumer Recycled Rubber.
- Two large molded-in handles for easy placement & retrieval.
- The large rubber footprint (18”x27”) is skid resistant & stable even in windy conditions, while still offering a narrow profile on the roadway.

Ideal for Temporary In-Street Signage.

Collars convert standard rubber base into an Upright Holder

(see reverse side for possibilities)

- Made in the USA. Made from 100% Post-Consumer Recycled Rubber.
- Two large molded-in handles for easy placement & retrieval.
- The large rubber footprint (18”x27”) is skid resistant & stable even in windy conditions, while still offering a narrow profile on the roadway.

430 North Varney Street, Burbank, CA. 91502

T: 877 843 9757 F: 818 841 5096

Email: sales@trafficwks.com Web Site: www.trafficwks.com

Zero Waste - You make it happen!
Collar is made from 100% Recycled Content Black Hi-Impact Plastic.

Weight: 37 lbs. without Collar.
39 lbs with Collar & Fasteners.
Made from 100% Post-Consumer Recycled Rubber derived from passenger car tires!

1.750” X 72” Black Plastic Upright is available and comes pre-drilled, ready for use. Part # 845100.

Collar accepts 1.75 PSST uprights. Optional Reducing Inserts available.

Large Grip Handles

1/2-13 Hex Head Bolts, Washers & Nuts are all Zinc Plated.

Overall height is 4.50”, including Collar for PSST Inserts.
CONSTRUCTION STATUS - VIRGINIA BEACH

Overview
HRSD is undertaking a project to replace piping and valves at its existing Providence Road Pressure Reducing Station. This effort will also reduce the risk of sanitary sewer overflows during heavy rain events such as Nor’easters or hurricanes. See the Frequently Asked Questions attachment for more information about the project.

Most Recent Update
10/3/2013 Bids were received
10/22/2013 Contract awarded to (?)
XXXX Notice to proceed awarded
XXXX Project Staging to begin
Current Project Related Construction Areas: Not started at this time

Roads Affected
The work will be confined to HRSD property; however, construction traffic will be entering and exiting the site on Old Providence Road between Avalon Avenue and Maralon Drive. Comprehensive traffic control plans will be implemented to minimize inconvenience.

Key Dates
Staging: Actual Month to stage XXXX
Construction: By seasons Fall 2013 – Spring 2015
Restoration: Immediately following construction

Project Cost
$2,500,000 {TOTAL Project Costs Design & Construction. Collected from CIP unless an updated figure is known}

HRSD Contacts
Public Information Specialist: Lisa Bolen 757.460.7000 (Office)
City of XXX Contact: Name local Office and Cell numbers
Onsite Inspector: Name local Office and Cell numbers
HRSD Project Manager: Name
Media Inquiries: Director of Communications: Leila Rice 757.460.7056 (Office) 757.642.1321 (Cell)

Project Partners
Engineering Consultant Firm: XXX Engineering, Inc., City, State
Engineering Consultant Project Lead: XXX 757.XXX.XXXX (Office) internal use only 757.XXX.XXXX (Cell) internal use only
Contractor: XXX, City, State 757.XXX.XXXX (Office) internal use only 757.XXX.XXXX (Cell) internal use only

Additional Information: Email projects@hrsd.com
Frequently Asked Questions

Sewer Rehabilitation Project: 24th Street and Barberton Drive

Why is this project necessary?
A. This project is a necessary part of a larger, federally-mandated program to reduce sewage overflows during rainstorms. This project will provide updated infrastructure that will help ensure HRSD’s ability to protect public health and the environment for decades to come.

Will the project affect the flow of traffic in the neighborhood?
A. Disruptions to traffic will be minimized, and in most cases, a single lane of traffic will be maintained. No planned detours are anticipated but flagging will be used to help direct traffic as needed. Although the majority of the project work will be located within the public and private right-of-ways, much of the construction will be “trenchless,” meaning the contractor will not need to dig up the street to fix the pipes. However, certain sections of sewer are in very poor condition and must be replaced by digging.

Will access to properties along the route be maintained during construction?
A. The contractor will ensure that access to residences and at least one entrance to businesses will be maintained throughout construction. Trash and mail services will not be affected. If necessary, the contractor will move trash containers from within a work zone to an area accessible for pickup, and will be responsible for returning them to each residence.

What are the general working hours for the project?
A. Work will typically take place Monday through Friday during daylight hours (8 a.m. - 4 p.m.). However, there may be times when extended hours, work at night, or weekend work may be necessary.

Will there be any interruptions to my water or sewer service?
A. Your sewer service will be temporarily interrupted if work is to be performed on the sewer lateral pipe that serves your property. The contractor will notify you before your lateral is to be rehabilitated so you can plan appropriately. Sewer service typically will be restored within several hours. Your water service should not be affected by this project.

Will construction affect the existing pavement?
A. Where sewer and lateral pipes are dug up, asphalt, curb, gutters, driveway aprons, and grass will be removed and then restored upon completion of the project.

What sort of noise should I expect during construction?
A. The typical construction noises such as equipment engines and back-up alarms, materials being delivered, diesel generators and air compressors, sawing and the like should be anticipated.

Will material and equipment be stored on-site?
A. The contractor has negotiated with a private property owner for a storage area in the project vicinity and this site will be used for most of the equipment and supplies. The contractor will keep some supplies within the active work zone, in the public right-of-way.

Where will construction workers park?
A. Construction workers will not be allowed to park their personal vehicles on the public streets. However, work trucks will be allowed to park within the active work zone.

What is the cost of the project?
A. The estimated cost for the project is $3 million, and is financed by the wastewater treatment fees paid by HRSD customers.

How can I receive regular project updates?
A. Regular project updates are posted on the HRSD website at www.hrsd.com.

If you have any questions, concerns or comments about the project, please feel free to contact:
Lisa Bolen, HRSD Public Information Specialist, at 757.460.7000 or lbolen@hrsd.com
The vision of HRSD is that future generations will inherit clean waterways and be able to keep them clean.
Please keep to the same format as provided, same font and sizing, same legend and directional.
This item MUST be returned in a fully editable version, including the map background used and all line markings.
Do not embed the map, street labels or pipeline markings.
Whenever possible use a Google map (Earth View) image
  • Map Content must include source attribution within the maps area.
  • You can find the attribution in the line(s) shown on the bottom of the Content in the products along with copyright notices, such as “Map data ©2015 Google”. Note that the exact text of the attribution changes based on geography and content type. The attribution text must be legible to the average viewer or reader.
  • Turn off street labels in Google and create your own (using the template/format provided) for the most prevalent streets and building.
Preferred color selections
  • Yellow for completed work
  • Red for active construction
  • Blue for project path and work not yet begun
  • Green for existing HRSD lines/sites
  • All other colors (purple, orange and hashed marks) should be those that standout against the background
The vision of HRSD is that future generations will inherit clean waterways and be able to keep them clean.
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  - Map Content must include source attribution within the maps area.
  - You can find the attribution in the line(s) shown on the bottom of the Content in the products along with copyright notices, such as “Map data ©2015 Google”. Note that the exact text of the attribution changes based on geography and content type. The attribution text must be legible to the average viewer or reader.
Turn off street labels in Google and create your own (using the template/format provided) for the most prevalent streets and building.
Preferred color selections
  - Yellow for completed work
  - Red for active construction
  - Blue for project path and work not yet begun
  - Green for existing HRSD lines/sites
  - All other colors (purple, orange and hashed marks) should be those that standout against the background
TEMPORARY LANE CLOSURES IN EFFECT ON EAST LITTLE CREEK ROAD FOR EMERGENCY SANITARY SEWER REPAIRS

NORFOLK – Motorists are advised that HRSD is currently performing emergency repairs within the right and center lanes of westbound East Creek Road at the I-64 overpass near Waco Street. Motorist traveling west along East Little Creek Road in that area are restricted to the left lane while the work continues. In addition, all traffic accessing Little Creek Road from the I-64 off ramp 276C is being detoured to eastbound East Little Creek Road.

An updated advisory will be issued when the lanes are reopened. Motorists should expect delays in the area and plan their travel accordingly.

HRSD’s mission is to protect public health and the waters of Hampton Roads by treating wastewater effectively. A political subdivision of the Commonwealth of Virginia, HRSD was created by public referendum in 1940 and currently serves 18 cities and counties in southeast Virginia, an area with a population of 1.7 million.

###
MEDIA/PROJECT INQUIRY CARDS

Media Inquiries

Leila Rice
Director of Communications

Phone: 757.460.7056
Mobile: 757.642.1321
Email: lrice@hrsd.com
Website: www.hrsd.com
**UNIFIER Monthly Project Website Update**

### Project Overview
HRSD is undertaking a multi-phased project to install two valves on an existing force main at various locations along Independence Boulevard between Virginia Beach Boulevard and Northampton Boulevard. This effort to

**Date of Update:** 06/01/2016

**Project Update for Web:**
- **Valve #1 (Near Ewell Road):** The contractor has substantially completed the repair and re-insertion of the main line valve at this site and will be completing final restoration before moving on to the second valve site in mid-June.
- **Valve #2 (Near Pembroke Boulevard):**

**Roads Affected:** The work will be performed at two locations along Independence Boulevard between the north side of Pembroke Mall and Ewell Road:
- Between N. Hessian Road and Lake Pembroke (center median)
- Between Bayside Presbyterian Church and Ewell Road (center median)

### Key Dates

- **Staging (Month and Year):** February 2016
- **Construction (Season and Year):** Winter 2016 to Summer 2016
- **Restoration:** Immediately Following Construction

### Contacts

**Engineer Contact Name:**

**Engineer Phone Number:**

**Contractor Contact Name:**

**Contractor Phone Number:**

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**Attach your monthly map updates here with the date, note this under general comments.**

**Please list your updated columns here and any information you feel I need to be aware of.**

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**Attachments (0)**  **Linked Records (0)**  **General Comments (0)**  **Linked Mail (0)**
N. Great Neck Road Sanitary Sewer Pipeline Replacement
--Night Work Continues--

HRSD, your regional wastewater treatment utility, continues work to replace a sanitary sewer pipeline located along N. Great Neck Road. This work should take place primarily between the hours of **9 p.m. to 5 a.m., Sunday night to Friday morning**, to minimize traffic disruptions as requested by the City of Virginia Beach.

**In the upcoming weeks, pipe installation and hauling of wastewater during pipe connection is scheduled to start. This work will take place through the overnight hours into the mornings. We work at night because this is when sewer flows are at their lowest. This work should not affect your water or sewer services.**

While our project team works diligently to minimize impacts, you may notice increased noise, traffic and the crews and heavy equipment (with back-up safety alarms) associated with construction. Please take care when traveling around the construction area and for your safety, do not enter the site.

Due to the nature of construction, work is weather and situation dependent and dates are subject to change. For updates, please visit the project’s website page, [www.hrds.com/construction-status](http://www.hrds.com/construction-status)

Thank you for your support of this effort to help achieve HRSD’s vision: **Future generations will inherit clean waterways and be able to keep them clean.**

Should you have any questions or comments, you may contact:

HRSD Public Information
Specialist: Lisa Bolen
(757) 460-7000
lbolen@hrds.com

City of XXX Contact:
Name
(757) office phone
email

Onsite Inspector
(Emergency Concerns):
Name
(757) cell phone
email
N. Great Neck Road Pipeline Replacement
--Night Work Continues--

HRSD, your regional wastewater treatment utility, continues work to replace a sanitary sewer pipeline located along N. Great Neck Road. This work should take place primarily between the hours of 9 p.m. to 5 a.m., Sunday night to Friday morning, to minimize traffic disruptions as requested by the City of Virginia Beach.

In the upcoming weeks, pipe installation and hauling of wastewater during pipe connection is scheduled to start. This work will take place through the overnight hours into the mornings. We work at night because this is when sewer flows are at their lowest. This work should not affect your water or sewer services.

While our project team works diligently to minimize impacts, you may notice increased noise, traffic and the crews and heavy equipment (with back-up safety alarms) associated with construction. Please take care when traveling around the construction area and for your safety, do not enter the site.

Due to the nature of construction, work is weather and situation dependent and dates are subject to change. Please visit the project’s website page, www.hrsd.com/construction-status for updates.

Thank you for your support of this effort to help achieve HRSD’s vision: *Future generations will inherit clean waterways and be able to keep them clean.*

Should you have any questions or comments, you may contact:

HRSD Public Information Specialist:
Lisa Bolen
(757) 460-7000
lbolen@hrsd.com

City of XXX Contact:
Name
(757) office phone
email

Onsite Inspector (Emergency Concerns):
Name
(757) cell phone
email
Dear Neighbor:

This letter is to introduce the bearer as an individual authorized to perform work on behalf of HRSD.

We have retained the firm of XXX, Inc. to perform closed-circuit television (CCTV) inspections of the public and private sewer laterals and other tasks to help us locate needed repairs in your neighborhood. Some of their work may require access to pipelines and other facilities that lie within public right-of-ways and adjacent to your property. These activities typically do not affect your sewer service.

If you have concerns about the presence or performance of any worker while accomplishing these duties on our behalf, please do not hesitate to contact me at 757-460-7000.

We appreciate your understanding and assistance as we work to improve our system and fulfill HRSD’s vision: *Future generations will inherit clean waterways and be able to keep them clean.*

Sincerely,

Lisa Bolen
HRSD Public Information Specialist
HRSD is undertaking an important project to clean and inspect the sanitary sewer pipelines and laterals that serve your neighborhood. This maintenance activity will help eliminate blockages that could lead to sewage overflows and also allow us to insert a small TV camera into the pipeline to determine if it is in need of replacement. Once these inspections have been completed, any necessary repairs will begin immediately. However, this work is weather and situation dependent.

HRSD has retained the firm XXX to perform this work for us. Beginning the week of September 7, you can expect to see their trucks and employees in your area, Monday - Friday during the hours of 8:00 a.m. until 5:00 p.m. Some of their work may require access to pipelines that lie within the public right-of-way, or adjacent to, or at the cleanout located on your property. They will be cleaning the pipes by forcing water through them. There are some things you can do to help with the effort:

1. Please loosen the lid on your sewer clean out. The crew will come onto your property to do this if the clean out has been installed beyond the public right-of-way.
2. Please flush all your toilets and run water down the sinks and tubs that you have not used in the last few days.
3. Please leave all the toilet lids DOWN while the crew is working near your home.

There have been occasions when a toilet has overflowed while cleaning was underway. If this happens while you are at home, please notify the XXX foreman overseeing the job. They will ask to enter your home with a colleague to inspect the bathroom and arrange for any cleaning that might be necessary.

You also can report any issues stemming from the work underway in your neighborhood by calling XXX at 757-XXX-XXXX from 8:00 a.m. to 5:00 p.m. After hours you may call 757-XXX-XXXX.

HRSD expects our contractors to work in a safe and effective manner, and to be courteous in their interactions with the public. If you have any concerns about the work being accomplished in your area or the level of customer service provided, please call the HRSD office at 757-460-7000.

We appreciate your understanding and assistance as we work to improve your sanitary sewer system so we can better protect public health and area waterways.

Sincerely,

Lisa Bolen
HRSD Public Information Specialist
Sanitary Sewer Testing to Begin
--City of Virginia Beach--

Smoke testing of the sanitary sewer system will take place within the XXXX neighborhood in the City of Virginia Beach from late October through December.

Testing along your street is planned between these dates:

(This schedule is situation and weather dependent)

This non-invasive test of the system does not require private property access and will usually take place Monday through Friday from 7 a.m. to 5 p.m., unless in a school zone.

Please read the back of this notice for some tips and answers to some Frequently Asked Questions about what to expect during the Smoke Testing.
Frequently Asked Questions

Smoke Testing

Q: Do I need to be at home during smoke testing?
A: No.

Q: What is the purpose and how will the smoke testing be accomplished?
A: Smoke testing is used to find possible leaks in the sanitary sewer system. During this test, non-toxic, artificially created smoke (like a fog machine at a concert) is blown into access points (manholes) in the pipe. This smoke will escape through defects in the pipe, such as holes or cracks, or through illicit connections such as roof leaders, and be visible above ground. Plumes coming from plumbing vents and manhole rims are normal. The plumes may be marked with flags, and defects will be noted. The plumes or markers may also be photographed. The fire department will be notified of smoke testing plans.

Q: What do I need to do to prepare for smoke testing?
A: When you receive notice that smoke testing will take place, you should check to see that all drain traps under sinks, toilets, washing facilities and floor drains have water in them. To fill them, simply run each faucet for 30 – 60 seconds, flush toilets or fill the drains with about 3 cups of water.

Q: What should I do if I have pets in the house and will not be home during smoke testing?
A: The smoke is not harmful to pets. It would be a good idea to leave several windows partially open for ventilation, should any smoke enter the building. If you have proper plumbing connections and all of the drain traps have water in them, there should not be any problems.

Q: Is the smoke harmful to humans or furnishings?
A: No. It may make you cough, but it is not harmful to your health and will not harm clothing, drapes or furniture.

Q: What should I do if smoke gets into the house and how long will it take to dissipate?
A: If smoke enters your home during testing, please notify the contractor immediately, open windows to allow ventilation and note the location of the smoke. Smoke inside your home can help identify bad plumbing connections or a cracked seal around a toilet. Smoke alarms may also sound. The smoke will clear within a few moments. The amount of time required will depend upon how much smoke enters the building and how much ventilation you can provide.

Q: Who will conduct these tests?
A: HRSD has retained Brown and Caldwell to manage the testing. Brown and Caldwell plans to use the services of Hydrostructures to conduct the investigative tests.

Q: Can smoke stop up the sanitary sewer?
A: No. The smoke is made up of a vaporous substance.

Q: What happens if HRSD finds a bad sewer connection or lack of traps in my home?
A: An engineer will review the investigation information and make a recommendation, which will be reviewed by HRSD staff and shared with you.

If you have other questions or concerns about smoke testing, you may call 757.460.7000 or send an email to Projects@hrsds.com.
NOTICE OF SMOKE TESTING

Smoke testing of the sanitary sewer system will take place within your neighborhood from ________ through __________; your street will be tested between ______________.

This non-invasive test of the whole system does not require private property access and will usually take place Monday through Friday from 7am to 5pm.

This notice provides answers to some questions you may have about what to expect on the day of testing.

Smoke Testing FAQs

Q: What is the purpose and how will the smoke testing be accomplished?
A: Smoke testing is used to find possible leaks in the sanitary sewer system. During this test, non-toxic, artificially created smoke (like a fog machine at a concert) is blown into access points (manholes) in the pipe. This smoke will escape through defects in the pipe, such as holes or cracks, or through illicit connections such as roof leaders, and be visible above ground. Smoke coming from plumbing vents and manhole rims is normal. The plumes may be marked with flags, and defects will be noted. The plumes or markers may also be photographed. The fire department will be notified of smoke testing plans.

Q: Do I need to be at home during smoke testing?
A: No.

(Continue reading for homeowner tips and Frequently Asked Questions about Smoke Testing)

Q: What do I need to do to prepare for smoke testing?
A: When you receive notice that smoke testing will take place, you should check to see that all drain traps under sinks, toilets, washing facilities and floor drains have water in them. To fill them, simply run each faucet for 30 – 60 seconds, flush toilets or fill the drains with about 3 cups of water.

Q: What should I do if I have pets in the house and will not be home during smoke testing?
A: The smoke is not harmful to pets. It would be a good idea to leave several windows partially open for ventilation, should any smoke enter the building. If you have proper plumbing connections and all of the drain traps have water in them, there should not be any problems.

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A: No. It may make you cough, but it is not harmful to your health and will not harm clothing, drapes or furniture.

Q: What should I do if smoke gets into the house and how long will it take to dissipate?
A: If smoke enters your home during testing, please notify the contractor immediately, open windows to allow ventilation and note the location of the smoke. Smoke inside your home can help identify bad plumbing connections or a cracked seal around a toilet. Smoke alarms may also sound. The smoke will clear within a few moments. The amount of time required will depend upon how much smoke enters the building and how much ventilation you can provide.

Q: Who will conduct these tests?
A: HRSD has retained Brown and Caldwell to manage the testing. Brown and Caldwell plans to use the services of Terra Contracting, Hydrostructures and Video Pipe Services to conduct the investigative tests.

Q: Can smoke stop up the sanitary sewer?
A: No. The smoke is made up of a vaporous substance.

Q: What happens if HRSD finds a bad sewer connection or lack of traps in my home?
A: An engineer will review the investigation information and make a recommendation, which will be reviewed by HRSD staff and shared with you.

Q: Whom do I contact if I have other questions or concerns about smoke testing?
A: You may call 757.460-7000 or send an email to Projects@hrsd.com.
A MESSAGE TO OUR NEIGHBORS
October 21, 2015

Dear Neighbor:

This letter is to introduce the bearer as an individual authorized to perform work on behalf of HRSD, your regional wastewater treatment utility.

We have retained the firm of XXX, Inc. to perform land surveys and other tasks to help us plan for a new pipeline in your neighborhood. Some of this work may require access to pipelines and other facilities residing within public easements, right-of-ways, or adjacent to your property.

If you have concerns about the presence or performance of any worker while accomplishing these duties on our behalf, you may contact me at 757-460-7000. If you wish to be present during this survey or desire to discuss this effort further, please contact the Project Manager at (757) XXX-XXXX or XXXXX@hrsd.com.

We appreciate your understanding and assistance as we work to improve our system and fulfill HRSD’s vision: Future generations will inherit clean waterways and be able to keep them clean.

Sincerely,

Lisa Bolen
HRSD Public Information Specialist
HRSD, your regional wastewater utility, is undertaking a project to clean and inspect the sanitary sewer pipelines and laterals (the pipes that connect homes to the sewer system) in your neighborhood. HRSD has retained the firm of XXX to perform this work for us.

**FIRM** will be performing sewer rehabilitation adjacent to your property and the lateral that services your home. There will be a temporary interruption to your sewer services and we ask that you **refrain from heavy water usage** (such as washing clothes or using the dishwasher) **during this time (7:30 a.m. to 6 p.m.)**. This work should not affect your water service. We will attempt to notify anyone at home prior to the work beginning and again once the work has been completed by a door knock from one of our inspectors.

**Please leave enough room for FIRM to access the cleanout in your yard or driveway** (for instance, please park your vehicle at least 5 feet away from the cleanout).

Cleanouts will be marked with an orange or yellow cone the night before work is to be done.

**THIS WORK IS TENTATIVELY SCHEDULED TO BE PERFORMED ON:** _____________

You can report any issues stemming from the work underway in your neighborhood by calling XXX at 757-XXX-XXXX from 8:00 a.m. to 5:00 p.m. After hours you may call 757-XXX-XXXX.

HRSD expects our contractors to work in a safe and effective manner and to be courteous in their interactions with the public. If you have any concerns about the work being accomplished in your area or the level of customer service provided, please call HRSD at 757-460-7000.

We appreciate your understanding and assistance as we work to improve your sanitary sewer system so we can better protect public health and area waterways.
Sewer Rehabilitation Project: Newmarket Plaza Area

-REMINDER NOTICE-

The contractor for HRSD, your regional wastewater treatment utility, will **begin** the cleaning and inspection portion of work adjacent to your home **tomorrow**. They will be cleaning the pipes by forcing water through them.

There are some things you can do to help with the effort:

1. **Please flush all your toilets and run water down the sinks and tubs** that you have not used in the last few days.

2. **Please leave all the toilet lids DOWN** while the crew is working near your home.
   
   You will receive a notice when this work is completed.

HRSD would like to thank all the residents for their continued understanding and patience during this important rehabilitation project fulfilling HRSD’s vision:

*Future generations will inherit clean waterways and be able to keep them clean.*

Should you have any questions or comments, you may contact:

HRSD Public Information
Specialist:
Lisa Bolen
(757) 460-7000
lbolen@hrsd.com

HRSD’s on-site Inspector:
Name
(757) XXX-XXXX
lterry@warallp.com
Sewer Rehabilitation Project: Newmarket Plaza Area

-WORK COMPLETED-

HRSD’s contractor has completed the cleaning and inspection portion of work occurring adjacent to your home.

If any additional work is required, you will be notified.

HRSD would like to thank all the residents for their continued understanding and patience during this important rehabilitation project fulfilling

HRSD’s vision:

*Future generations will inherit clean waterways and be able to keep them clean.*

Should you have any questions or comments, you may contact:

HRSD Public Information Specialist:
Lisa Bolen
(757) 460-7000
lbolen@hrsd.com

HRSD’s on-site Inspector:
Name
(757) XXX-XXXX
lterry@warallp.com
CONSTRUCTION NOTICE
Newport News
August 2017

Neighborhoods Surrounding Warwick and Boxley Boulevards, Menchville and Scufflefield Roads and Riverview Parkway Projects

-Project Closeout Notification-

The contractor for HRSD, your regional wastewater treatment utility, has successfully completed pipeline construction work related to the sewer pipeline replacement projects in your area. Final landscape restorations will take place in the fall when the weather is more conducive to successful plantings.

As the newly installed pipeline is now in service, HRSD will fill the old pipeline with cementitious like material and will safely leave it in place to minimize additional disruptions. The contractor may need to access a few locations along existing easements to perform this work and will coordinate with those homeowners. This work should begin this week and is anticipated to be completed within two weeks.

HRSD maintains a one-year warranty period with the contractor to review items that may need to be addressed after final restoration. If you have any areas of concern, please let us know so these items may be addressed through this process.

HRSD would like to thank you for your understanding and patience during this important effort to help achieve HRSD’s vision:

*Future generations will inherit clean waterways and be able to keep them clean.*

Should you have any questions or comments, you may contact:

HRSD Public Information Specialist:
Lisa Bolen
(757) 460-7000
lbolen@hrsd.com
## SURVEY NOTICES - Mailing and Tracking Log

<table>
<thead>
<tr>
<th>Location/Map #</th>
<th>PARCELID</th>
<th>OWNER FIRST NAME</th>
<th>OWNER LAST NAME</th>
<th>PHYSICAL ADDRESS</th>
<th>CITY</th>
<th>STATE</th>
<th>ZIPS</th>
<th>POSTAL ADDRESS (mail to both)</th>
<th>tracking #</th>
<th>Return Receipt Received</th>
<th>Crossing Property</th>
<th>Adjacent to Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>27A-1-48</td>
<td>DAVIN and BEVERLY BABB</td>
<td>968 BEECHLAND ROAD</td>
<td>ELBERON</td>
<td>VA</td>
<td>23846</td>
<td>ROLFE HWY</td>
<td>6677</td>
<td>T</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**YELLOW Col. - info to be used in letters**

- Crossing Property Receives ROE Letter
- Adjacent to Receives Standard Survey Letter or Surveyor carries letter in hand
To all Stakeholders:

Construction of the HRSD Downtown Norfolk Pipeline Replacement project has begun/is ongoing.

Please use this link [www.hrsd.com/subscriptions](http://www.hrsd.com/subscriptions) to be redirected to the HRSD Subscriptions web page. From there, you can fill out the form to receive email notifications about the project when there is an update on the website. You can choose to be notified about a specific HRSD project, or you can choose to be notified about any HRSD project by selecting one or more localities.

Specific project areas scheduled for work will be notified via field distributed project flyers within two weeks of the actual work. (verify schedule)

Should you have any questions or concerns, please feel free to reply to this email with your contact information and a project representative will contact you.

Thank you.

*(Project Team Member, email signature line, and contact info)*

*Ensure that this email is going out as a Bcc to all parties
**Ensure that you have included all recent inquiring parties in and are maintaining the project’s-email distribution group (city partners, meetings, and citizen correspondence).*
Section 12 – Preconstruction Assessment and Damage Mitigation Procedures

A. Introduction - In recent years, HRSD has received an increasing number of complaints from private property owners, the general public and locality staff regarding the condition of roads, sidewalks, drainage ditches, private property, damage to buildings, etc. within and along pipeline construction corridors and in close proximity to pumping station construction projects. For many of these construction projects, the captured preconstruction photography and/or video coverage were inadequate to resolve claims or complaints. This section provides evaluation processes and expectations for varying levels of preconstruction surveys and active construction impact monitoring during construction related to the potential of construction noise, vibration, ground settlement, building damage, water ponding, and restoration complaints. Numerous publications have been authored on the matter of construction related noise and vibration and on impacts to individuals and structures. Included in this section are excerpts from some of these publications to assist the FIRM in determining the appropriate level of preconstruction survey / assessment and active construction impacts monitoring to be performed for a planned construction project for the purpose of protecting all parties. Also included in this document are template forms and documentation that are to be used by the FIRM for encounters with property owners and businesses in the determined impact zone from a HRSD construction project. The FIRM must obtain a waiver, in writing, from the responsible Chief of Design and Construction as well as HRSD’s Real Estate Manager for any variances from the required use of this or any parts of this section of the standards.

B. Organization and outline of this Section – This section is divided into Stages that correspond with evaluations and decision points related to the various identified types of possible construction related impacts for typical HRSD projects. Figure B-1 is a decision flow chart that is included to assist in navigating this section. The FIRM may use one or all Stages of this standard but every project should go through a Stage 1 discovery and review resulting in a project team discussion to determine the process forward. The FIRM shall provide this discovery and review in writing and file it in the project’s folder utilizing HRSD’s UNIFIER Software.

For a more detailed understanding of each stage and its requirements, see the corresponding and following sections beginning with item “C” of this section of the Standards.

1. Stage 1 – Construction Impact Research and Evaluation (at the conclusion of this Stage, the FIRM shall facilitate a discussion of their preliminary findings of possible project impacts and provide their recommendation or if a waiver is warranted)
   a. Research and Investigations
      i. Soil conditions
      ii. Previous projects in the area and issues
      iii. What types of sensitive structures may exist in the area (schools, churches, historical buildings or monuments)
   b. Likely Construction Means and Methods Determinations
   c. Potential of Construction Related Impacts
      i. Noise Generation and Impacts
ii. Vibrations Impacts
iii. Dewatering Impacts on Ground and Structures Settlement (remember to consider pools and other subsurface structures)
iv. Construction Impacts on Existing Topography, Hydrology, and Construction Travel Routes
v. Dust, Odor, and Other Emissions beyond Construction Zone
vi. Jurisdictional Limitations, Requirements or Ordinances (for the items above)
d. Determination of construction’s zone of influence for each potential construction related impacts both perceived and actual (Provide written report clearly detailing impact distances from project site and visual diagram detailing the same).
   i. Sample – Vibration Generation and Impacts (diagram and impact table)
   ii. Sample – Noise Generation and Impacts (diagram and impact table)
   iii. Sample – Noise and Vibration Impacts (combined map)
   iv. Sample – Dewatering Impacts

2. Stage 2 – Risk Mitigation Analysis and Bid Document Development for Contractor Actions
   a. Noise Impacts, Restrictions, and Abatement
   b. Vibration Impacts, Abatement, and Monitoring
   c. Groundwater Dewatering Requirements
   d. Pre-Construction Surveys and Assessments within Construction Corridors and Impact Areas
   e. Fugitive Emissions Controls and Restrictions

3. Stage 3 – Specific Pre-Construction Field Surveys and Construction Activity Monitoring Programs
   a. Responsibilities of the FIRM
   b. Responsibilities of the Contractor
   c. Identification of Other Party Responsibilities
C. Stage 1 – Construction Impact Research and Evaluation

1. The FIRM shall perform the following research and investigations during the Design phase of a project at a minimum to provide needed information for determination of possible construction related impacts to surrounding areas:
   a. Determination of the zone of influence throughout the entire project impact area.
   b. Presence of historically significant buildings, structures, and/or sites.
   c. Determination of the types of buildings (residential, business, religious, education,
etc.).

**d.** Determination of age, materials of construction, presence of basements for buildings.

**e.** Distance from closest point of construction to each building, structure and/or site.

**f.** Soil types and strata from soil borings (at recommended locations).

**g.** Groundwater levels and seasonal variations within the construction site or corridor.

**h.** Topography and hydrology and known or likely stormwater drainage issues.

**i.** Dust, odor and other emissions.

2. The FIRM shall determine the following during the Design phase of a project to provide information for possible construction related impacts to surrounding areas:

**a.** Ranges of depth of construction (bottom of pipe trench, pump station wetwell, vault, etc.)

**b.** Anticipated heavy construction equipment for specific areas (noise and vibration impacts).

**c.** Construction methods and materials for trench or excavation pit stabilization and foundation support (driven temporary or permanent sheet piling, auger foundation piles, driven foundation piles).

**d.** Dewatering methods and likely impacts on ground or structure settling as a result of dewatering in the cone of depression zone.

**e.** Pavement type and thickness where construction equipment will travel upon or equipment/materials staged upon.

**f.** Determination of day verses night construction noise requirements.

**g.** Determination of prevailing winds in areas of construction and fugitive emissions from the construction zone.

3. The FIRM shall evaluate the potential of construction related impacts to adjacent properties and structures based upon collected information as mentioned in the preceding paragraphs of this Section. Referenced publications and excerpts from noted publications are included in this Section to assist the FIRM in determining the potential of construction related impacts and a course of action for preconstruction assessments that suite the particular risks. This referenced information and these procedures are not all inclusive, and therefore the FIRM shall apply their own experience and evaluations to supplement the information in this Section to minimize risks related to construction impacts. At the conclusion of this process, the FIRM shall produce a single detailed report of the findings and FIRM’s determination of construction related impacts and submit to the HRSD Project Manager (PM) and Real Estate Manager.

**a. Noise Generation and Impacts.** Noise influences from construction activities may vary depending on the duration, equipment used, sound frequencies, environmental conditions, among other factors that need to be evaluated and possibly abated depending upon the anticipated impact of noise.

The following tables and information from the *Federal Transit Administration Office of Planning and Environment Transit Noise and Vibration Impact Assessment May 2006* publication should be reviewed by the FIRM to assess noise influences and action plans.
12.1.1 Quantitative Noise Assessment Methods

A quantitative construction noise assessment is performed by comparing the predicted noise levels with impact criteria appropriate for the construction stage. The approach requires an appropriate descriptor, a standardized prediction method and a set of recognized criteria for assessing the impact.

The descriptor used for construction noise is the $L_{eq}$. This unit is appropriate for the following reasons:

- It can be used to describe the noise level from operation of each piece of equipment separately and is easy to combine to represent the noise level from all equipment operating during a given period.
- It can be used to describe the noise level during an entire phase.
- It can be used to describe the average noise over all phases of the construction.

The recommended method for predicting construction noise impact for major transit projects requires:

- An emission model to determine the noise generated by the equipment at a reference distance.
- A propagation model that shows how the noise level will vary with distance.
- A way of summing the noise of each piece of equipment at locations of noise sensitivity. The first two components of the method are related by the following equation:

$$ L_{eq\text{(equip)}} = E.L. + 10 \log(U.F.) - 20 \log(D/50) - 10G \log(D/50) $$

where:

- $L_{eq\text{(equip)}}$ is the $L_{eq}$ at a receiver resulting from the operation of a single piece of equipment over a specified time period
- $E.L.$ is the noise emission level of the particular piece of equipment at the reference distance of 50 feet, taken from Table 12-1
- $G$ is a constant that accounts for topography and ground effects, taken from Figure 6-5 (Chapter 6)
- $D$ is the distance from the receiver to the piece of equipment, and
- $U.F.$ is a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.

The combination of noise from several pieces of equipment operating during the same time
period is obtained from decibel addition of the Leq of each single piece of equipment found from the above equation.

**General Assessment**

The approach can be as detailed as necessary to characterize the construction noise by specifying the various quantities in the equation. For projects in an early assessment stage when the equipment roster and schedule are undefined, only a rough estimate of construction noise levels is practical.

The following assumptions are adequate for a general assessment of each phase of construction:

- Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period. Therefore, U.F. = 1, and 10 log(U.F.) = 0.

- Free-field conditions are assumed and ground effects are ignored. Consequently, G = 0.

- Emission level at 50 feet, E.L., is taken from Table 12-1.

- All pieces of equipment are assumed to operate at the center of the project, or centerline, in the case of a guideway or highway construction project.

- The predictions include only the two noisiest pieces of equipment expected to be used in each construction phase.

**Detailed Assessment**

A more detailed approach can be used if warranted, such as when a large number of noise-sensitive sites are adjacent to a construction project or where contractors are faced with stringent local ordinances or heightened public concerns expressed in early outreach efforts. Additional details include:

- **Duration.** Long-term construction project noise impact is based on a 30-day average L_{dn}, the times of day of construction activity (nighttime noise is penalized by 10 dB in residential areas), and the percentage of time the equipment is to be used during a period of time which will affect U.F. For example, an 8-hour L_{eq} is determined by making U.F. the percentage of time each individual piece of equipment operates under full power in that period. Similarly, the 30-day average L_{dn} is determined from the U.F. expressed by the percentage of time the equipment is used during the daytime hours (7 a.m. to 10 p.m.) and nighttime (10 p.m. to 7 a.m.), separately over a 30-day period. However, to account for increased sensitivity to nighttime noise, the nighttime percentage is multiplied by 10 before performing the computation.
• **Site Characteristics.** Taking into account the site topography, natural and man-made barriers and ground effects will involve the factor G. Use Figure 6-5 (Chapter 6) to calculate G.

• **Noise Sources.** Measuring or certifying the emission level of each piece of equipment will refine E.L.

• **Site Layout.** Determining the location of each piece of equipment while it is working will specify the distance factor D more accurately.

• **Combined Sources.** Including all pieces of equipment in the computation of the 8-hour $L_{eq}$ and the 30-day average $L_{dn}$ will determine the total noise levels using Table 6-11 (Chapter 6).

**12.1.2 Noise from Typical Construction Equipment and Operations**

The noise levels generated by construction equipment will vary greatly depending on factors such as the type of equipment, the specific model, the operation being performed, and the condition of the equipment. The equivalent sound level ($L_{eq}$) of the construction activity also depends on the fraction of time that the equipment is operated over the time period of construction. The dominant source of noise from most construction equipment is the engine, usually a diesel, often without sufficient muffling. In a few cases, such as impact pile-driving or pavement-breaking, noise generated by the process dominates.

For considerations of noise assessment, construction equipment can be considered to operate in two modes, stationary and mobile. Stationary equipment operates in one location for one or more days at a time, with either a fixed power operation (pumps, generators, compressors) or a variable noise operation (pile drivers, pavement breakers). Mobile equipment moves around the construction site with power applied in cyclic fashion (bulldozers, loaders), or to and from the site (trucks). The movement around the site is handled in the construction noise prediction procedure discussed earlier in this chapter. Variation in power imposes additional complexity in characterizing the noise source level from a piece of equipment. This is handled by describing the noise at a reference distance from the equipment operating at full power and adjusting it based on the duty cycle of the activity to determine the $L_{eq}$ of the operation. Standardized procedures for measuring the exterior noise levels for the certification of mobile and stationary construction equipment have been developed by the Society of Automotive Engineers. These typical noise levels from representative pieces of equipment are listed in Table 12-1. These source levels can be used in FHWA's Windows-based screening tool, “Roadway Construction Noise Model” (RCNM), for the prediction of construction noise.

Construction activities are characterized by variations in the power expended by equipment, with resulting variation in noise levels with time. Variation in the power is expressed in terms of the previously mentioned "usage factor" of the equipment, which is the percentage of time during the workday that the equipment is operating at full power. Time-varying noise levels are converted to a single number ($L_{eq}$) for each
piece of equipment during the operation. Besides having daily variations in activities, major construction projects are accomplished in several different phases. Each phase has a specific equipment mix depending on the work to be accomplished during that phase.

As a result of the equipment mix, each phase has its own noise characteristics; some have higher continuous noise levels than others, some have high impact noise levels. The purpose of the quantitative assessment is to determine not only the levels, but also the duration of the noise. The $L_{eq}$ of each phase is determined by combining the $L_{eq}$ contributions from each piece of equipment used in that phase. The impact and the consequent noise mitigation approaches depend on the criteria to be used in assessing impact, as discussed in the next section.

<table>
<thead>
<tr>
<th>Table 12-1. Construction Equipment Noise Emission Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equipment</strong></td>
</tr>
<tr>
<td>Air Compressor</td>
</tr>
<tr>
<td>Backhoe</td>
</tr>
<tr>
<td>Ballast Equalizer</td>
</tr>
<tr>
<td>Ballast Tamper</td>
</tr>
<tr>
<td>Compactor</td>
</tr>
<tr>
<td>Concrete Mixer</td>
</tr>
<tr>
<td>Concrete Pump</td>
</tr>
<tr>
<td>Concrete Vibrator</td>
</tr>
<tr>
<td>Crane, Derrick</td>
</tr>
<tr>
<td>Crane, Mobile</td>
</tr>
<tr>
<td>Dozer</td>
</tr>
<tr>
<td>Generator</td>
</tr>
<tr>
<td>Grader</td>
</tr>
<tr>
<td>Impact Wrench</td>
</tr>
<tr>
<td>Jack Hammer</td>
</tr>
<tr>
<td>Loader</td>
</tr>
<tr>
<td>Paver</td>
</tr>
<tr>
<td>Pile-driver (Impact)</td>
</tr>
<tr>
<td>Pile-driver (Sonic)</td>
</tr>
<tr>
<td>Saw</td>
</tr>
<tr>
<td>Pneumatic Tool</td>
</tr>
<tr>
<td>Pump</td>
</tr>
<tr>
<td>Rail Saw</td>
</tr>
<tr>
<td>Rock Drill</td>
</tr>
<tr>
<td>Roller</td>
</tr>
<tr>
<td>Saw</td>
</tr>
<tr>
<td>Scarifier</td>
</tr>
</tbody>
</table>
### Table 12-1. Construction Equipment Noise Emission Levels

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Typical Noise Level (dBA) 50 ft from Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scraper</td>
<td>89</td>
</tr>
<tr>
<td>Shovel</td>
<td>82</td>
</tr>
<tr>
<td>Spike Driver</td>
<td>77</td>
</tr>
<tr>
<td>Tie Cutter</td>
<td>84</td>
</tr>
<tr>
<td>Tie Handler</td>
<td>80</td>
</tr>
<tr>
<td>Tie Inserter</td>
<td>85</td>
</tr>
<tr>
<td>Truck</td>
<td>88</td>
</tr>
</tbody>
</table>

*Table based on an EPA Report,[4] measured data from railroad construction equipment taken during the Northeast Corridor Improvement Project, and other measured data.*

### 12.1.3 Construction Noise Criteria

No standardized criteria have been developed for assessing construction noise impact. Consequently, criteria must be developed on a project-specific basis unless local ordinances can be found to apply. Generally, local noise ordinances are not very useful in evaluating construction noise. They usually relate to nuisance and hours of allowed activity and sometimes specify limits in terms of maximum levels, but are generally not practical for assessing the impact of a construction project. Project construction noise criteria should take into account the existing noise environment, the absolute noise levels during construction activities, the duration of the construction, and the adjacent land use. While it is not the purpose of this manual to specify standardized criteria for construction noise impact, the following guidelines can be considered reasonable criteria for assessment. If these criteria are exceeded, there may be adverse community reaction.

#### General Assessment

Estimate the combined noise level in one hour from the two noisiest pieces of equipment, assuming they both operate at the same time. Then identify locations where the level exceeds the following:

<table>
<thead>
<tr>
<th>Land Use</th>
<th>One-hour L&lt;sub&gt;eq&lt;/sub&gt; (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
<td>Night</td>
</tr>
<tr>
<td>Residential</td>
<td>90</td>
</tr>
<tr>
<td>Commercial</td>
<td>100</td>
</tr>
<tr>
<td>Industrial</td>
<td>100</td>
</tr>
</tbody>
</table>

#### Detailed Assessment

Where a more refined analysis is needed, predict the noise level in terms of 8-hour L<sub>eq</sub> and 30-day averaged L<sub>dn</sub> and compare to criteria in the following table:
<table>
<thead>
<tr>
<th>Land Use</th>
<th>8-hour $L_{eq}$ (dBA)</th>
<th>$L_{dn}$ (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day</td>
<td>Night</td>
</tr>
<tr>
<td>Residential</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>Commercial</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td>Industrial</td>
<td>90</td>
<td>90</td>
</tr>
</tbody>
</table>

<sup>(a)</sup> In urban areas with very high ambient noise levels ($L_{dn} > 65$ dB), $L_{dn}$ from construction operations should not exceed existing ambient + 10 dB.

<sup>(b)</sup> Twenty-four-hour $L_{eq}$, not $L_{dn}$.

The following diagram provides a visual relationship between common indoor and outdoor sound generators and their accompanying decibel levels. This type of graphic can be used to compare expected construction related noise levels to more commonly experienced sounds.
b. **Vibration Impacts.** Ground vibration impacts from construction activities may vary depending on the duration, equipment used, soil types, groundwater level, vibration frequencies, construction methods among other factors that need to be evaluated and monitored depending on the anticipated impact of vibration.

The following tables and information from the *Federal Transit Administration Office of Planning and Environment Transit Noise and Vibration Impact Assessment May 2006* publication should be reviewed by the FIRM to assess vibration impacts, create action plans, and identify the zone of influence specific to each project.
12.2 CONSTRUCTION VIBRATION ASSESSMENT

Construction activity can result in varying degrees of ground vibration, depending on the equipment and methods employed. Operation of construction equipment causes ground vibrations that spread through the ground and diminish in strength with distance. Buildings founded on the soil in the vicinity of the construction site respond to these vibrations, with varying results ranging from no perceptible effects at the lowest levels, low rumbling sounds and perceptible vibrations at moderate levels, and slight damage at the highest levels. As expressed previously in this chapter with respect to construction noise, the type of assessment – qualitative or quantitative – and the level of construction vibration analysis will be determined by factors related to the scale of the project and the sensitivity of the surrounding land use. A quantitative analysis should be conducted in cases where construction vibration may result in prolonged annoyance or building damage.

Ground vibrations from construction activities do not often reach the levels that can damage structures, but they can achieve the audible and feelable ranges in buildings very close to the site. A possible exception is the case of fragile buildings, many of them old, where special care must be taken to avoid damage. The construction vibration criteria include special consideration for such buildings. The construction activities that typically generate the most severe vibrations are blasting and impact pile driving.

In cases where prolonged annoyance or damage from construction vibrations are not expected, a qualitative assessment is appropriate. Such an assessment should include a description of the duration and the type of equipment to be used during the construction, with an explanation of how the groundborne vibration will be maintained at an acceptable level. For example, if the equipment is of the type that generates little or no ground vibration – air compressors, light trucks, hydraulic loaders, etc. – a simple explanation is sufficient and no quantitative analysis is necessary.

12.2.1 Quantitative Construction Vibration Assessment Methods

Construction vibration should be assessed quantitatively in cases where there is significant potential for impact from construction activities. Such activities include blasting, pile-driving, vibratory compaction, demolition, and drilling or excavation in close proximity to sensitive structures. The recommended procedure for estimating vibration impact from construction activities is as follows:

**Damage Assessment**

- Select the equipment and associated vibration source levels at a reference distance of 25 feet from Table 12-2.
- Make the propagation adjustment according to the following formula (this formula is based on point sources with normal propagation conditions):

\[
P_{PV_{eq}} = P_{PV_{ref}} \times (25/D)^{1.5}
\]
where: PPV (equip) is the peak particle velocity in in/sec of the equipment adjusted for distance

PPV (ref) is the reference vibration level in in/sec at 25 feet from Table 12-2.

D is the distance from the equipment to the receiver.

- Apply the vibration damage criteria from Table 12-3.

**Annoyance Assessment**

- If desired for consideration of annoyance or interference with vibration-sensitive activities, estimate the vibration level $L_v$ at any distance $D$ from the following equation and apply the vibration impact criteria for General Assessment in Chapter 8 for vibration-sensitive sites:

$$L_v(D) = L_v(25 \text{ ft}) - 30\log(D/25)$$

### 12.2.2 Vibration Source Levels from Construction Equipment

Ground-borne vibration related to human annoyance is generally related to root mean square (rms) velocity levels expressed in VdB. However, a major concern with regard to construction vibration is building damage. Consequently, construction vibration is generally assessed in terms of peak particle velocity (PPV), as defined in Chapter 7.1.2. The relationship of PPV to rms velocity is expressed in terms of the “crest factor,” defined as the ratio of the PPV amplitude to the rms amplitude. Peak particle velocity is typically a factor of 1.7 to 6 times greater than rms vibration velocity.

Various types of construction equipment have been measured under a wide variety of construction activities with an average of source levels reported in terms of velocity as shown in Table 12-2. In this table, a crest factor of 4 (representing a PPV-rms difference of 12 VdB) has been used to calculate the approximate rms vibration velocity levels from the PPV values. Although the table gives one level for each piece of equipment, it should be noted that there is a considerable variation in reported ground vibration levels from construction activities. The data provide a reasonable estimate for a wide range of soil conditions.
### Table 12-2. Vibration Source Levels for Construction Equipment
(From measured data.\(^{7,8,9,10}\))

<table>
<thead>
<tr>
<th>Equipment</th>
<th>PPV at 25 ft (in/sec)</th>
<th>Approximate (L_v^\dagger) at 25 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pile Driver (impact)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>upper range</td>
<td>1.518</td>
<td>112</td>
</tr>
<tr>
<td>Typical</td>
<td>0.644</td>
<td>104</td>
</tr>
<tr>
<td>Pile Driver (sonic)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>upper range</td>
<td>0.734</td>
<td>105</td>
</tr>
<tr>
<td>Typical</td>
<td>0.170</td>
<td>93</td>
</tr>
<tr>
<td>Clam shovel drop (slurry wall)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.202</td>
<td>94</td>
</tr>
<tr>
<td>Hydromill (slurry wall)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>in soil</td>
<td>0.008</td>
<td>66</td>
</tr>
<tr>
<td>in rock</td>
<td>0.017</td>
<td>75</td>
</tr>
<tr>
<td>Vibratory Roller</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.210</td>
<td>94</td>
</tr>
<tr>
<td>Hoe Ram</td>
<td>0.089</td>
<td>87</td>
</tr>
<tr>
<td>Large bulldozer</td>
<td>0.089</td>
<td>87</td>
</tr>
<tr>
<td>Caisson drilling</td>
<td>0.089</td>
<td>87</td>
</tr>
<tr>
<td>Loaded trucks</td>
<td>0.076</td>
<td>86</td>
</tr>
<tr>
<td>Jackhammer</td>
<td>0.035</td>
<td>79</td>
</tr>
<tr>
<td>Small bulldozer</td>
<td>0.003</td>
<td>58</td>
</tr>
</tbody>
</table>

\(\dagger\) RMS velocity in decibels (VdB) re 1 micro-inch/second
The following diagram provides a relationship between vibration sources and likely impacts from the vibrations they generate.

![ Typical Vibration Sources and Sensitivities ]

**Figure C-2: Typical Vibration Sources and Sensitivities**

c. **Dewatering Impacts on Ground and Structures Settlement.** Dewatering of deep construction trenches and excavation pits is a common practice for HRSD construction projects. The cone of depression for ground water removal with well point dewatering systems needs to be evaluated for possible settling impacts on ground movement, paved surfaces, buried utilities, buildings and other structures in close proximity to the construction zone. Common occurrences with groundwater dewatering are compaction of soils as water is removed resulting in soil movement and removal of fine soil particles along with the groundwater resulting in voids in the soil. The FIRM is to evaluate settlement abatement methods and materials, create
action plans and identify the zone of influence specific to each project.

This following figure shows the results of groundwater modeling for a calculated withdrawal rate.

Figure C-3: Example of Impact Zone and Groundwater Elevations during Withdrawal

d. Construction Impacts on Existing Topography, Hard Surfaces, Hydrology, and Construction Travel Routes. The FIRM to document existing conditions and evaluate likely impacts on stormwater drainage, unpaved surfaces, paved surface, concrete driveways / sidewalks, vegetation / plantings from construction equipment and material storage within the construction zones. Consideration to be given to preventative and protective measures as practical to be incorporated into the construction Bid Documents. The FIRM to consider how the Contractor(s) will deliver materials to the construction area and storage sites and movement of construction equipment across paved and unpaved surfaces. The FIRM shall create
action plans and identify the zone of influence specific to each project.

e. **Dust, Odor, and Other Emissions beyond Construction Zone.** Construction projects have the potential to generate numerous type and quantities of fugitive emissions. Some examples of emission generating activities include site clearing; excavation and earthwork; stockpiles and storage mounds; demolition activities; spray painting; power washing; operating equipment exhausts, and site vehicular entrances and exits. The FIRM is to consider the types of construction equipment and activities within the construction zone and the potential of fugitive emissions from these sources and nuisance of these emissions. Determination of prevailing wind direction and proximity of buildings and/or sensitive receptors are to be made by the FIRM as part of this evaluation. Upon completion of these evaluations, if nuisance emissions are considered likely beyond the construction zone, then further investigations and abatement efforts are warranted. The FIRM shall create action plans and identify the zone of influence specific to each project.

D. **Stage 2 – Risk Mitigation Analysis and Bid Document Development for Contractor Actions.**

1. Based upon the risk assessment of noise impacts emanating beyond the limits of the construction zone, the FIRM needs to take appropriate steps to mitigate these potential impacts. The following information from the *Federal Transit Administration Office of Planning and Environment Transit Noise and Vibration Impact Assessment May 2006* publication should be reviewed by the FIRM to mitigate noise influences and other action plans as recommended.

12.1.4 **Mitigation of Construction Noise**

After using the above approaches to locate potential impacts from construction noise, the next step is to identify appropriate control measures. Three categories of noise control approaches, with examples, are given below:

1. **Design considerations and project layout:**
   
   - Construct noise barriers, such as temporary walls or piles of excavated material, between noisy activities and noise-sensitive receivers.
   - Re-route truck traffic away from residential streets, if possible. Select streets with fewest homes if no alternatives are available.
   - Site equipment on the construction lot as far away from noise-sensitive sites as possible.
   - Construct walled enclosures around especially noisy activities or clusters of noisy equipment. For example, shields can be used around pavement breakers and loaded vinyl curtains can be draped under elevated structures.

2. **Sequence of operations:**
• Combine noisy operations to occur in the same time period. The total noise level produced will not be significantly greater than the level produced if the operations were performed separately.

• Avoid nighttime activities. Sensitivity to noise increases during the nighttime hours in residential neighborhoods.

3. **Alternative construction methods:**

• Avoid use of an impact pile driver where possible in noise-sensitive areas. Drilled piles or the use of a sonic or vibratory pile driver are quieter alternatives where the geological conditions permit their use.

• Use specially-quieted equipment, such as quieted and enclosed air compressors and properly-working mufflers on all engines.

• Select quieter demolition methods, where possible. For example, sawing bridge decks into sections that can be loaded onto trucks results in lower cumulative noise levels than impact demolition by pavement breakers.

If possible, the environmental impact assessment should include descriptions of how each impacted location will be treated with one or more mitigation measures. However, with a large, complex project, the information available during the preliminary engineering phase may not allow final decisions to be made on all specific mitigation measures. In such cases, it is appropriate to describe and commit to a mitigation plan that will be developed during final design. The objective of the plan should be to minimize construction noise using all reasonable (i.e., cost vs. benefit) and feasible (i.e., physically achievable) means available. Components of the plan may include some or all of the following provisions which would be specified in construction contracts:

• **Equipment noise emission limits.** These are absolute noise limits applied to generic classes of equipment at a reference distance (typically 50 feet). The limits should be set no higher than what is reasonably achievable for well-maintained equipment with effective mufflers. Lower limits that require source noise control may be appropriate for certain equipment when needed to minimize community noise impact, if reasonable and feasible. Provisions could also be included to require equipment noise certification testing prior to use on site.

• **Lot-line construction noise limits.** These are noise limits that apply at the lot line of specific noise-sensitive properties. The limits are typically specified in terms of both noise exposure (usually Leq over a 20-30 minute period) and maximum noise level. They should be based on local noise ordinances, if applicable, as well as pre-construction baseline noise levels; limits that are 3-5 decibels above the baseline are often used.

• **Operational and/or equipment restrictions.** It may be necessary to prohibit or restrict certain construction equipment and activities near residential areas during nighttime.
hours. This is particularly true for activities that generate tonal, impulsive or repetitive sounds, such as back-up alarms, hoe ram demolition and pile driving.

- **Noise abatement requirements.** In some cases specifications may be provided for particular noise control treatments, based on the results of the design analysis and/or prior commitments made to the public by civic authorities. An example would be the requirement for a temporary noise barrier to shield a particular community area from noisy construction activities.

- **Noise monitoring plan requirements.** Plans can be developed for pre-project noise monitoring to establish baseline noise levels at sensitive locations, as well as for periodic equipment and lot-line noise monitoring during the construction period. The plan should outline the measurement and reporting methods that will be used to demonstrate compliance with the project noise limits.

- **Noise control plan requirements.** For major construction projects, specifications have required the preparation and submission of noise control plans on a periodic basis (e.g., every six months). These plans should predict the construction noise at noise-sensitive receptor locations based on the proposed construction equipment and methods. If the analysis predicts that the specified noise limits will be exceeded, the plan should specify the mitigation measures that will be applied and should demonstrate the expected noise reductions these measures will achieve. The objective of this proactive approach is to minimize the likelihood of community noise complaints by ensuring that any necessary mitigation measures are included in the construction plans.

- **Compliance enforcement program.** If construction noise is a significant issue in the community, it is important that a program be put in place to monitor contractor compliance with the noise control specifications and mitigation plan. It is best that this function be performed by a construction management team on behalf of the public agency.

- **Public information and complaint response procedures.** To maintain positive community relations, the public should be kept informed about the construction plans and efforts to minimize noise, and procedures should be established for prompt response and corrective action with regard to noise complaints during construction.

Most of these provisions are appropriate for very large projects where construction activity will continue for many months, if not years. References 4 and 5 contain details on dealing with construction noise on major transportation projects.\(^{(5,6)}\)

2. Based upon the risk assessment of vibration impacts emanating beyond the limits of the construction zone, the FIRM needs to take appropriate steps to mitigate these potential impacts. The following information is an excerpt from \textit{Federal Transit Administration Office of Planning and Environment Transit Noise and Vibration Impact Assessment May 2006} publication should be reviewed by the FIRM to mitigate vibration influences and other action plans as recommended. The FIRM is to collaborate with HRSD to identify and determine the level of preconstruction surveys of properties, buildings, and structures
with the potential to be impacted by construction vibrations.

12.2.3 Construction Vibration Mitigation

After using the above methods to locate potential human impacts or building damage from construction vibrations, the next step is to identify control measures. Similar to the approach for construction noise, mitigation of construction vibration requires consideration of equipment location and processes, as follows:

1. **Design considerations and project layout:**
   - Route heavily-loaded trucks away from residential streets, if possible. Select streets with fewest homes if no alternatives are available.
   - Operate earth-moving equipment on the construction lot as far away from vibration-sensitive sites as possible.

2. **Sequence of operations:**
   - Phase demolition, earth-moving and ground-impacting operations so as not to occur in the same time period. Unlike noise, the total vibration level produced could be significantly less when each vibration source operates separately.
   - Avoid nighttime activities. People are more aware of vibration in their homes during the nighttime hours.

3. **Alternative construction methods:**
   - Avoid impact pile driving where possible in vibration-sensitive areas. Drilled piles or the use of a sonic or vibratory pile driver causes lower vibration levels where the geological conditions permit their use (however, see cautionary note below).
   - Select demolition methods not involving impact, where possible. For example, sawing bridge decks into sections that can be loaded onto trucks results in lower vibration levels than impact demolition by pavement breakers, and milling generates lower vibration levels than excavation using clam shell or chisel drops.
   - Avoid vibratory rollers and packers near sensitive areas.

Pile-driving is one of the greatest sources of vibration associated with equipment used during construction of a project. The source levels in Table 12-2 indicate that sonic pile drivers may provide substantial reduction of vibration levels. However, there are some additional vibration effects of sonic pile drivers that may limit their use in sensitive locations. A sonic pile driver operates by continuously shaking the pile at a fixed frequency, literally vibrating it into the ground. Vibratory pile drivers operate on the same principle, but at a different frequency. However, continuous operation at a fixed frequency may be more noticeable to nearby residents, even at lower vibration levels. Furthermore, the steady-state excitation of the ground may induce a growth in the resonant response of building components. Resonant response may be unacceptable in cases of fragile buildings or
vibration-sensitive manufacturing processes. Impact pile drivers, on the other hand, produce a high vibration level for a short time (0.2 seconds) with sufficient time between impacts to allow any resonant response to decay.

As with construction noise, in many cases the information available during the preliminary engineering phase will not be sufficient to define specific construction vibration mitigation measures. In such cases, it is appropriate to describe and commit to a mitigation plan that will be developed and implemented during the final design and construction phases of the project. The objective of the plan should be to minimize construction vibration damage using all reasonable and feasible means available. The plan should provide a procedure for establishing threshold and limiting vibration values for potentially affected structures based on an assessment of each structure’s ability to withstand the loads and displacements due to construction vibrations. The plan should also include the development of a vibration monitoring plan during final design and the implementation of a compliance monitoring program during construction.

3. Based upon the risk assessment of dewatering impacts emanating beyond the limits of the construction zone, the FIRM needs to take appropriate steps to mitigate these potential impacts. The FIRM is to collaborate with HRSD to identify and determine the level of preconstruction surveys of properties, buildings, and structures with the potential to be impacted by construction dewatering.

4. Based upon the risk assessment of construction impacts to existing drainage, loss of trees / vegetation, damage to locality and/or private roads, the FIRM needs to take appropriate steps to mitigate these potential impacts and incorporate appropriate requirements for the Contractor within the Bid Documents. The FIRM is to collaborate with HRSD to identify and determine the level of preconstruction surveys within and outside of the construction zone.

5. Based upon the risk assessment of dust, odor and other fugitive emissions emanating beyond the limits of the construction zone, the FIRM needs to take appropriate steps to mitigate these potential impacts and incorporate appropriate requirements for the Contractor within the Bid Documents.

E. Stage 3 – Specific Pre-Construction Field Surveys and Construction Activity Monitoring Programs

1. General Discussion – The following paragraphs detail communication, documentation, responsible parties, and action plans for site specific pre-construction condition assessments for public and private property and facilities, and construction activity monitoring in areas where a level of damage or nuisance is possible. These efforts are intended to follow best practices for protecting all parties from damage and nuisance related claims and occurrences. HRSD has developed templates and examples of various forms and recording logs that are included in this publication of HRSD Design and
Construction Standards.

2. The FIRM shall perform the following services during the Pre-Construction Phase for all pipelines, pump stations, storage tanks, and similar projects. This effort is divided into two parts with the first part held in coordination with the Contractor and the second part conducted independently from the Contractor.

a. Part 1 - Conduct a pre-construction condition assessment, with the Contractor’s staff in attendance, after award of the construction contract and prior to any work beginning, to document the existing conditions of areas to be impacted by the work and adjacent areas which could be potentially impacted by the work. The purpose of this assessment is to provide a baseline condition on all properties documenting existing conditions prior to any construction services taking place. This effort should document the existing conditions of but not limited to: right of ways, utilities, storm drains and inlets, manholes, fire hydrants, telephone, power and light poles, medians, signage, pavement, curb and gutter, sidewalks, drainage, driveways and aprons, mailboxes, landscaping, adjacent structures, residences, commercial and industrial property and other areas to be used by the Contractor along the project alignment or in close proximity to the construction activities, within the zone of influence and any structure identified to be of significant importance (such as historical registry). Document the exterior and interior (if possible) of residences, commercial and industrial properties after obtaining the signed approval of the owner or owner’s authorized agent for the property. Documentation should include detailed and identifiable video of all areas and structures within the areas identified above. Digital images of both areas in which existing deficiencies are observed and areas in fair condition shall be documented. The documentation shall also provide detailed comments to describe the location / area documented (i.e. 1st floor, living room, right wall) and any observations (i.e. step crack 4mm width and 36-inch length). Review of past surveys will be coordinated with HRSD’s Real Estate Manager for format information upon request (a small sample is included in the attachment portion of this section. Review the limits of the proposed pre-construction survey with HRSD’s Project PM and Real Estate Manager prior to beginning these assessments. The FIRM shall coordinate the assessments with all parties ensuring they are completed 30 days prior to the Contractor entering the site. The FIRM shall provide a copy of this documentation to HRSD’s PM and Real Estate Manager within one week of completing the field assessments for review and approval. Once approved, the FIRM will forward a copy to the Contractor for their use.

b. Part 2 – Conduct a post rain event field reconnaissance as soon after the event as practically feasible. At a minimum, take photographs at each roadway intersection, all driveways, and a minimum of two pictures at the front of each property. Photograph all standing water areas within the construction limits. Digital photographs are to be labeled with the time and date taken. Photographs are also to be referenced to the construction plans to highlight the location and angle taken. Furnish digital images to the HRSD PM for review and approval. Capture video recordings along the construction limits including roadway intersections, all driveways and each property.
Recorded audio on the video tracks shall call out highlighted observances either by property number of construction stationing. Furnish a DVD to the HRSD PM for review and approval.

3. The following are specific procedures associated with pre-construction condition assessment of private property buildings and facilities if warranted based upon the risk assessment.
   a. The FIRM to incorporate into the Contract Documents the requirements and specifics of the pre-construction existing conditions assessment program for designated structures and locations.
   b. Maintain the HRSD Approved Pre-Construction Conditions Assessment Communications and Contact Tracking Log, using HRSD’s template to include each verified property owner and address contacted, method of contact, and number of contact attempts with dates to gain access permission. Three, certified return receipt attempts for each property are the minimum standard.
   c. Use HRSD’s Approved Assessment of Pre-Existing Conditions Request Letters to gain permission to enter the property for this assessment
      i. Letter to Business - Template
      ii. Letter to Private Property (residential) – Template
   d. Use HRSD’s Right to Access Property form, have this document signed by the property owner or verifiable authorized agent, and provide a copy to property owner for their records prior to entering private property.
   e. Provide video, still photographs and describe the particulars of each noted crack or defect. Included in the description should be the length and width of each crack.
      i. Photographs and videos should be taken with a high pixel camera with “Exchange Image File Format” (EXIF) the date stamp should be present on all files.
      ii. A ruler or other measurement device should be included in the photograph and video next to the observed crack or defect.
      iii. Log the conditions using the HRSD approved Pre-Existing Condition Assessment – Report On-Site Form and gaining a signature from the property owner after completion.
   f. Document via a sketch of each room of the building interior and/or exterior where a crack or defect is observed.
   g. FIRM shall prepare an overall summary report of each property visited and provide to HRSD’s Real Estate Manager for review. This process shall be completed and reviewed prior to the contractor entering the work site.
      *Note – all documentation sent out to the public shall be approved by HRSD Communications Department prior to distribution or use. Coordinate this effort with both the Public Information Specialist and the Real Estate Manager.

4. The following are specific procedures associated with a vibration monitoring program if warranted based upon risk assessment.
a. The FIRM to incorporate into the Contract Documents the technical requirements and specifics of a vibration monitoring program at designated locations.
b. Specify peak particle velocity (PPV) thresholds for the individual structures to be monitored.
c. Specify the calibration requirements for vibration monitors.
d. Specify experience and qualification requirements for technician and firm performing the vibration monitoring program.
e. Evaluate the use vibration monitors in tandem, placed a designated distance apart, for properties to be monitored.
f. Verify vibration monitors are properly installed at the correct locations.
g. Evaluate and specify amount of memory needed for each vibration monitor to capture data in the monitoring log for the date ranges required.
h. Specify locations throughout the project extents for a vibration monitoring program.
i. Based upon observations of cracks in buildings where pre-construction surveys were performed, evaluate and recommend a monitoring program for changes to these benchmark cracks during the construction period.
j. Produce a document intended for educational use with the public, detailing the zone of influence, distance attenuation of ground vibrations and how it was determined, the levels of vibration (maximum peak velocity) recorded during the project and examples of what those levels equate to for the general public. This document could be used throughout the life of the project when discussing claims and concerns with property owners.

5. The following example of “Special Provision Language for Vibration Control and Monitoring” was found through Internet search (no accompanying Ownership reference available) and included in this section to provide insight for establishing various responsibilities and accountabilities for a construction related vibration program. The FIRM is to collaborate with HRSD to establish a vibration control and monitoring program specific to the construction project need.

Sample Program

Special Provision Language for Vibration Control and Monitoring

Vibration producing activities (such as blasting, pile driving, vibratory compaction, pavement breaking or operation of heavy construction equipment) are common in construction projects. Four levels of vibration control can be provided on a project, depending on things such as structure susceptibility to damage, proximity to vibration producing activities, local concerns, or district policy. The "levels" can briefly be defined as follows:

Level 1 - No specific mention in contract of possible problems or controls. This is most common for minor or small quantities of pavement breaking or pile driving, when they are not in proximity to occupied structures or sensitive receptors.
Level 2 - Alert contractor to possible problems by brief description in the special provisions. Vibration levels and monitoring are at the discretion of the contractor, and the contractor is responsible for all damage caused by his activities.

Level 3 - Detail concerns and require the contractor to do a prescribed condition survey and to employ a qualified vibration specialist to establish a safe vibration level and monitor the vibrations. As an alternative, a vibration level may be set by the Owner. It may also be appropriate to use experienced based vibration criteria. The contractor is still responsible for any problems.

Level 4 - Owner takes lead role and has consultant(s) do a damage susceptibility study to establish vibration control limits, and a preconstruction condition survey for each structure. The Owner also takes responsibility for vibration monitoring during construction to insure compliance with vibration control limits. At this level, the Owner assumes some responsibility for damage to structures if the established vibration limits are not exceeded by the contractor. The degree of responsibility depends on the vibration specification - most vibration specifications are aimed at avoiding structural damage, leaving the contractor responsible for any cosmetic damage (e.g. plaster cracks, broken windows, etc.) and keeping residents/occupants informed and "happy".

Examples of Level 2 through Level 4 specifications are given below. Each of these was produced for a specific project and need to be personalized or fine-tuned for other projects. There may be levels between those shown, but care must be taken to keep the specifications consistent, for example, it would be inconsistent to expect the contractor to take total responsibility for vibrations and then put a vibration specification in the contract.

Level 2

S- CONSTRUCTION VIBRATIONS

Vibration producing activities (such as blasting, pile driving, vibratory compaction, pavement breaking or operation of heavy construction equipment) may be required for construction of this project. The Contractor is advised that structures are located close to the proposed work and that construction activities shall be conducted so as to preclude damage to these structures and undue annoyance to occupants. The Contractor shall be responsible for all damage caused by his activities.

Level 3

S- CONSTRUCTION CONTROLS AND MONITORING

Vibration producing activities (such as blasting, pile driving, vibratory compaction, pavement breaking or operation of heavy construction equipment) may be required for construction of this project. The Contractor is advised that structures are located close to the proposed work and that construction activities shall be conducted so as to preclude damage to same. The Contractor shall be responsible for any damage caused by his activities.

At least 30 days prior to start of such work, the Contractor shall provide a_________ plan
(blasting, pile driving, etc.) plan to the Engineer, which shall include, but not be limited to the following: proposed construction method(s), vibration monitoring plans (including the format for reporting the vibration readings), anticipated vibration levels at the closest building(s), condition survey format, and public relations activities. A copy of all reports shall be provided to the Engineer.

S-.1 Condition Survey

A preconstruction building Condition Survey shall be conducted by the Contractor on the___ building(s), prior to the commencement of any vibration producing activity. (In lieu of naming the buildings, a radius of ___ ft from the vibration producing activity can be used – this distance can be adjusted based on the type of activity and the sensitivity of the receptors.)

The survey will include documentation of interior sub-grade and above grade accessible walls, ceilings, floors, roof and visible exterior as viewed from the grade level. It will detail (by engineering sketches, video tape, photographs, and/or notes) any existing structural, cosmetic, plumbing or electrical damage. The survey will be conducted by a Professional Engineer, registered in the State of Virginia.

A report shall be issued that will summarize the pre-construction condition of the building(s) and will identify areas of concern, including potential personnel hazards (falling debris) and structural elements that may require support or repair.

Crack displacement monitoring gages will be installed as appropriate across any significant existing cracks to help verify any additional building distress if it should develop. The appropriate location, number, and type of gages will be established by the Contractor and/or the Project Engineer. The gages will be read prior to vibration producing activities, as well as during these activities. Data shall be obtained on a weekly basis for as long as vibration-producing activities are being conducted. A report shall be submitted which summarizes the data. The Engineer shall be alerted if any significant movement is detected by the monitoring gages.

S-.2 Vibration Controls

(Sound level limits should also be included for blasting projects)

The Contractor shall employ a qualified vibration specialist to establish a safe vibration level for the___ building(s). This specialist shall also supervise the Contractors vibration-monitoring program. During all vibration producing activities, the Contractor shall monitor vibration levels at ____ building(s), and shall not exceed the safe level established to preclude damage to this structure(s).

The vibration monitoring equipment shall be capable of continuously recording the peak particle velocity and providing a permanent record of the entire vibration event. Copies of all vibration records and associated construction activity (blasting, pile driving, pavement breaking, etc.) data shall be provided to the Engineer in a format approved by the Engineer.

S-.3 Public Relations

The Contractor shall maintain a complaint log and make this available to the Engineer on request. Occupants/owners of adjacent buildings shall be notified by the Contractor at least 2
weeks prior to commencement of any vibration producing activity that might affect the structure or inhabitants.

**Level 4**

**S- VIBRATION MONITORING AND CONTROL**

The following provisions do not relieve the Contractor of any responsibility for damage caused by his operations, nor do they relieve the Contractor from compliance with all applicable federal, state, county and city codes relative to the use and storage of explosives. In the event that a conflict occurs between this specification and other codes, it shall be resolved by the Engineer.

**S-.1 Susceptibility Study**

A detailed document titled ______________________, has been prepared for Owner by (Name of consulting firm), and a copy of this report is available for inspection at _________ (address & contact). This report includes an evaluation of buildings and structures in proximity to the project and an evaluation of their susceptibility to construction vibration damage. The vibration criteria for this project is based on this study.

**S-.2 Condition Survey**

A condition survey will be (or has been) performed for buildings in proximity to the project. This survey will document the existing exterior and interior conditions of these buildings.

The survey will include documentation of interior sub-grade and above grade accessible walls, ceilings, floors, roof, and visible exterior as viewed from the grade level. It will detail (by engineering sketches, video tape, photographs, and/or notes) the existing structural, cosmetic, plumbing and electrical damage, but will not necessarily be limited to areas in buildings showing existing damage.

Crack displacement monitoring gages will be installed as appropriate across any significant existing cracks to help verify any additional building distress, should it develop. The gages will be read prior to commencement of vibration producing activities, as well as during these activities. Results of this monitoring will be made available to the Contractor.

**S-.3 Ground Vibration Controls**

The following vibration control limits are applicable for all construction work, including but not limited to blasting, pile driving, compaction, ripping, and hauling activities.

The Contractor is advised that the ground vibration control limits defined herein may restrict his construction practices, and that he should consider these limitations in preparing his bid.

If the Contractor exceeds 80% of the ground vibration limit as given below, for any construction activity, he shall cease that activity and submit a report. The report shall give the construction parameter data and include a proposal for corrective action necessary to ensure that the specified limit is not exceeded for future activities. This report shall be submitted to the Engineer, and his permission must be obtained prior to the continuation, or beginning of any future vibration producing construction activities.
If the Contractor exceeds the ground vibration limit for any construction activity, the Engineer will direct that all activities related to those causing the vibration be stopped. The Contractor shall submit to the Engineer a report giving the construction parameter data and include the proposed corrective action for future construction events. In order to proceed with any further vibration producing activities, written permission must be obtained from the Engineer.

A. Definitions

The following definitions shall apply to the vibration controls:

Peak particle displacement - the peak particle displacement is the maximum movement induced by the vibration. The displacement amplitudes are in units of mils (0.001 inch) zero to peak amplitude.

Peak particle velocity - The peak particle velocity is the maximum rate of change with respect to time of the particle displacement. The velocity amplitudes are in units of inches per second (ips), zero to peak amplitude.

Frequency - The frequency of the vibration is the number of oscillations which occur in one second. The frequency units are given in Hertz (Hz) where one Hz equals one cycle per second.

B. Ground vibration control limit
(Sound level limits should also be included for blasting projects)

The ground vibration controls are applicable to external locations adjacent to affected buildings or structures. The maximum single component peak particle velocity resulting from construction activity shall not exceed ___.

S-.4 Instrumentation

The Contractor shall furnish, maintain and operate three vibration monitors (amplitude and frequency sensitive) during any vibration producing activities that could, in the judgment of the Engineer, produce measurable ground vibrations. In the event that the Contractor chooses to have concurrent vibration producing activities at more than one location on the construction site, he shall notify the Engineer in writing at least two weeks prior to the commencement of such activities. The Engineer may require additional vibration monitoring instruments at each location depending on site parameters.

No vibration producing activities may be started until the appropriate instrumentation is provided by the Contractor and approved by the Engineer.

All vibration instruments shall be powered with rechargeable batteries, and the Contractor shall supply extension geophone and microphone cables so that the instruments can be placed within structures if outside temperatures drop below 32 degrees Fahrenheit.

All vibration instruments shall be supplied with current calibration documents and shall be recalibrated on approximately a six-month use interval. At a minimum, instrument specific calibration curves of peak particle velocity input to peak particle velocity output shall be provided over the specified frequency ranges at both 0.5 and 1.0 ips for each instrument.
The Contractor shall be responsible for instrument maintenance. If the Contractor does not maintain a sufficient number of instruments to monitor the buildings/structures adjacent to the vibration producing activity, the Engineer may direct that all vibration activities cease until a sufficient number are working. Recording tape shall be supplied by the Contractor and at least a two-week supply maintained.

The Contractor shall designate an individual in his organization or under contract to him, who will be responsible for instrument coordination. The Contractor will be responsible for placing the instruments at measuring locations designated by the Engineer, and reading and recording the pertinent vibration event data. The Contractor will report the data to the Engineer at the completion of each vibration event.

The amplitude/frequency vibration monitor shall be an Instantel Blastemate II, or equivalent. This instrument shall be capable of measuring, recording and producing a hard copy of the frequency and peak particle velocity in three mutually perpendicular axes. ("Vector sum" instruments are not acceptable). This instrument shall be capable of measuring Linear Scale (dB-L) sound levels.

S- .5 Public Relations

The Contractor is required to have both letter and personal contact with residents and owners or operators of the buildings that are adjacent to the construction area or near enough to it for ground vibrations from construction operations to affect the personal property, displays or merchandise of these buildings. This contact will be made prior to the beginning of any vibration producing activity. The Contractor will furnish a list of those contacted to the Engineer.

As described elsewhere in these provisions, the ground vibration resulting from construction work will be monitored by the Contractor. The Contractor will measure the magnitude of each vibration event with at least two vibration instruments, generally located adjacent to the closest or most critical structures.

S- .6 Record Keeping

The Contractor shall maintain a log of all vibration-producing activities at which ground vibrations were measured. The log shall include the maximum peak particle velocity and its associated frequency, type and location of the vibration producing event, location of the geophones and closest distance from the vibration-producing event to the geophone(s). When vibration-producing activities are in progress, the Contractor shall submit daily reports to the Engineer which include all the vibration log data from that day. These reports shall be submitted at the end of each day, and no further vibration producing activity will be allowed until such reports are received by the Engineer.

The Contractor shall be responsible for removing all vibration records produced by the vibration instruments and attaching them to the corresponding Blast Log for submittal to the Engineer as part of the daily report.

The Contractor shall maintain a complaint log of all vibration related complaints, contacts and actions, and shall furnish copies to the Engineer on request.
Researched Publications

- *Federal Transit Administration Office of Planning and Environment Transit Noise and Vibration Impact Assessment May 2006*

- *New Hampshire DOT Research Record Ground Vibrations Emanating from Construction Equipment*

- *Construction Vibration and Historic Buildings*, prepared for Bureau of Environment Division of Transportation Infrastructure Development, prepared by CTC & Associates LLC, WisDOT RD&T Program (July 8, 2003)


Attachments

1. Sample – Vibration Generation and Impacts (diagram and impact table) / Noise and Vibration Impacts (combined map)
2. Sample – Noise Generation and Impacts (diagram and impact table)
3. Sample – Dewatering Impacts
4. Pre-Construction Conditions Assessment Communications and Contact Tracking Log
5. Assessment of Pre-Existing Conditions Request Letter
   a. To include Right to Access Property Form - Template
6. Pre-Existing Condition Assessment – Reporting Form - Template

End of Section
<table>
<thead>
<tr>
<th>Street #</th>
<th>Street Address</th>
<th>Parcel #</th>
<th>Owner Name</th>
<th>Phone #</th>
<th>1st (letter)</th>
<th>2nd (letter)</th>
<th>3rd (call)</th>
<th>4th, Final Attempt Ltr.</th>
<th>Access Signature Date</th>
<th>Authorized &amp; Signed By</th>
<th>Survey Date</th>
<th>Survey Time</th>
<th>Survey Extent</th>
<th>Copy to Owner</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1436</td>
<td>Air Rail Ave</td>
<td>1234567890</td>
<td>Russo, Karen XXX-XXX-XXXX</td>
<td>Mailed Certified Return Receipt Letter on 2/19/14</td>
<td>Mailed Certified Return Receipt Letter on 2/26/14</td>
<td>2/26/14 at 8:47 p.m. and scheduled an inspection time for Mar 3, 2014 at</td>
<td>3/7/2014</td>
<td>Real Estate Manager</td>
<td>3/7/2014</td>
<td>9:12 a.m.</td>
<td>Interior and Exterior Video &amp; Photos Authorized</td>
<td>Y</td>
<td>*Owner would not allow access to attic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2734</td>
<td>Gate House Rd</td>
<td>143567890</td>
<td>Annetta M Lane Housing Inc.</td>
<td>Spoke to site manager Sherill Christian on 2/19/14 at 2:10 p.m. who said she would forward letter to the property owner.</td>
<td>Spoke with site manager on 2/26/14 at 9:15 a.m. She stated the owner has received the letter but has not yet verified if she wants to proceed with the pre-construction survey.</td>
<td>3/10/2014</td>
<td>Sherill Christian</td>
<td>3/13/2014</td>
<td>10:30 a.m.</td>
<td>Interior and Exterior</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Apartments (speak with Property Management):
Right to Access Property

Insert ‘Public’ Project Name

I hereby acknowledge that I understand the purpose of the pre-existing condition assessment (pre-construction survey) for the property address listed below. I am the owner / owner’s agent and I am authorized to make the following decision:

☐ Allow access to the exterior and interior of the property.

☐ Allow access to the exterior of the property only.

☐ Allow access to the interior of the property only.

☐ Deny access to the property.

Video and Photographic Documentation

☐ Allow the inspector/ engineer to take photos and videos of the exterior and interior of the property.

☐ Allow the inspector/ engineer to take photos and videos of the exterior of the property only.

☐ Allow the inspector/ engineer to take photos and videos of the interior of the property only.

☐ Deny the inspector/ engineer to take photos and videos of the property.

Address ______________________________________________________________

Authorized Party Print Name _____________________________________________

Authorized Party Signature __________________________ Date ______________

Inspector’s Name ___________________________________ Date of Inspection _________

Preconstruction Assessment
Date

Subject: Pre-Existing Condition Assessments for the Public Project Name

Dear Property Owner/ Authorized Representative:

We are contacting you with regards to the HRSD Public Project Name here project that will be constructed near your property. Insert - name of Assessing Firm here, an independent, third-party consulting firm, has been engaged by HRSD’s select one- contractor/consultant, insert contractor/consultant’s name here to document conditions of buildings and improvements adjacent to the project before construction begins. These condition assessments, which are being offered for specific buildings along the construction corridor, will be performed at no cost to you.

While the construction operations are not expected to have any impact on your building, a Pre-Existing Condition Assessment is a precautionary measure to protect all parties involved. The full assessment will include video / photographs of the interior and exterior of your building along with written documentation of the various building materials and any deficiencies that are visible during the survey. This documentation of conditions before the start of construction will form a basis of discussion and resolution for any concerns that may arise during this project.

It is normal for occupants to notice some vibrations during construction, and these should not be a cause for alarm. To ensure buildings are protected from vibration impacts, seismic monitoring equipment may be placed at structures near and throughout the work site and will be used to measure ground vibration during this project.

We request your permission to perform the assessment, and ask that you call the insert- Assessing Firm’s name here scheduling department at insert - local or toll free number 1-XXX-XXX-XXXX to schedule an appointment or if you have questions about this service. We suggest that you plan to accompany our representative to ensure you receive the best possible assessment in the time available, and encourage you to bring specific items of concern to the assessor’s attention.

As these assessments need to be completed prior to construction beginning, we ask that you respond to this letter by scheduling, as soon as possible. We look forward to hearing from you.

Respectfully Submitted,

HRSD | Real Estate Manager

*Use Updated Letterhead*
## Pre-Existing Condition Assessment Report

This checklist is for informational purposes only.

<table>
<thead>
<tr>
<th>PROJECT NAME:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Property Address:</td>
<td></td>
</tr>
<tr>
<td>Property Owners Name</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Owner Occupied:</th>
<th>Yes</th>
<th>No</th>
<th>Age of Dwelling:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspector Name:</td>
<td></td>
<td></td>
<td>Dwelling Location on Block:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>House size (sq. feet)</th>
<th>No. of bedrooms</th>
<th>No. of bathrooms</th>
<th></th>
</tr>
</thead>
</table>

House style and color

<table>
<thead>
<tr>
<th>House faces</th>
<th>north</th>
<th>south</th>
<th>east</th>
<th>west</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Daytime street traffic</th>
<th>Yes</th>
<th>No</th>
<th>Nighttime street traffic</th>
<th>Yes</th>
<th>No</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Air traffic</td>
<td>Yes</td>
<td>No</td>
<td>Train traffic</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Sidewalks</td>
<td>Yes</td>
<td>No</td>
<td>Condition of Sidewalk:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Construction:</th>
<th>Frame</th>
<th>Masonry Veneer</th>
<th>Masonry</th>
<th>Other:</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Overall condition of Home</th>
<th>Excellent</th>
<th>Good</th>
<th>Poor</th>
<th>Other:</th>
<th></th>
</tr>
</thead>
</table>
Pre Existing Condition Assessment Checklist

<table>
<thead>
<tr>
<th>Any unrepaid Damages:</th>
<th>Yes</th>
<th>No</th>
<th>Describe:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driveway</td>
<td>☑</td>
<td>☐</td>
<td>Condition of Driveway</td>
</tr>
</tbody>
</table>

Exterior Inspection (Note all existing)

<table>
<thead>
<tr>
<th>Condition of Exterior Walls:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition of Roof:</td>
</tr>
<tr>
<td>Condition of Exterior Surfaces:</td>
</tr>
<tr>
<td>Condition of Chimney(s):</td>
</tr>
<tr>
<td>Condition of Landscaping:</td>
</tr>
<tr>
<td>Irrigation System:</td>
</tr>
<tr>
<td>Special Architectural features:</td>
</tr>
<tr>
<td>Condition of neighboring houses</td>
</tr>
<tr>
<td>Other Comments:</td>
</tr>
</tbody>
</table>

**Visible Condition of the Property:** Using the key below, apply the letter that best describes the condition of each item.

<table>
<thead>
<tr>
<th>Key</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>M  - Missing</td>
<td></td>
</tr>
<tr>
<td>G  - Good condition</td>
<td></td>
</tr>
<tr>
<td>S  - Scratched</td>
<td></td>
</tr>
<tr>
<td>D  - Damaged</td>
<td></td>
</tr>
<tr>
<td>B  - Broken</td>
<td></td>
</tr>
<tr>
<td>R  - Repair/Replacements needed</td>
<td></td>
</tr>
</tbody>
</table>
### Visible Condition of the Property: Using the key below, apply the letter that best describes the condition of each item.

<table>
<thead>
<tr>
<th>Key</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Missing</td>
</tr>
<tr>
<td>G</td>
<td>Good condition</td>
</tr>
<tr>
<td>S</td>
<td>Scratched</td>
</tr>
<tr>
<td>D</td>
<td>Damaged</td>
</tr>
<tr>
<td>B</td>
<td>Broken</td>
</tr>
<tr>
<td>R</td>
<td>Repair/Replacements needed</td>
</tr>
</tbody>
</table>

**Key**
- **M** - Missing
- **G** - Good condition
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- **D** - Damaged
- **B** - Broken
- **R** - Repair/Replacements needed
Pre Existing Condition Assessment Checklist

**Kitchen**

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td></td>
</tr>
<tr>
<td>Floor</td>
<td></td>
</tr>
<tr>
<td>Walls</td>
<td></td>
</tr>
<tr>
<td>Ceiling</td>
<td></td>
</tr>
<tr>
<td>Lights and switches</td>
<td></td>
</tr>
<tr>
<td>Outlets</td>
<td></td>
</tr>
<tr>
<td>Stove</td>
<td></td>
</tr>
<tr>
<td>Refrigerator</td>
<td></td>
</tr>
<tr>
<td>Sink</td>
<td></td>
</tr>
<tr>
<td>Cabinets and counter</td>
<td></td>
</tr>
<tr>
<td>Baseboards</td>
<td></td>
</tr>
<tr>
<td>Trim</td>
<td></td>
</tr>
</tbody>
</table>

**Living Room**

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td></td>
</tr>
<tr>
<td>Carpet or floor</td>
<td></td>
</tr>
<tr>
<td>Walls</td>
<td></td>
</tr>
<tr>
<td>Ceiling</td>
<td></td>
</tr>
<tr>
<td>Outlet, including cable outlet</td>
<td></td>
</tr>
<tr>
<td>Lights and switches</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hallway and Stairwell</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEATURE</td>
</tr>
<tr>
<td>Floor</td>
</tr>
<tr>
<td>Walls</td>
</tr>
<tr>
<td>Ceiling</td>
</tr>
<tr>
<td>Lights and switches</td>
</tr>
<tr>
<td>Outlets</td>
</tr>
<tr>
<td>Baseboards</td>
</tr>
<tr>
<td>Trim</td>
</tr>
<tr>
<td>Stair treads</td>
</tr>
<tr>
<td>Stair structure</td>
</tr>
<tr>
<td>Landing and handrail</td>
</tr>
</tbody>
</table>

Visible Condition of the Property: Using the key below, apply the letter that best describes the condition of each item.

**Key**

- M - Missing
- G - Good condition
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- R - Repair/Replacements needed

**Comments**

---

Page | 4
Pre Existing Condition Assessment Checklist

## Bedrooms

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>BEDROOM 1</th>
<th>BEDROOM 2</th>
<th>BEDROOM 3</th>
<th>BEDROOM 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carpet or floor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walls</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceiling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lights and switches</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outlets</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseboards</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trim</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Visible Condition of the Property:** Using the key below, apply the letter that best describes the condition of each item.

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- R - Repair/Replacements needed

**Comments**

---

Page | 5
**Bathrooms**

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>BATHROOM 1</th>
<th>BATHROOM 2</th>
<th>BATHROOM 3</th>
<th>BATHROOM 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Window</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walls</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceiling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sink</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tub/shower</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toilet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cabinet, shelves, closet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Towel bars</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lights and switches</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outlets</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseboards</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trim</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Key**
- **M** – Missing
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- **D** – Damaged
- **B** – Broken
- **R** – Repair/Replacements needed

**Comments**

---

Page | 6
**Visible Condition of the Property:** Using the key below, apply the letter that best describes the condition of each item.

**Key**

<table>
<thead>
<tr>
<th>M – Missing</th>
<th>G – Good condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>S – Scratched</td>
<td></td>
</tr>
<tr>
<td>D – Damaged</td>
<td></td>
</tr>
<tr>
<td>B – Broken</td>
<td></td>
</tr>
<tr>
<td>R – Repair/Replacements needed</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Fireplace</strong></th>
<th><strong>Basement</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FEATURE</strong></td>
<td><strong>CONDITION</strong></td>
</tr>
<tr>
<td>Damper</td>
<td></td>
</tr>
<tr>
<td>Firebox</td>
<td></td>
</tr>
<tr>
<td>Chimney</td>
<td></td>
</tr>
<tr>
<td>Spark arrestor</td>
<td></td>
</tr>
<tr>
<td>Rain cap</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Basement</strong></th>
<th><strong>Plumbing</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FEATURE</strong></td>
<td><strong>CONDITION</strong></td>
</tr>
<tr>
<td>Door</td>
<td></td>
</tr>
<tr>
<td>Windows</td>
<td></td>
</tr>
<tr>
<td>Floor</td>
<td></td>
</tr>
<tr>
<td>Walls</td>
<td></td>
</tr>
<tr>
<td>Ceiling</td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td></td>
</tr>
<tr>
<td>Foundation</td>
<td></td>
</tr>
<tr>
<td>Lights and switches</td>
<td></td>
</tr>
<tr>
<td>Outlets</td>
<td></td>
</tr>
<tr>
<td>Baseboards</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Plumbing</strong></th>
<th><strong>FEATURE</strong></th>
<th><strong>CONDITION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drainage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dryer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
Visible Condition of the Property: Using the key below, apply the letter that best describes the condition of each item.

<table>
<thead>
<tr>
<th>Key</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>M - Missing</td>
<td></td>
</tr>
<tr>
<td>G - Good condition</td>
<td></td>
</tr>
<tr>
<td>S - Scratched</td>
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<td>D - Damaged</td>
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<td>B - Broken</td>
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<td>R - Repair/Replacements needed</td>
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</tbody>
</table>
**Visible Condition of the Property:** Using the key below, apply the letter that best describes the condition of each item.

<table>
<thead>
<tr>
<th>Key</th>
<th>Comments</th>
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<tbody>
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<td>M – Missing</td>
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<tr>
<td>G – Good condition</td>
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<td>S – Scratched</td>
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<td>R – Repair/Replacements needed</td>
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</table>
Section 13 - Coordination with Virginia Department of Environmental Quality (DEQ) for Certificate to Construct and Certificate to Operate

A. **Introduction** - As a result of significant staffing reduction within DEQ in 2008, requirements by DEQ were implemented in an attempt to streamline their approval process for applications of Certificates to Construct (CTC) and Certificates to Operate (CTO). DEQ also identified a variance procedure for those projects that are non-capacity related or maintenance related work. Projects that have been identified by DEQ as requiring a CTC and CTO include new sewage treatment works, new sewage pump stations and force mains in excess of 2,000 gallons per day (gpd), new sanitary gravity sewers in excess of 40,000 gpd, any project that increases or decreases capacity and major modifications to sewage treatment works. In addition, water reuse related projects that require CTC and CTO under the Water Reclamation and Reuse Regulations (9 VAC 25-740.120.B.1.) include new industrial or municipal reclamation systems, new municipal satellite reclamation systems and reuse water storage. This Section describes when to use each of the four listed approaches to obtain either a CTC and/or state sales tax exemption status for qualifying projects.

1. FIRMs shall have HRSD (HRSD’s Chief of Technical Services and/or HRSD Permits Manager) review and approval prior to submitting CTC and CTO to VDEQ.

B. **Approval CTC Process for State Water Quality Improvement Fund (WQIF) Projects** - This involves DEQ’s full engineering review process. Approval steps and specifics follow:

   
   a. Specifics for PER as listed below.
      i. Suggested outline in 9 VAC 25-940.
      ii. Must address any additional items required by WQIF.
      iii. One hard copy initially to Office of Wastewater Engineering (OWE), WQIF, Virginia Revolving Loan Fund (VRLF) if needed plus one Portable Document Format (PDF) copy of final to OWE.
      iv. Review time 30-60 days per submittal
   
   b. Specifics for FER as listed below:
      i. Details in GM 07-2011
      ii. All calculations, site plan, hydraulic profile, etc.
      iii. Geared toward design build project
      iv. One hard copy to WQIF, OWE, VRLF (if needed) initially
      v. One PDF and one hardcopy of final plans and specifications to OWE
      vi. Review time 30-60 days per submittal
      vii. Conditional CTC issued on FER
      viii. Plans and specifications due 180 days prior to the desired issuance of a CTO
      ix. Deficiencies found in plans and specifications must be corrected regardless of status

2. Other submissions to include:
a. Plans and Specifications  
b. Design calculations with explanatory text as needed  
c. Certification statement for non-WQIF funded components  
d. One hard copy to OWE, WQIF, VRLF (if needed) initially (half size preferred)  
e. One PDF and one hardcopy of final plans and specifications to OWE  
f. Review time 30-60 days per submittal

3. Submission of a Statement of Completion for CTO.

   a. FIRM should contact DEQ 30-60 days prior to issuing Statement of Completion to coordinate inspection.  
   b. The inspection will be scheduled as close to the Statement of Completion issuance date as possible  
   c. Upon confirmation of the project’s compliance with the CTC and after Statement of Completion is received, a CTO is issued by DEQ.

4. DEQ recommendations for full approval process:

   a. Use proven technology or have design basis well established  
   b. Provide complete submittal packages  
   c. Provide complete contact information  
   d. Bring up potentially controversial issues early  
   e. Provide background and goal of project  
   f. Provide separate calculations  
   g. QA/QC all work

C. Abbreviated Administrative Process for Non-WQIF Projects - Projects that fall into this category include; Municipal Sewage Treatment Works, Sewage Collection Systems, Reclamation Systems and Satellite Reclamation Systems.

1. Approval process involves:

   a. Submission of an Application  
   b. Attachments (if applicable)  
     i. Project Description  
     ii. Pump Stations – Reliability Class Worksheet  
     iii. Downstream owner acceptance  
     iv. Justification for variances from SCAT Regulations  
   c. Apply after Plans and Specifications Complete  
   d. Apply after VPDES permit obtained  
   e. For Sewage Treatment Plants (STPs), design flow must match permitted flow  
   f. FIRM must provide signature and seal on certification statement  
   g. FIRM assumes responsibility for compliance with design regulations

2. CTO for Projects NOT receiving WQIF funds:

   a. Submission of an Application  
   b. Application contains a Statement of Completion  
   c. FIRM signs Statement of Completion to certify construction complete in substantial compliance with CTC  
   d. Provide original to DEQ Regional Office
e. Processed by Water Permit Staff
f. Application is signed by DEQ and becomes the CTC or the CTO
g. Turnaround time about 2 weeks
h. If needed, the CTO will trigger issuance of a new DMR

D. Approval Process for Non-WQIF Project That Involve Greater Than a 25% Capacity Increase or Decrease - Projects that fall under this process include new, replacement, or relocated sanitary sewer mains and force mains that are to be larger or smaller in diameter than the original pipelines; and new or rehabilitated sanitary sewage pumping stations with capacity increase/decrease. This process follows the steps of the Abbreviated Administrative Process for Non-WQIF projects as detailed above with the addition of the following requirements:

1. Demonstrate that the Project meets/exceeds the HRSD Regional Sewage Flow Projection Table or was designed to another standard to be described in the CTC request letter.
2. HRSD has adequate downstream capacity to convey and treat the flows.
3. HRSD has consulted with the affected Locality and there are no detrimental impacts.
4. In order to satisfy these additional requirements, a letter shall be submitted to DEQ that contains the elements in the template letter. The Director of Engineering for HRSD will sign the letter that is to be submitted to DEQ.
   a. Pressure reducing pumping stations (PRS) in Exhibit A;
   b. Pumping station replacement in Exhibit B;
   c. New or replacement pipeline in Exhibit C.

E. Relocation, Replacement-In-Kind, Maintenance or Emergency Projects - The FIRM as an agent for HRSD will request a review exemption from DEQ.
   1. A template letter is included as Exhibit D.

F. On-line Resources within DEQ for Approval Process - The following web address (http://www.deq.virginia.gov/Programs/Water/Forms.aspx) contains the application forms for the Administrative Approval as well as the ability to track the status of a project submitted for CTC or CTO.
Exhibit A

Date:

Mr. Robert Smithson, Jr.
Virginia Department of Environmental Quality
Tidewater Regional Office
5636 Southern Boulevard
Virginia Beach, VA 23462

Re: HRSD Example PRS Replacement Project
Notiﬁcation of Approval and Capacity Veriﬁcation in accordance
with SCAT Regulation 9 VAC 25-790-90. CTC Application

Dear Mr. Smithson,

This letter is in reference to the project listed above and accompanies an application for a Certificate to Construct (CTC). Our request is supported by the following information:

The purpose of this project is to upgrade a pressure reducing station by adding an additional pump. The existing PRS is designed for 4,500 gpm at 70 feet. This project will not be adding new ﬂows to the system; however it will allow additional ﬂow to be conveyed.

The attached Hydraulic Analysis Review Team (HART) report provides ﬂow and pressure conditions used to develop design conditions for this project. This analysis has been performed using available information and tools including the calibrated capacity assessment version of the dynamic regional hydraulic model. It is intended to provide a reasonable design basis for sizing replacement interceptor system infrastructure that, for various reasons, needs to be implemented prior to the approval of the Regional Wet Weather Management Plan (RWWMP).

The HRSD infrastructure downstream from this project has been reviewed and has been veriﬁed to have adequate capacity to convey and treat the current ﬂows associated with this project. The PER dated _____ documents the criteria and analysis used in the veriﬁcation of capacity. Furthermore, the facilities associated with this project will be included in the analyses conducted for the Regional Wet Weather Management Plan.

HRSD, in consultation with the City / County of _______, has reviewed the project scope, the design basis and the sewer system impacts of this proposed project. In addition, HRSD has received all necessary approvals and associated permits.

Sincerely,

Bruce W. Husselbee, P.E.
Director of Engineering

CC: Chief of Planning and Analysis
    Chief of South / North Shore Interceptors
Exhibit B

Date:

Mr. Robert Smithson, Jr.
Virginia Department of Environmental Quality
Tidewater Regional Office
5636 Southern Boulevard
Virginia Beach, VA 23462

Re: HRSD Example PS Replacement Project
   Notification of Approval and Capacity Verification in accordance with
   SCAT Regulation 9 VAC 25-790-90. CTC Application

Dear Mr. Smithson,

This letter is in reference to the project listed above and accompanies an application for a Certificate to Construct (CTC). Our request is supported by the following information:

The purpose of this project is to replace an aging pump station which has become an operational challenge to maintain and the need to address the structural integrity of the existing wet well. The existing station has a firm capacity of _____ gpm at _____ feet. This project will not be adding new flows to the system; however it will allow additional flow to be conveyed. HRSD proposes the new _____ PS to be designed for an interim peak flow of _____ gpm at _____ feet.

The HRSD infrastructure downstream from this project has been reviewed and has been verified to have adequate capacity to convey and treat the current flows associated with this project. The PER dated _____ documents the criteria and analysis used in the verification of capacity. Furthermore, the facilities associated with this project will be included in the analyses conducted for the Regional Wet Weather Management Plan.

HRSD, in consultation with the City / County of _______, has reviewed the project scope, the design basis and the sewer system impacts of this proposed project. In addition, HRSD has received all necessary approvals and associated permits.

Sincerely,

Bruce W. Husselbee, P.E.
Director of Engineering

CC: Chief of Planning and Analysis
    Chief of South / North Shore Interceptors
Exhibit C

Date:

Mr. Robert Smithson, Jr.
Virginia Department of Environmental Quality
Tidewater Regional Office
5636 Southern Boulevard
Virginia Beach, VA 23462

Re: HRSD Example IFM Replacement Project
   CIP #Ex-001
   Notification of Approval and Capacity Verification in accordance with
   SCAT Regulation 9 VAC 25-790-90. CTC Application

Dear Mr. Smithson,

This letter is in reference to the project listed above and accompanies an application for a Certificate to Construct (CTC). Our request is supported by the following information:

The purpose of this project is to relocate the existing ___ inch Interceptor Force Main (IFM) under the river due to conflicts with the proposed bridge construction with a ____ inch IFM. This project will not be adding any new flows to the interceptor system and is increasing the pipe size to match the existing pipe diameter at the downstream connection point of the project. The project design flow rate is _____ gpm with a design pressure of _____ feet.

The HRSD infrastructure downstream from this project has been reviewed and has been verified to have adequate capacity to convey and treat the design flows from this project. The Preliminary Engineering Report dated ______ documents the criteria and analysis used in the verification of capacity. Furthermore, the facilities from this project will be included in the analyses conducted for the Regional Wet Weather Management Plan.

HRSD, in consultation with the City / County of ______, has reviewed the project scope, the design basis and the sewer system impacts of this proposed project. In addition, HRSD has received all necessary approvals and associated permits.

Sincerely,

Bruce W. Husselbee, P.E.
Director of Engineering

CC: Chief of Planning and Analysis
     Chief of South / North Shore Interceptors
Date:

Mr. Robert Smithson, Jr.
Virginia Department of Environmental Quality
Tidewater Regional Office
5636 Southern Boulevard
Virginia Beach, VA 23462

RE: (HRSD Project Name & Facility Number)

Dear Mr. Smithson,

HRSD is in the process of finalizing the design of (Project Description, Location and Purpose).

As the design engineer, we are acting on HRSD’s behalf to coordinate the approval by permitting agencies. We do not believe that a review by the Virginia Department of Environmental Quality (VDEQ) for this project is necessary because it is a maintenance project whereby there is no change in pipe diameter or capacity. If you concur, please sign below and return a signed copy of this letter.

Should you have any questions or comments, please contact me at (Consultant’s contact information).

Sincerely,

(Consultant’s name & title)

VDEQ waives the requirements for a CTC/CTO based on the information presented in the letter dated (date) for the (name of project) project in (city).

If any portion of the scope of the project changes, HRSD and/or the contractor shall contact the VDEQ Regional Office to determine if the CTC/CTO waiver is still valid.

_____________________________  ________________________
Virginia Department of Environmental Quality           Date

End of Section
Section 14 - Coordination of Preconstruction Phase Items

A. Introduction - In recent years, several recurring items have arisen related to requirements for submittals and procedures during the preconstruction (bid advertisement / pre-award) phase of projects managed by the Design and Construction Divisions. HRSD uses electronic business processes and systems as well as online construction bid advertisement and bid receipt. This Section does not addresses specific means of interfacing with the Oracle Unifier Enterprise Project Management System and Oracle Enterprise Resource Planning (ERP) Systems, rather general requirements.

B. Coordination with Engineering Contract Specialist - The following are to be provided to the Contract Specialist prior to construction bid advertisement: 
   Items 1-3 below to be provided a minimum of 10 business days prior to the bid advertisement date as agreed to with the Contract Specialist. Item 4 below to be provided a minimum of 5 business days prior to the bid advertisement date as agreed to with the Contract Specialist. Item 5 below to be provided no later than 2 business days prior the scheduled Bid opening to the Contract Specialist.

1. Updated Opinion of Probable Construction Cost (OPCC) as prepared by the FIRM.
2. Justification for established liquidated damages.
3. Redline markups of the EJCDC front end sections to the Bid Documents.
   a. The FIRM to print the front end documents from HRSD Design and Construction Standards on HRSD’s homepage.
   b. The Contract Specialist will make appropriate revisions to the referenced sections.
4. PDF version of Bid Documents (all volumes).
5. Copies of all addenda to be provided to the Contract Specialist as soon as available by the FIRM for distribution to Plan Holders via HRSD Oracle ERP.

End of Section
Section 15 - Preparation of and Format for Construction Addenda

A. **Introduction** - The Design and Construction Divisions contract with a wide variety and significant number of Professional Services firms (FIRM) for design and construction oversight responsibilities for both capital and non-capital projects. FIRMs are responsible to prepare addenda if necessary. The definition for “Addenda” in the General Condition Section 00700 of the EJCDC documents is: “Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents”. Due to the number of firms and their individual preferences and experiences for preparing construction addenda packages, a standard approach and template is desired. A standard format will lead to consistency on information within an addendum and enhance the FIRM’s ability to prepare consistent Conformed Documents as detailed in Section 16 in the manual. This Section establishes a protocol for addenda preparation for those projects managed by and thru the Engineering Department.

B. **Guidelines and Specific Requirements**

1. Per Article 7 “Interpretations and Addenda” in the Instructions To Bidders Section 00200 of the EJCDC documents, the following apply:
   a. All questions about the meaning or intent of the Bidding Documents are to be submitted to the Contract Specialist via HRSD’s Enterprise Resources Planning (ERP) System.
   b. Interpretations or clarifications considered necessary by FIRM in response to such questions will be issued by Addenda coordinated with the Contract Specialist and delivered via HRSD’s ERP to all registered Plan Holders.
   c. Questions received less than ten days prior to the date for the opening of Bids may not be answered.
   d. Only questions answered by Addenda will be binding.
   e. Oral and other interpretations or clarifications will be without legal effect.
   f. Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner or FIRM.

2. The Pre-Bid meetings are typically not mandatory so what is discussed in these meetings could provide an unfair bidding advantage for someone in attendance. Meeting summaries from the Pre-Bid meeting are to be issued as an Addendum if items were addressed in the meeting that could be interpreted as clarifying, correcting, or changing the bidding requirements or the proposed contract documents. If in the opinion of the FIRM and Project Manager no items were discussed in the Pre-Bid meeting that could possibly influence the bidding requirements or the proposed contract documents in any way, then the meeting summary should not be issued as an Addendum.

3. An Addendum should not be prepared for communication with potential bidders or manufacturer’s representatives, unless an issue related to potential change to contract price or time is mentioned. The attached Addenda template shall be used if an addendum is deemed necessary by the HRSD Project Manager and/or FIRM.

4. No Addenda are to be issued within two business days prior to the Bid Opening. All addenda are issued within HRSD ERP system.
5. Descriptive terms in the Addendum shall be limited to the following:
   - ADD
   - CLARIFY
   - DELETE
   - INSERT
   - REPLACE
   - REVISE

6. Copies of all Addenda developed by the FIRM are to be transmitted to the Contract Specialist for distribution to Plan Holders via HRSD’s ERP.

7. Confirmation by the Contract Specialist will be made via HRSD’s ERP that all Addenda have been received and acknowledged by the Plan Holders.

8. All Addenda are to be acknowledged by the Bidder(s) submitting a Bid.

9. All items included in issued Addenda are to be incorporated into the Conformed Documents detailed in Section 16 in this manual.

C. Exhibit A – Addendum Template
Exhibit A

Date:

AMENDMENT/ADDENDUM NO. ____
TO THE BIDDING DOCUMENTS
for the construction of
PROJECT NAME
CIP No.
[City], Virginia

To All Bidders:

The following changes, additions and/or deletions are hereby made part of the Bidding Documents for the construction of the PROJECT NAME, [City], Virginia, for the HRSD dated [Advertisement Date], as fully and completely as if the same were fully set forth therein.

A.

BIDDERS MUST ACKNOWLEDGE RECEIPT OF THIS AMENDMENT/ADDENDUM IN THE ONLINE SOLICITATION IN ORDER TO SUBMIT BID. FAILURE TO ACKNOWLEDGE AMENDMENT/ADDENDUM WILL NOT ALLOW PROPOSER TO SUBMIT BID.

End of Section
Section 16 - Preparation of and format for Conformed Documents

A. Introduction - The Design and Construction Divisions contract with a wide variety and significant number of Professional Services firms (FIRM) for design and construction oversight responsibilities for both capital and non-capital projects. As a part of the Bid Phase services, the FIRMs are responsible to prepare addenda as necessary, assist HRSD with determining if the apparent low bidder is both responsive and responsible, and making a recommendation for award of a construction project. Following the recommendation for award of a construction contract and prior to the pre-construction meeting with the successful Contractor, the FIRM is to prepare “Conformed Documents”. The Conformed Document includes revisions to the Bid Documents that are referenced in the Addenda, Agreement and Questionnaire from the Contractor, and any other changes from the original Bid Documents. These Conformed Documents (Drawings and Specifications) are intended to assist HRSD, the FIRM, Inspectors, the Contractor, the subcontractors, and product vendors easily identify any of the changes made on the plan sheets or specification pages that were modified via Addenda. This memorandum establishes a protocol for Conformed Document preparation for those projects managed by and thru the Engineering Department. No changes other than those described within this memorandum shall be made with the Conformed Documents.

B. Specifications - The Conformed Specifications shall include the following:

1. Specification Cover – the phrase “CONFORMED DOCUMENT” and the DATE shall be added adjacent to the Engineering’s or Architect’s Seal.

2. Revised TABLE OF CONTENTS with the heading “ADDENDA” and a listing of all addenda generated for the project. The new ADDENDA heading shall be added immediately prior to the BIDDING REQUIREMENTS heading on Page TOC-i.

3. An ADDENDA title page and all generated Addenda shall be included following the TABLE OF CONTENTS.

4. The electronic version of the “Front End” documents, as modified by and furnished by HRSD’s Contract Specialist shall be included.

5. The Contractor completed QUESTIONNAIRE, minus financial information, shall be included to replace the original Questionnaire provided with the Front End documents.

6. The Contractor completed VIRGINIA BID BOND (these are not required for Emergency Declaration Projects) shall be included to replace the original Virginia Bid Bond provided with the Front End documents.

7. The Contractor and HRSD completed AGREEMENT shall be included to replace the original Agreement (Section 00520) provided with the Front End documents.

8. The Contractor completed VIRGINIA PERFORMANCE BOND shall be included to replace the original Virginia Performance Bond provided with the Front End documents.
9. The Contractor completed VIRGINIA PAYMENT BOND shall be included to replace the original Virginia Payment Bond provided with the Front End documents.

10. Annotations in the Technical Specifications sections and paragraphs referenced in the Addenda. The annotations shall be in a “Track Changes” mode with new or replaced text being bold underlined and a line thru any changed or deleted text. The Addendum responsible for the revision shall be noted in {} at the end of the sentence where the Track Change is made. An example would be {Addenda No. 1}.

C. Drawings - The Conformed Drawings shall include the following:

1. Drawing Cover Sheet – the phrase “CONFORMED DOCUMENT” and the DATE shall be added adjacent to the Engineer’s or Architect’s Seal.

2. Annotations on the Drawings as referenced in the Addenda shall be made to the original DWG sheets and regenerated. Changes as a result of Addenda shall be either “clouded” along with the Addendum reference or leader lines pointing to the revision along with the Addendum reference in {}. An example would be {Addenda No. 1}.

3. Update the title block on all modified Drawing sheets to reflect “Conformed Drawings”.

4. If additional drawing sheets are needed due to additional notes or details, the Drawing sheet number shall be the number of the preceding sheet (at the proper insertion point) with the addition of a “.1”. An example would be if a new sheet to follow C-9 is required as per Addenda No. 2, the new sheet would be “C-9.1” and inserted immediately following sheet C-9.

5. Any additional Drawing sheets inserted as a result of an Addendum will necessitate renumbering the total number of sheets and an updated Drawing Sheet Index.

D. Format and Number of Conformed Documents. - Electronic and paper submittals to be delivered at the same time.

1. Electronic Format for Conformed Specifications Manual - A single Portable Document Format (PDF) format file of the Conformed Bid Documents (Project Manual) shall be prepared and delivered to HRSD. The following numbers of copies shall be delivered to HRSD’s Project Manager prior to the Pre-Construction meeting with the Contractor for distribution:

   a. For projects that are managed in HRSD’s Unifier (Unifier) Enterprise Project Management System, the PDF file shall be uploaded to the proper project and Business Process in Unifier.

   b. For all other projects that are not set up in Unifier, FIRM to supply PDF versions via portable media to both HRSD and Contractor.

2. Electronic Format for Conformed Drawings - A single PDF format file of the Conformed Drawings shall be prepared and delivered to HRSD. The following numbers of copies
shall be delivered to HRSD’s Project Manager at the same time as the Conformed Specification PDF for distribution:

a. For Capital Projects that are managed in Unifier, the PDF file shall be uploaded to the proper project and Business Process in Unifier.

b. For all other projects that are not set up in Unifier, FIRM to supply PDF versions via portable media to both HRSD and Contractor.

3. Paper Format - Refer to specifics in Attachment A of Section 8 “PER, Design, and Construction Submittal Requirements” or as otherwise negotiated for number of and specifics of paper copies.

End of Section
Section 17 - Tracking of Construction Phase Milestones and Performance Metrics

A. Introduction - The Project Managers / Task Managers administering and coordinating engineered projects are required to track numerous items during the construction phase of a project to verify HRSD’s project archives are complete prior to closing out a project. The purpose of this Section is to gain assistance tracking these milestones from the FIRM responsible for construction administration of HRSD’s projects. A template form (Attachment A) is provide for this use.

B. Completion and Submittal of Construction Milestone Tracking Form

1. The FIRM shall use the attached template form to create and input dates of the listed milestones for each project the FIRM is managing during the construction phase. Use “N/A” for any items that do not apply to the particular project.

2. The FIRM shall update and submit a copy of the construction milestone tracking form along with each monthly status report / payment request to HRSD upon start of the construction bid phase.

3. The Project Manager / Task Manager shall provide a copy of each received construction milestone tracking form if not included in HRSD’s Enterprise Resource Planning (ERP) System to the appropriate Chief of Design and Construction.

4. These tracking forms will assist the Project Manager / Task Manager in properly confirming Project Stage Gate in HRSD’s Unifier (Unifier) Enterprise Project Management System for CIP projects.

C. Performance Metrics

1. Regular updates, scheduled submittals and overall timely completion of the construction milestone tracking forms will be used as a Performance Metric for Project Managers / Task Managers and also for the FIRM.

2. The Chiefs of Design and Construction will discuss on a regular basis with the Project Managers / Task Managers whether the goals of submitting monthly updated construction milestone tracking forms to the chiefs are being met.

3. Goals for completion of Contractor’s evaluation by a joint effort by the Project Manager / Task Manager and the FIRM shall be within 60 calendar days of the Contractor’s final payment request.

4. Goals for completion of the FIRM’s evaluation by the Project Manager / Task Manager shall be within 60 calendar days of the FIRM’s final payment request.

End of Section
## Active Construction Project Tracking Form

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<td>Final Construction Cost Estimate</td>
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<td>Conformed Plans &amp; Specs Issued</td>
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<td>Pre-Construction Meeting</td>
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<td>NTP Issued</td>
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<td>Contractor’s Preliminary Construction Schedule Received</td>
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<td>Hydrostatic Pressure Test</td>
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<td>Interim Record Drawings Submitted</td>
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<td>Final Record Drawings Submitted</td>
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<td>Interim Valve Guides Submitted</td>
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<td>Final Valve Guides Submitted</td>
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<td>Certificate to Construct (CTC) Received</td>
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<td>O&amp;M Manuals Submitted to Operations Department</td>
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<tr>
<td>Certificate to Operate (CTO) Received</td>
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<td>Certification of Substantial Completion</td>
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<td>Letter of Final Completion</td>
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<td>Letter of Warranty Completion</td>
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**NOTES**

- Interim and Final Valve Guides to Operations and CAD/GIS
- Interim and Final Record Drawings to Operations and CAD/GIS
- Engineer Evaluation (within 60 days of Final Payment to Professional Services Firm)
- Contractor Evaluation (within 60 days of Final Payment to Contractor)
Section 18 - Expectations for Construction Administration and Construction Inspection

A. Introduction - HRSD has for many years relied upon Professional Services firms (FIRM) to provide construction administration and inspection as a natural extension of design and bid phase services for all types of HRSD infrastructure. In an effort to document and disseminate our expectations for construction inspectors and/or resident engineers, this Section was developed and intended to be followed. This document provides minimum expectations and is therefore not comprehensive with listing all the skills, knowledge and abilities that inspectors or resident architects/engineers (RA/RE) must possess to be successful.

Typically, the agreement between HRSD and the FIRM for construction phase services including project management, technical consultation and resident inspection during construction through either the Contract Administration Services or the Field Engineering and Inspection Services as mutually agreed by HRSD and the FIRM will refer to this section of the HRSD Design and Construction Standards for clarification between services covered under Contract Administration and Construction Inspection. HRSD expects the FIRM to perform these tasks as required as the prime administrator and inspector on the construction project with HRSD providing only general oversight and coordination.

The expectations in this Section are coded based on HRSD’s general experience to indicate whether the individual tasks are a primary responsibility (P) or secondary responsibility (S) as appropriate under the Lump Sum Contract Administration Services (CA) or the Unit Price Field Engineering and Inspection Services (CI). The FIRM may propose different primary and/or secondary responsibilities during negotiations based on their organization and qualifications of staff.

B. Organization of this Section - This document has been divided into main categories as follows:

1. General Expectations
2. Preconstruction
3. General Procedures
4. Tie-In, Shutdown, and Diversion Procedures
5. Line Stop Procedures
6. Trenchless Crossing Procedures
7. Damage Assessment and Claims Procedures
8. Training
9. Record Keeping
10. Staffing
11. Verifications
### C. General Expectations

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<th>CA</th>
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<th>EXPECTATION / TASK</th>
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<tr>
<td>P</td>
<td></td>
<td>Inspectors should understand the importance of their responsibility to provide the highest quality construction and have the technical knowledge, tact, and good judgment to effectively perform observation duties.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to fully understand the extent of responsibilities; accepts responsibility; does not overlook potential problems; does not overstep authority; understands supervisor’s expectations; and records all verbal instructions in daily reports.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors extent of responsibilities include requiring work in accordance with plans and specifications; does not direct work; points out issues; reviews with supervisor policies and authority to stop Contractor’s operations for safety violations or construction deficiencies.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to review and be familiar with HRSD, FIRM and Contractor’s organization, chain of command and team members.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to review and be familiar with administrative and reporting procedures.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to review and be familiar with contract documents, addenda, changes and other revisions.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to review and be familiar with the Bid Documents (drawings and specifications) related to required work, materials and equipment, omissions, discrepancies in and/or between plans and specifications and existing site conditions, common details, trouble areas, and overlooked items.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to review and be familiar with shop drawings related to layout, material and equipment, omissions, discrepancies, conformance with actual work performed and equipment installed.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to review and be familiar with contract schedule to anticipate work activities and to review time-sensitive submittals and shop drawings.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to review and be familiar with permits, approvals and other rights of entry documents issued by federal, state, and railroad or city/county agencies.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to interact with Contractor’s personnel in business-like, cooperative and personal manner; with understanding and without prejudice; while protecting interests of HRSD, FIRM and the Public. Inspector and RA/RE to be &quot;firm yet fair&quot; with Contractor.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to be courteous and helpful to the public at all times. If representatives from the Media or other interested parties ask questions or enter the work zone, inform HRSD Project Manager, HRSD Public Information Specialist and/or Director of Communication as soon as possible. Inspectors are not to represent HRSD with the Media or other similar groups/individuals.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to avoid at all times dictating directions to Contractor’s personnel unless specified in the Contract documents; discussing issues directly with Contractor’s crew unless the Contractor’s designated supervisor is present; taking part in any labor dispute; and giving specific safety related directions to Contractor unless imminent danger conditions are observed.</td>
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<tr>
<td>P</td>
<td></td>
<td>Inspectors to observe Contractor’s work activities for conformance with plans, specifications and other contract documents.</td>
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<tr>
<td>P</td>
<td></td>
<td>Inspectors to read and understand the specifications, conditions of the contract, and plans.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to be knowledgeable of HRSD definitions of conflict when situations arise in construction that are not accurately shown on the plans.</td>
</tr>
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<td>P</td>
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<td>Inspectors to be knowledgeable of personal safety issues and informing Contractor on observed unsafe conditions and/or practices.</td>
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<tr>
<td>P</td>
<td></td>
<td>Inspectors to follow HRSD and regulatory requirements for personal protective equipment (PPE) for the particular environments and conditions to be encountered.</td>
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<tr>
<td>P</td>
<td></td>
<td>Inspectors to understand the importance of protective coatings, knowing what to look for, and being knowledgeable of repair methods.</td>
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<tr>
<td>S</td>
<td>P</td>
<td>Inspectors to be knowledgeable of how to address issues with inquiring residents, regulators, jurisdictional inspectors, fire marshal, and OSHA.</td>
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<tr>
<td>P</td>
<td></td>
<td>Inspectors to exercise good judgment and know when to call their supervisor to assist. HRSD does not desire Inspectors making &quot;Deals&quot; in the field affecting cost, time, and/or quality.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors to assist FIRM and HRSD staff as requested.</td>
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**D. Preconstruction**

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<th>EXPECTATION / TASK</th>
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<tbody>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to conduct pre-construction conference.</td>
</tr>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to coordinate with Contractor to establish survey reference points for horizontal and vertical control.</td>
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<tr>
<td>P</td>
<td></td>
<td>Inspectors and Contractor to jointly conduct the Pre-Construction Field Survey including the capture of dry day and post rain event photos and video prior to mobilization to the site.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to review requirements of preconstruction surveys and vibration baseline.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>FIRM to prepare conformed sets of plans / specs by date of Pre-construction meeting for distribution to HRSD staff. FIRM needs to ensure that the &quot;Conformed Set&quot; properly incorporates the addenda. The &quot;Conformed Set&quot; needs to be checked prior to distribution.</td>
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<tr>
<td>P</td>
<td></td>
<td>Inspectors to be in possession of and use the Conformed Plans and Specifications.</td>
</tr>
<tr>
<td>P</td>
<td>S</td>
<td>The FIRM to schedule a meeting between the RA/RE, Field Staff, and HRSD at the beginning of construction project to discuss expectations and the roles of the individuals involved.</td>
</tr>
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</table>

**E. General Procedures**

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<th>EXPECTATION / TASK</th>
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<tr>
<td>P</td>
<td></td>
<td>FIRM to issue Notice to Proceed to Contractor.</td>
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<tr>
<td>P</td>
<td></td>
<td>FIRM to conduct correspondence with the Contractor as required facilitating the project, and forward one (1) copy of all project correspondence to HRSD.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>FIRM to review and approve schedule of values submitted by the Contractor.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>FIRM to review and approve shop drawings, equipment submittals, construction drawings and erection drawings submitted by the Contractor for compliance with the construction plans and specifications.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>FIRM to review and approve laboratory, mill and shop tests reports of equipment and materials submitted by the Contractor.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>FIRM to prepare proposals, work change directives and change orders as required, prepare independent estimates of cost and time impacts, negotiate acceptable agreements with the Contractor for HRSD approval, and document all time and material work orders on a daily basis.</td>
</tr>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to review progress schedule submitted by the Contractor, monitor actual progress, and prepare as built progress schedule as required.</td>
</tr>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to conduct shop and field tests for pipe, machinery, equipment and materials including any off site witness tests as required under the construction specifications.</td>
</tr>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM to contract for and administer outside testing services procured by HRSD for concrete, soils and specialty testing as specified.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors to assist FIRM with field testing efforts and specialty inspections as required.</td>
</tr>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to respond to requests for information, inquiries, proposals and suggestions submitted by the Contractor.</td>
</tr>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to resolve changed site conditions and design conflicts, and prepare supplemental drawings and sketches to resolve conflicts as required.</td>
</tr>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to review and approve requests for progress payments submitted by the Contractor for compliance with the work performed.</td>
</tr>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to conduct periodic on-site job meetings with the Contractor to discuss schedule, progress, problems, coordination of activities with existing HRSD facilities, etc.</td>
</tr>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM to provide specialized inspection for mechanical, electrical, instrumentation and control, etc. as required.</td>
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<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to reject unsatisfactory work performed and equipment and materials submitted by the Contractor.</td>
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<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to apprise HRSD of project status and potential problems.</td>
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<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to review operation and maintenance manuals submitted by the Contractor.</td>
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<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to review performance tests for equipment and processes.</td>
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<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to conduct substantial completion and final inspections(s), prepare punch list(s) and establish warranty period(s).</td>
</tr>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to assist in resolving warranty issues.</td>
</tr>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to assist in startup of new facilities and troubleshooting.</td>
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<tr>
<td>P</td>
<td></td>
<td>Inspectors to coordinate activities of the Contractor with other consultants and/or contractors working on the site.</td>
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<tr>
<td>P</td>
<td></td>
<td>Inspectors to coordinate activities of the Contractor with HRSD to prevent interference or interruption of safe and reliable operation of existing HRSD facilities.</td>
</tr>
<tr>
<td>P</td>
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<td>Inspectors to coordinate preparation of spare parts lists and turnover of spare parts to HRSD by the Contractor.</td>
</tr>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to coordinate equipment and system training by design staff and by equipment vendors.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to attend daily, weekly and monthly progress meetings as appropriate.</td>
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<tr>
<td>P</td>
<td></td>
<td>Inspectors to inform supervisor promptly of observed deficiencies in materials, equipment, workmanship or other adverse conditions; slowdowns, delays and slippages in progress or ability to meet schedules and deadlines; any situation or condition that may result in a dispute or claim; safety related concerns; and concerns raised by the Public, locality inspectors or other individuals at the site.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to ensure site is clean, organized and picked-up daily.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to inspect materials and equipment for conformance with approved shop drawings, plans, specifications, and any change orders, potential change orders, RFI's etc. This must be performed immediately after materials or equipment is delivered. Any discrepancies need to be brought to the attention of the RA/RE immediately.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to observe the installation of all buried pipe, valves, fitting and any other buried asset. Inspectors to staff up accordingly to match Contractor's work crews.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to advise HRSD Safety Division and HRSD Project Manager of uncorrected unsafe conditions immediately.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to carefully review Contractor payment claims and reject / return to Contractor if supporting material is not complete (diversity statement, X-Y-Z table of installed pipe, and other contract requirements).</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors to confirm stored material prior to payment claim.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors to review monthly with the Contractor status of &quot;As-Built&quot; record keeping and tie approval of monthly pay request from Contractor to meeting these requirements.</td>
</tr>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to develop their own record drawing markups including changes resulting from addenda, requests for information, field orders, change orders, equipment and material substitutions, etc.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors, FIRM and Contractor to coordinate work schedule, sequence of construction, and timely notifications to residents in affected areas in advance of work commencing. Efforts may involve door hangers. Advanced notification efforts are intended to minimize complaints from residents and businesses about lack of awareness of project schedules and impacts.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to have a copy of the Contractor’s Emergency Action Plan (EAP) and must to be thoroughly familiar with its content.</td>
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<td>P</td>
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<td>Inspector shall be in possession of the most up to date emergency contact information for all involved parties and key individuals.</td>
</tr>
<tr>
<td>P</td>
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<td>Inspectors to attend and actively participate in regularly scheduled construction progress meetings per requirements of Bid Documents.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>RA/RE / Inspectors and FIRM to be knowledgeable of Work Change Directives, field orders, Contractor proposed alternate products and when to use these.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to have a copy of a diagram of responsible individuals and authority of each.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>RA/RE / Inspectors need to respond promptly on RFIs and Change Proposals.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors need to receive field copies of all RFI's, Change Orders, Field Orders etc. This information should be marked up on their plans and specs as required.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>RA/RE / Inspectors to coordinate with Contractor on providing proper notification on shutdowns to affected parties including HRSD Operations and Locality field crews to be involved.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>RA/RE / Inspectors to notify HRSD if Contractor attempts to operate a HRSD, Locality, or Private main line valve or air vent.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors may be interviewed by HRSD staff if a specific incident or accident occurs on the site (HRSD Safety Manager - safety / injury issues; HRSD Water Quality Department - spills / SSO; HRSD Real Estate Manager - insurance / damage claim by resident or motorist).</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors to report any accidents or interruptions of existing HRSD facility operations to HRSD.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to request pump station keys back from Contractor / subs following Final Completion being achieved for a project involving access to a HRSD pump station.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to be knowledgeable of definition and procedures to achieve Substantial Completion. Warranty period commences after Substantial Completion is achieved.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to be knowledge of definition and procedures to achieve Final Completion following Substantial Completion.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors to coordinate with Contractor on force main projects to complete the Data Collection Checklist for limited pipe condition assessment and collection of any pipe coupons / line stop coupons per HRSD Design and Construction Standards, latest edition.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors to document any previously unknown utility or obstruction that causes a vertical or horizontal change to the intended buried pipe alignment. Verify these changes are recorded on the Interim and Final Record Drawings along with the utility or obstruction that resulted in the change if the utility or obstruction remains following pipe installation.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to be aware of all work performed for others by the Contractor outside the limits of the project when and only if prior approval granted by HRSD’s Project Manager for the Contractor to perform this work.</td>
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<td>Inspectors to track the minimum listed required inspections related to ductile iron pipe: cutting or tapping lined pipe in accordance with proper procedures in manufacturers installation guide; proper installation of restraint system or restrained joints per manufacturer’s recommendations; check for flat spots when pipe stored for extended period of time.</td>
</tr>
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<td>P</td>
<td></td>
<td>Inspectors to track the minimum listed required inspections related to PVC pipe: proper bedding and backfill in accordance with the contract documents for PVC pipe; over insertion of spigot into bell is not occurring; over deflection of joints beyond manufacturer recommendations; installation of tracer wire and warning tape in accordance with the specifications; use proper tapping saddles for field taps to prevent pipe fractures; proper handling to prevent cracks; proper restraint system per manufacturer recommendations.</td>
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<tr>
<td>P</td>
<td></td>
<td>Inspectors to track the minimum listed required inspections related to HDPE pipe: expansion and contraction per manufacturer recommendations; follow manufacturer guidelines for fusing pipe (environment and cooling time); pipe wall thickness shall be compatible with fusing joints; conduct fusion strap tests as recommended by the manufacturer or Contract Documents; remove interior and exterior joint fused beads as per the manufacturer recommendations or Contract Documents; inspect for excessive gouges in pipe.</td>
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<tr>
<td>P</td>
<td></td>
<td>Inspectors to track the minimum listed required inspection on delivery and installation of valves: specified valve; damage to valve coating; damage to operating nut or actuator if remotely controlled; installed in proper flow direction; properly aligned (vertically plumb) valve and valve box; confirm valve opens and closes in correct direction; record number of turns required to open/close (perform twice); exercise valve prior to installation.</td>
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<td>P</td>
<td></td>
<td>Inspectors to track the minimum listed required inspection for ball valves and corporation stops: inspect valves for barbs for HRSD Air Vent Verification Rod passing; install corporation stops fully opened; plumb vertically corporation stop if factory installed on pipe for installation of air vent assembly; verify proper height/clearance in air vent housing; verify alignment of ball valve; verify frame and cover set correctly for final restoration.</td>
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<tr>
<td>P</td>
<td></td>
<td>Inspectors to use HRSD Air Vent Verification Rod and check-out / check-in procedure.</td>
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<tr>
<td>P</td>
<td></td>
<td>Inspectors to track the minimum listed required inspection for check valves: confirm operation of swing arm/lever and verify proper flow direction (arrow on valve).</td>
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<td>P</td>
<td></td>
<td>Inspectors to track the minimum listed required inspection for sanitary sewer manholes: confirm manufactured or field installed openings/penetrations are in correct location (vertical and horizontal); inspect for proper channel and benching; inspect correct height; inspect concrete and joint material; inspect drop connections into manhole; riser ring installation for frame and cover set properly for final pavement or restoration.</td>
</tr>
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</table>
CA CI EXPECTATION / TASK

P Inspectors to track the minimum listed issues related to pipe trench: measurement and payment in accordance with the contract requirements; use of proper trench box along with necessary steel sheeting; proper trench width for pipe installation; proper dewatering of the pipe trench; excavation for pipe bells; proper installation of trace wire and pipe warning tape during backfilling operations; trench safety issues.

P Inspectors to track the minimum listed issues related to pipe joints: Inspector shall have pocket guide for pipe installation as published by pipe manufacturer; use feeler gage to confirm proper gasket installation; review manufacturer’s “stab” joint limit marking on the pipe spigot; proper gasket lubrication practices; dispose of damaged gaskets.

P Inspectors to track the minimum listed required inspections for external pipeline corrosion prevention: bond cables properly across joints; proper pin brazing; periodically check for continuity; placement of sacrificial anodes in accordance with corrosion system manufacturer recommendations; verify electrical continuity where HDPE spool sections may be installed; verify proper installation of polyethylene encasement bags in accordance with the manufacturer recommendations; tape wrap products to be heat shrunk to fit properly; properly apply field coatings to steel pipe field welds for HDD in accordance with the manufacturer recommendations. Bonding pads are required to be factory installed prior to the application of the interior lining for pipes to be bonded.

P Inspectors to track the minimum listed required inspections for internal pipeline corrosion prevention: verify lining thickness on DIP by thickness/spark test; observe blisters or spalled areas; observe handling of pipe; limit cutting or tapping lined pipe in accordance with manufacturer recommendation; field applied repair coatings refer to manufacturer recommendations for temperature, environment, cure time and surface preparation.

F. Tie-In, Shutdown and Diversion Procedures

CA CI EXPECTATION / TASK

S P RA/RE, Inspectors, and FIRM to review / approve Contractor shutdown / diversion plan / tie-in plan for constructability. Issues for postponing a planned event include Contractor not having adequate time or resources to accomplish what has been submitted; and Contractor not complying fully with the pre tie-in check list and not ready to accomplish tie-in.

S P Inspectors and FIRM to review the “point of no return” for a planned tie-in and engage the Contractor, HRSD, and Locality in a recommendation to postpone / cancel tie-in if necessary. These conditions may be related to changed field conditions, changed weather conditions, excessive flows to handle, Contractor behind planned sequence of events schedule, or malfunctioning equipment.
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<tr>
<td>P</td>
<td>Inspectors to verify proper clear space is maintained under each assembled pipe joint for checking bolts and being able to observe leaks at all pipe joints and fittings not hydrostatically tested.</td>
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<tr>
<td>P</td>
<td>Inspectors to visually observe and check assembled pipe sections for proper assembly, tightened bolts, and thrust restraint.</td>
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<tr>
<td>P</td>
<td>Inspectors to verify proper remedy for any leaks noted from visual observations under line pressure.</td>
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<td>S</td>
<td>Inspector and FIRM to collect measurements, sketches, photographs, and X,Y, Z coordinates collected for assembled pipe in the tie-in area.</td>
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G. Line Stop Procedures

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<tr>
<td>S</td>
<td>RA/RE, Inspectors, and FIRM to review and approve Contractor’s Line Stop Plan for implementation and contingencies.</td>
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<tr>
<td>P</td>
<td>Inspectors to verify Contractor is using the most recent version of HRSD’s Line Stop Checklist from <em>HRSD Design and Construction Standards</em>, latest edition.</td>
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H. Trenchless Crossing Procedures

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<tr>
<td>S</td>
<td>RA/RE, Inspectors, and FIRM to review and approve Contractor’s trenchless crossing plan for constructability and contingencies.</td>
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</tr>
<tr>
<td>P</td>
<td>Inspectors to confirm Contractor is using the most recent version of HRSD’s Trenchless Crossing Checklist from <em>HRSD Design and Construction Standards</em>, latest edition.</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Inspectors to monitor potential settlement and void formation in areas of casing and entry/exit pits.</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Inspectors and FIRM to track the minimum listed requirements related to bore and jacked casing installation: proper horizontal and vertical alignment; monitor for settlement by visual inspection; conduct pre &amp; post ground penetrating radar (GPR) measurements for voids; identify varying soils and groundwater conditions prior to bore &amp; jacking; review Contractors plan for addressing these conditions; if conditions are extreme reconsider method of trenchless crossing; conduct soil stabilization prior to work; review Contractors method of sealing ends; determine how to handle unknowns as undocumented obstructions prior to beginning work; determine exactly where end of casing when terminating with no receiving pit.</td>
<td></td>
</tr>
</tbody>
</table>
I. Damage Assessment and Claims Procedures

<table>
<thead>
<tr>
<th>CA</th>
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<th>EXPECTATION / TASK</th>
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</thead>
<tbody>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to coordinate with Contractor to include an agenda item at each construction progress meeting related to damage claims and resident complaints.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to notify and compile information to report of any accidents or resident/business report of damages.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to notify HRSD Real Estate Manager of any damage reported by residents, property owners or the traveling public.</td>
</tr>
</tbody>
</table>

J. Training

<table>
<thead>
<tr>
<th>CA</th>
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<th>EXPECTATION / TASK</th>
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<tbody>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to be trained for confined space entry and OSHA Standard 29 CFR Part 1926 Safety &amp; Health Regulations for Construction, Sub-parts A thru Z. Confined space entry OSHA 29 CFR 1910.146(g)(4) and OSHA 10-hour Construction Safety &amp; Health.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to complete training on VDOT Basic Work Zone Traffic Control.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to be knowledge of and in compliance with regulatory and HRSD procedures for asbestos handling and disposal.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>NACE Level 2 certification required for all inspectors overseeing coatings and lining related work.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to have both NAASCO ITCP inspector certifications for CIPP and Manhole Rehabilitation project work.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to be familiar with and in compliance with HRSD Hot Work Permit requirements.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to be trained on and proficient with HRSD’s Unifier (Unifier) Enterprise Project Management System and the Enterprise Resource Planning (ERP) System.</td>
</tr>
</tbody>
</table>

K. Record Keeping

<table>
<thead>
<tr>
<th>CA</th>
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<th>EXPECTATION / TASK</th>
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<tbody>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM and Inspectors to maintain complete set of project files at the job site as required (or full access to digital files), and provide this set of project files to HRSD at the completion of the project.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to prepare daily report including activities and completed tasks; difficulties; controversial issues involving questionable items or disputes; deficiencies and violations; instructions given and received; progress and delays including actions taken or contemplated to minimize delays; equipment in use by Contractor; materials and equipment delivered for installation; photographic documentation of the work; and spare parts provided by the Contractor or Vendors.</td>
</tr>
<tr>
<td>CA</td>
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<td>EXPECTATION / TASK</td>
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<tr>
<td>P</td>
<td></td>
<td>Inspectors to maintain a Project Log Book for each project. A Project Log Book is a Legal Document. All entries shall be in ink. Erasers are not allowed. Corrections shall be made by crossing off with a line through the deleted writing. Notes should be kept as to why changes were necessary.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to maintain daily records, photographs, temporary valve guides, drawing markups to compare to Contractor records for dispute resolution.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to capture sufficient photographs of utility crossings, fittings installed with GPS digital camera where appropriate.</td>
</tr>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM, RA/RE, and Inspectors to include detailed information on monthly status report that accompanies Engineer's payment request on the activities anticipated in the next 30 days. In particular, field activities that involve HRSD Operations staff assistance.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to confirm Contractor is collecting X,Y,Z field information where required per <em>HRSD Design and Construction Standards</em> and in accordance with the Bid Documents.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to confirm turns open and close for new valves being installed and verify information correctly input on the Interim and Final Valve Guides.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to record the serial numbers on all new valves and the actuators for inclusion on records transmitted to HRSD for each valve location.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors shall take required measurements and document these. Examples include location of building service connection tee-wye, end of service connection piping, location of valves and fittings, location of utility crossings.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors shall prepare sketches to include pertinent buried items, end of service connections, utility crossings, other items that will be buried, and all ties taken.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors shall take required swing ties to include measurements to two or more permanent structures.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to observe on going work by the Contractor for compliance with the construction plans and specifications with emphasis on critical construction activities such as placement of reinforcing steel and concrete, items being covered up or embedded, pipe laying and testing, equipment placement and testing, etc.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>RA/RE, Inspectors, and FIRM to prepare and distribute the Substantial Completion punch list and the Final Completion punch list to Contractor and other parties.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to document any concerns or plan deviations raised by HRSD Operations staff visiting the construction site and discuss with HRSD Project Manager for resolve.</td>
</tr>
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</table>

L. **Staffing**

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<tbody>
<tr>
<td>P</td>
<td>S</td>
<td>FIRM to provide proper inspection coverage for multiple construction crews where work can be covered up quickly as with buried pipe installation and coatings / linings preparation work.</td>
</tr>
</tbody>
</table>
### M. Verification

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<th>EXPECTATION / TASK</th>
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<tbody>
<tr>
<td>P</td>
<td>S</td>
<td><strong>FIRM to provide proper inspection coverage during tie-ins and 24/7 critical construction activity periods. Contingency planning for backup personnel for exhaustive work schedule and planned or unplanned leave.</strong></td>
</tr>
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<tr>
<td>P</td>
<td>P</td>
<td>Inspectors to verify proper storage and protection of materials and equipment.</td>
</tr>
<tr>
<td>P</td>
<td>P</td>
<td>Inspectors to verify Contractor stays within permitted easement limits (does not enter onto private property without acquiring easement) and does not park in unauthorized areas. Inspectors to immediately notify HRSD Project Manager if Contractor is not in compliance.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to verify traffic maintenance plan consistent with bid documents and jurisdictional approved permit and notify HRSD Project Manager and Contractor if Contractor is not in compliance.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to verify Contractor’s efforts are meeting all environmental/erosion control requirements in the Bid Documents. Inspectors to notify HRSD Project Manager if Contractor is not in compliance.</td>
</tr>
<tr>
<td>P</td>
<td>P</td>
<td>Inspectors to verify proper setup by Contractor and procedures are followed for hydrostatic testing of new pipelines. Inspectors to notify Contractor of missed steps that will delay the planned test.</td>
</tr>
<tr>
<td>P</td>
<td>P</td>
<td>Inspectors to verify proper setup by Contractor and procedures followed for soil density testing as required for installation of new buried pipelines.</td>
</tr>
<tr>
<td>P</td>
<td>P</td>
<td>Inspectors to verify pipe (gravity and force main) installed on proper grade to avoid sags or unplanned high point in the pipe. Inspectors to notify Contractor and HRSD Project Manager of any installation that deviates from Bid Documents or approved Work Directives / Change Orders.</td>
</tr>
<tr>
<td>P</td>
<td>P</td>
<td>Inspectors to verify pipe handling procedures for each pipe material being used. Use of a forklift without padded forks (insert fork into fitting) is not allowed for handling fittings to protect inside linings nor chains allowed for lifting pipe or fittings with exterior coatings that may be damaged as a result of this action.</td>
</tr>
<tr>
<td>P</td>
<td>P</td>
<td>Inspectors to verify other testing to witness and record information including vacuum testing of manholes, concrete cylinder/strength, concrete air entrainment, concrete slump.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to track the following verifications related to Asbestos Cement pipe installation: confirm pipe outside diameter (OD) and compare to manufacturer published data and shop drawings; and connect new pipe to existing Asbestos Cement pipe with proper adaptors (refer to manufacturer recommendations).</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to track the following verifications related to Asbestos Cement pipe demolition: certified firm to handle Asbestos Cement pipe; break collar verses saw cutting to avoid air/friable particles; follow manufacturer and HRSD safety procedures for handling and transport; proper personal protective equipment and equipment for demolition.</td>
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<tr>
<td>CA</td>
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<td>EXPECTATION / TASK</td>
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<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to track the following required verifications related to Miss Utility coordination: record when “Miss Utility” ticket request called in; record differences marked in field vs. contract plans; review Contractor’s test pit work plan for utility location verification in advance of excavation to avoid conflicts.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to track the following required verifications related to bedding and backfill: advance written authorization/approval required for additional excavation of unsuitable materials; review of Contractor’s disposal plan for unsuitable excavated materials (dispose to approved sites and not in environmentally sensitive areas); backfill and bedding meet contract specifications (free of boulders, debris and shall be dry); proper backfill compaction in specified lifts, compaction testing where required.</td>
</tr>
<tr>
<td>S</td>
<td>P</td>
<td>Inspectors and FIRM to track the following verifications related to pipe rehabilitation: review Contractor’s diversion pumping systems; review Contractor’s plan to provide adequate advance notice to affected customers and to avoid or assure customer service interruptions are minimal; verify proper cure times for materials to be used; be aware of effects of temperature variation; follow manufacturer recommendations; inspect to ensure Contractor has taken accurate measurements to all connections; immediately upon pipe lining/curing reestablish service or other connections; verify that all customers are reconnected; adequate grouting between host pipe and liner pipe; ensure adequate support (water pressure if possible) of liner prior to grouting; mix shall be suitable for filling annular space; install grout holes along pipe where possible; inspect grouted pipe where possible.</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>Inspectors to verify with Contractor proper grade and surface elevations intent of Bid Documents verses actual ground elevations.</td>
</tr>
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</table>

End of Section
**Section 19 - Use of Air Vent Proving Tool (“Whammy Rod”)**

A. **Introduction** - In recent past interceptor system force main projects, Contractor installed air vents have not been fully open during final inspection walk-throughs. This has led to delays in getting the force main online by the Contractor having to excavate down to the corporation stop on the air vent assembly and confirming that the corporation stop is in the full open position, and able to pass HRSD’s air vent cleaning rod through it. HRSD’s Design and Construction Divisions each have an Air Vent Proving Tool, otherwise known as a “Whammy Rod” by the Interceptor System field crews. These tools can be reserved by HRSD Project Managers for use by the FIRM’s Inspector prior to final backfilling around each air vent assembly. This Section details the expectations and procedures of how this tool is to be used by the FIRM during construction.

B. **FIRM Responsibilities and Procedures** - The FIRM shall coordinate with HRSD’s Project Manager (PM) and follow the identified steps for use of the Air Vent Proving Tool:

1. Request that HRSD’s PM reserve the tool prior to final backfilling around each air vent assembly.
2. HRSD’s PM will check out the tool on SharePoint and make available to the FIRM’s Inspector.
3. The Inspector shall notify the Contractor immediately of any air vents where the head of the proving tool does not pass through the corporation stop.
4. Follow-up attempts to prove the air vent is passable shall be done after the Contractor has fully opened the corporation stop.
5. The Inspector will coordinate a walk-through with HRSD operations personnel only after all air vents have been proven to be fully open, properly aligned, and in full compliance with the Bid Documents.
6. The air vent proving tool shall be returned to HRSD’s PM for making available for other projects.

**End of Section**
Section 20 - Condition Assessment Protocol for Repaired or Abandoned Pipelines

A. **Introduction** – One of the elements of the HRSD’s Management, Operation, and Maintenance (MOM) per Environmental Protection Agency (EPA) involves collection of condition assessment information on HRSD’s active and planned to be abandoned force mains and gravity sewer mains. HRSD has developed procedures for collecting limited information on pipelines taken out of service either temporarily for repair / rehabilitation or for abandonment. This Section will detail the desired condition assessment program on repaired or abandoned pipelines of the types in HRSD’s system as part of the construction bid documents.

B. **Condition Assessment Plan during PER phase** – The FIRM will coordinate with HRSD’s Asset Management Division of the Engineering Department during the PER phase of a project to develop a Condition Assessment Plan for the existing HRSD infrastructure to be impacted by the rehabilitation, replacement, or new infrastructure project(s) This Condition Assessment Plan will be incorporated into the final PER.

C. **Condition Assessment Plan during Design phase** – The FIRM will incorporate condition assessment needs as determined in the Condition Assessment Plan in the PER into the design. As changes occur in the design that may change the Condition Assessment Plan, FIRM shall coordinate with HRSD’s Asset Management Division of the Engineering Department to make appropriate revisions to the Condition Assessment Plan.

D. **Technical Specification** – The FIRM shall coordinate with HRSD’s Project Manager on who should collect the data as part of the Condition Assessment Plan, HRSD personnel, FIRM personnel, or the Contractor. Construction plans and specifications shall clearly state who is responsible for collecting the condition assessment data. A Master Technical Specification Section 02774 – Condition Assessment Data Collection for Pipelines Being Repaired or to be Abandoned was developed for insertion into HRSD administered construction projects when it is decided the Contractor is responsible for condition assessment data collection. This Master Technical Specification may be revised to delineate FIRM, HRSD and Contractor’s responsibilities in condition assessment data collection.

E. **Data Collection Forms** – The Asset Management Division of the Engineering Department has created condition assessment data collection forms for the following that shall be used when applicable:

   a. Concrete Pipelines
   b. Ferrous Pipelines
   c. Coupon Data

FIRM shall request the most recent version of forms to be used during the condition assessment.

End of Section
Section 21 - Regulatory Reporting Requirements for Spills

A. **Introduction** - During the course of construction projects on the collection system, spills from manholes, force mains, etc. occur. These events need to be reported to HRSD personnel immediately.

B. **Procedures** – The following procedure should be followed for all spills. Failure to report a spill can lead to enforcement action by Virginia Department of Environmental Quality (VDEQ) and/or US Environmental Protection Agency (EPA). Please distribute these phone numbers to the appropriate supervisors. If you have any questions, please contact Lauren Grimmer (HRSD Environmental Scientist) at (757) 460-4245 or 419-8577.

C. **Contact Information** - The Contractor or Inspector on-site are to contact the appropriate Operations Center Coordinator. The following phone numbers are manned from 6:00 am to 4:30 pm (North Shore) Monday through Thursday and 5:45 am to 4:30 pm (South Shore) Monday through Thursday.

<table>
<thead>
<tr>
<th>Location</th>
<th>Phone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Shore (Peninsula)</td>
<td>(757) 833-1720</td>
</tr>
<tr>
<td>South Shore</td>
<td>(757) 460-7072</td>
</tr>
</tbody>
</table>

If the Contractor has a problem outside of these business hours, then one of the following personnel should be notified. Someone should call you within 15 minutes.

<table>
<thead>
<tr>
<th>Contact Person</th>
<th>Phone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Shore Duty Supervisor Cell Phone</td>
<td>(757) 613-6600</td>
</tr>
<tr>
<td>North Shore Duty Foreman Cell Phone</td>
<td>(757) 613-6601</td>
</tr>
<tr>
<td>South Shore Duty Supervisor Cell Phone</td>
<td>(757) 284-8118</td>
</tr>
<tr>
<td>South Shore Duty Technician Cell Phone</td>
<td>(757) 284-8120</td>
</tr>
</tbody>
</table>

**End of Section**
Section 22 – HRSD Safety Program

A. Introduction - This Section addresses the various safety programs and policies of HRSD that apply to design and construction efforts. HRSD staff, as well as professional service firms (FIRM), contractors, and others involved with implementing work on HRSD facilities and on behalf of HRSD are to be in compliance with the following paragraphs. FIRMs will need to verify that appropriate edits are made to Bid Documents to capture these items.

B. Safety Programs

1. Hazard Communication Program – HRSD is required, in accordance with 29 CFR 1910.1200, to inform HRSD and contractor’s personnel that work within HRSD of the hazardous chemicals on site. HRSD and contractor’s personnel may be exposed to these hazardous chemicals while working at HRSD facilities. A written Hazard Communication Program, as well as, Response Procedures, has been developed to inform personnel of the specific hazardous chemicals at HRSD facilities and the related safety information including protective measures, special precautions, emergency procedures and muster points to be observed. The Hazard Communication Program including Safety Data Sheets (SDS) for each hazardous chemical at the HRSD facility site will be made available to contractors. HRSD utilizes an online program for Safety Data Sheets (SDS) known as MSDSonline. Contractors will be provided with the link to MSDSonline. Contractors are responsible for communicating the information contained in the SDS to their personnel working at the HRSD facility. Contractors shall attend an Outside Contractor Safety Briefing conducted by the Safety Division or Plant Superintendent prior to start of work. Contractors are responsible for informing HRSD of hazardous chemicals they bring on the plant site or to HRSD facilities. Contractors are responsible for obtaining SDS for hazardous chemicals that they are using and storing at HRSD facilities and providing SDS to HRSD upon request. Contractors are responsible for using and storing the hazardous chemicals in an appropriate method while on site at an HRSD facility. Contractors are responsible for the disposal and labeling of hazardous chemicals that they use or store at HRSD facilities.

2. The HRSD Hot Work Permit Program requires that HRSD employees and/or Contractors who perform work involving electric or gas welding, cutting, brazing or similar flame producing or spark producing operations on or in close proximity to (within 25 feet or where posted) hazardous chemical process systems/equipment, within HRSD confined space, or within the fence line/property line of an HRSD Pump Station be issued a hot work permit prior to beginning work. Contractors must attend an Outside Contractor Safety Briefing conducted by the Safety Division or Plant Superintendent prior to the start of work. The Contractor must comply with this requirement and obtain a daily hot work permit from HRSD site management before engaging in any hot work. Contractors must utilize their own Fire Watch for hot work permit operations. Note: No hot work is permitted within 50 feet of the methanol storage and feed areas.

3. Lockout/Tagout Program – Contractors are responsible for compliance with the OSHA Lock Out/Tag Out Standard. Whenever Contractors are involved in lock out/tag out
activities at an HRSD facility, the equipment, process, or system shall be locked and tagged out in accordance with the HRSD Lock Out/Tag Out Program by the work center supervisor overseeing the work. The HRSD Supervisor overseeing the work will ensure that the Contractor is shown the location to apply their lock(s) and tag(s). The HRSD employee overseeing the work must be an “Authorized Employee.” Only in emergency situations are equipment, processes, or systems shut down by other than an HRSD “Authorized Employee.” The HRSD work center supervisor must be notified immediately if this occurs. Whenever Contractors are involved in lock out/tag out activities covered by this program, HRSD and the Contractor will inform each other of their lockout/tagout programs and procedures. The work center supervisor will inform the Contractor on the precautionary measures involved in performing lock out/tag out at the HRSD facility. All Contractors performing work at an HRSD treatment plant or pump station will receive an Outside Contractor Briefing prior to starting work. The briefing will be given by the Plant Superintendent or the HRSD Safety Division. Engineering Project Managers, will specify in contracts, bids, and requisitions that Contractors must comply with the Occupational Safety and Health Administration’s (OSHA) 29 CFR 1910.147 standard while working at an HRSD facility.

4. Confined Space Entry Program – The HRSD Confined Space Entry Program provides HRSD employee training and awareness of the potential hazards of entering and working in confined spaces. All tanks, manholes, vessels, as well as, other areas designated by signs or otherwise instructed are considered confined spaces HRSD’s employees cannot act as “qualified person” for the Contractor, cannot complete confined space entry permits for Contractors, nor will HRSD’s owned gas detection monitors or other confined space entry equipment be loaned to the Contractor. The Contractor must comply with all Federal and Virginia OSHA Confined Space Standards. Contractors can request information concerning known hazards of HRSD Confined Spaces. HRSD’s Safety Division or Plant Superintendent will brief the Contractor’s key personnel on the confined spaces located on the project site during the Outside Contractor Safety Briefing.

5. Plant Access Procedures for Contractors Performing Long-Term Projects at HRSD Treatment Plants. [Note: Human Resources staff codes the badges and plant staff or Project Manager or Safety Division provides badges to the Contractor.]

a. The Contractor will be issued a limited number of access badges for distribution among direct employees or sub-contractors. The badges will allow access through the plant gate during normal working hours. Each badge must be assigned to an individual and that individual’s name logged on a form to be provided to the appropriate HRSD Plant Superintendent or Project Manager. The Contractor is responsible for periodically verifying the possession of the badges by the assigned individual. Any discrepancy in the possession or location of any badge must immediately be reported to a member of the plant supervisory staff. Any misuse of the badges will result in immediate revocation of access privileges.

b. If a Contractor badge is lost, immediate notification to the Project Manager or Human Resources is required. If necessary, a replacement card will be issued.
c. The Contractor may be issued a limited number of badges for supervisory personnel with extended access to the plant at the discretion of HRSD personnel.

d. In the event that the Department of Homeland Security raises the threat level of the country to “Red”, all Contractor access badges will be disabled. Access to the plant at that time will require individual identification verification and entry only via plant staff.

e. Contractor to develop and submit an approvable plan to the HRSD Project Manager for site access procedures and protocols. This plan shall include, but not be limited to, daily log in entry, current emergency contact information, management of gate openings, and daily log out procedures. Plan must be approved by HRSD Project Manager and HRSD Safety Manager. Changes to the approved plan must be submitted in writing and approved by HRSD.

f. Contractor work hours will be discussed and approved by the HRSD plant or facility.

g. Security guards shall be provided if Treatment Plant gates are to be left open during normal work hours. The following are requirements and expectations of a security guard:
   1. The Security Guard is expected to be alert and awake while guarding the open gate.
   2. The Security Guard is expected to check cars and trucks in and out of the plant site.
   3. If the Security Guard is not on duty the plant gate will be closed and secured.
   4. The Security Guard must turn unwanted site visitors away.

h. Perimeter fencing must be maintained during construction at HRSD Workcenters.

i. In the event of a site evacuation, the Contractor Site Supervisor / Superintendent is responsible for accounting for contractor personnel.

6. NFPA 70E – Contractors hired to install or modify electrical components will do so in compliance with NFPA 70E. Only qualified HRSD Electricians or Instrumentation employees or qualified Contractors are to perform work on electrical circuits, components, and equipment. Contractors hired to perform electrical work at an HRSD plant or pump station must receive an Outside Contractor Safety Briefing by the HRSD Safety Division, or Plant Superintendent and the HRSD Electricians assigned to that facility. The Outside Contractor Safety Briefing will include information on existing electrical hazards, personal protective equipment/clothing requirements, arc flash labeling system as appropriate, and where to lock and tag out sources of power. HRSD electrical personnel and affected Operations personnel will be involved in the planning of work. Contractors are required to contact HRSD electrical personnel prior to tapping into existing HRSD electrical sources or shutting off equipment (unless an emergency exists.)
Warning and/or barricading are required to be used when live electrical components are exposed in areas utilized by HRSD staff.

7. Fall Protection – Contractors that are removing existing guardrails, hatch covers, deck grating, etc. in which an employee could fall four feet or greater must install temporary guardrails. Temporary guardrails include a 42 inch top rail, a 21 inch mid-rail, and a 4 inch toeboard. Temporary guardrails must sustain 200 pounds of pressure applied in any direction. When construction is complete, permanent guardrails must be installed or reinstalled, deck grating replaced and secured down, and/or hatch covers replaced. If utilizing temporary covers, temporary covers must be secured and labeled “hole.” Contractors are responsible for compliance with OSHA fall protection standards when working at heights such as on roofs, off of scaffolding, or when using aerial lifts.

8. New construction buildings and processes cannot be turned over to HRSD until all safety issues have been corrected. Contact the Safety Division for a safety walk through prior to the release of a new building or processes to HRSD.

9. Excavations and Trenching – Contractors involved in excavation work must be in compliance with OSHA Standards 1926.651 and 1926.652. Trenches 5 feet or greater in depth must have a protection system prior to employees working inside. Trenches or excavations 4 feet or greater in depth are required to have safe access and egress devices located within 25 feet of all workers. Open excavations must have adequate fall protection for personnel if greater than 4 feet and must have adequate protection (e.g. barricades) if next to areas accessed by vehicles. If an HRSD employee must enter a Contractor’s excavation and is unsure about its safety, they must contact the Safety Division immediately. Contractors are responsible for evaluating their trenches or excavations for a safe atmosphere. Contractors are responsible for identifying existing utilities in areas in which they plan to dig. Contractors are responsible for not getting too close to overhead electrical lines with construction equipment.

10. Fire Protection Systems – Anytime a contractor’s work may impact installed fire detection or protection systems, the HRSD work center, Safety Division, and Facilities Maintenance must be notified.

11. Housekeeping – The contractor is responsible for the overall housekeeping within their work areas.
   a. All exit doors, electrical panels, fire extinguishers, emergency eyewash/showers, first aid kits must have clear access maintained for emergencies.
   b. Trash and debris must not accumulate nor impede travel on designated walkways.
   c. Weeds and grass must be maintained during the project by the contractor in their designated areas so as not to create fire hazard or harborage of vermin.

12. Outside Contractor Briefing – All contractors working at an HRSD Plant or Pump Station will be given an Outside Contractor Safety Briefing by the Plant Superintendent or HRSD Safety Division prior to starting work. The briefing will cover the following:
a. HRSD Safety Rules  
b. Evacuation Procedures  
c. Chemicals on site  
d. HRSD Safety Programs relevant to the work that is being done  
e. Personal Protective Equipment (PPE) Requirements for location

13. Asbestos Awareness Program. HRSD’s program objectives include employee awareness of regulations, health issues, and proper procedures for working around and handling products, or materials containing asbestos. Attachment A to this Section is a check list that should be used on each project. For existing HRSD buildings contact the HRSD Safety Division for a list of building materials which contain asbestos.

14. Weapons Policy – Weapons, if brought onto HRSD property, must be kept locked in personal vehicle. No weapons are permitted in HRSD buildings or vehicles.

15. Use of HRSD Equipment – Contractor must provide all equipment necessary to perform work on HRSD property. Use of HRSD equipment is prohibited. This includes:
   a. Ladders  
   b. Forklifts  
   c. Telehandlers  
   d. Aerial Lifts  
   e. Rolling Gantry Cranes  
   f. Slings

End of Section
## Asbestos Check List

<table>
<thead>
<tr>
<th>Concerns</th>
<th>Yes</th>
<th>No</th>
<th>Unsure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there asbestos in the building, is the roof made of asbestos, or is the pipe made of asbestos? (If unsure, contact Safety Division)</td>
<td></td>
<td></td>
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<tr>
<td>Will the identified asbestos need to be removed or disturbed?</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Is the asbestos removal contractor licensed within the State of Virginia?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has the contractor submitted proof of their license?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the asbestos removal job within a building? If “yes”, HRSD will need to hire a separate Project Monitor to perform air sampling within HRSD Building.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Will over 10 linear feet or 10 square feet of asbestos pipe or friable asbestos be removed? Will over 5,585 feet of asbestos roofing be removed? If so, the asbestos removal contractor will need to notify the state of Virginia 20 calendar days ahead of time. (Make sure notification was made.)</td>
<td></td>
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</tr>
<tr>
<td>Will the contractor be using OSHA approved removal techniques (i.e. wet methods)? If unsure, contact Safety.</td>
<td></td>
<td></td>
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<tr>
<td>Does the Contractor’s plan include bagging or poly-wrapping the asbestos waste? The handling method and protocol is required in the plan.</td>
<td></td>
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</tr>
<tr>
<td>Has the Contractor been specifically instructed to provide HRSD with a manifest stating which landfill the asbestos waste was taken to for disposal? This manifest is a required submittal.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Will the building be demolished? If yes, an asbestos inspection is required.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you checked “unsure” on any of the above items, contact the Safety Division for assistance.
Section 23 - VDOT 2011 Work Area Protection Manual (WAPM)

Requirements

A. Introduction - HRSD’s Design and Construction Divisions contract with a wide variety and a significant number of Professional Services firms (FIRMs) for design and construction oversight responsibilities for both capital and non-capital projects. Typically, the FIRM providing the design services will also assemble a team to perform construction administration and inspection (CA/CI) services for HRSD during the construction period. Many of these projects lie within state and locality road rights of way. One of HRSD’s top priorities during construction activities is the safety of all staff and HRSD’s field representatives. As such, it is crucial that our staff and our contracted work force adhere to the latest federal, state, and locality safety standards.

The 2011 edition of the *Virginia Work Area Protection Manual* along with updates became effective for HRSD on July 1, 2012. Several localities have already adopted this manual and have been requiring compliance with it. The 2011 *Virginia Work Area Protection Manual* and a presentation highlighting changes from the previous Work Area Protection Manual can be found at the following web link: [http://www.virginiadot.org/business/trafficeng-WZS.asp](http://www.virginiadot.org/business/trafficeng-WZS.asp)

This Section establishes expectations and requirements for being in compliance with the 2011 *Virginia Work Area Protection Manual* for all FIRMs providing CA/CI services on behalf of HRSD.

B. Training Requirements for Construction Inspectors - All construction inspection personnel representing HRSD on any construction projects within rights of way exposed to traffic, work vehicles, and construction equipment within traffic control zones must take an approved course and become certified in Intermediate Work Zone Safety Training. HRSD will require a copy of each inspector’s certification in order to represent HRSD on a construction project.

C. Personal Protective Equipment (PPE) Requirements – The following pages detail specifics on PPE and other safety equipment.
High Visibility Vests & Flagger Station Lighting

Due to recent changes to the 2011 Virginia Work Area Protection Manual, beginning July 1, 2012, ANSI/ISEA 107-2004 Class 2 High Visibility Traffic Vests will no longer be used in Temporary Traffic Control work areas.

Instead, all workers (ex. flaggers, work crew, engineers, etc) within the right of way exposed to traffic, work vehicles and construction equipment within the Temporary Traffic Control Zone must wear an ANSI/ISEA 107-2010 Class 3 High Visibility Traffic Vest. Also, the workers hard hats are required to have a minimum of 10 square inch of retro-reflectivity.
Workers that are installing, maintaining and/or removing Temporary Traffic Control Devices as well as performing flagging operations must also wear a Class “E” Trouser along with their Class 3 vest, when:

- Working during emergency situations
- Working in low light conditions
- Working during inclement weather (ex. fog, sleet, snow, etc)
- Working during night time operations (30 minutes before sunset until 30 minutes after sunrise)

Lastly, flagger stations must be illuminated at night. The light source can not be satisfied by street lights or vehicle headlights but by a light source that produces a minimum of 50 lux or 5 foot-candles for the entire area (not just in one spot). The light source needs to be higher than the flagger station and points down on the flagger. Also, the lighting source must not interfere with the flagger or motorist’s line of sight.

End of Section
Section 24 - Pipelines and Appurtenances

A. Introduction – The HRSD interceptor system conveys wastewater to the treatment plants through a network of gravity sewers, force mains, pressure reducing stations, pressure control valves, and pump stations. This section includes specifics for design and construction of force mains, sanitary sewer gravity mains and manholes, and valves and other appurtenances. This section also includes specifics for the design of temporary diversion and line stop systems. Designers for planned work on or near HRSD pipelines are to follow these requirements and use the appropriate details contained in Section 36 - Standard Details, appropriate technical specifications contained in Section 40 - Master Specification Sections, and other referenced checklists or forms within this manual.

B. General – The following items apply to all HRSD pipelines.

1. Design Specifics:

   a. Design and construction is to be in accordance with current Commonwealth of Virginia Sewage Collection and Treatment Regulations (SCAT).

   b. Pipeline design flows are provided by HRSD. HRSD will provide pipe sizes for force mains and gravity mains based on the HRSD regional hydraulic model.

   c. HRSD desires to bid alternative materials to increase competition wherever possible. Typical materials used are lined ductile iron, FRP, PVC, and HDPE. HRSD has more experience and operational knowledge with ductile iron for use in force mains than these other materials. Other materials should be considered as appropriate based on site-specific conditions and current technology.

   d. Evaluate all utility crossings and critical tie-in points for conflicts. Conflicts shall be determined by the HRSD Project Manager and/or FIRM with concurrence from the Operations Department on a case by case basis. Maintain a minimum 18-inch vertical separation for all utility crossings and/or 10-feet horizontal separation from buried utilities unless otherwise approved by HRSD. Other conflicts may be identified on a project case by case basis for such concerns as maintenance of operation of valves and air vents or access to buried pipelines for condition assessment programs.

   e. The use of conflict structures is not permitted in the HRSD system.

   f. In situations where jurisdictional gravity sanitary sewer mains are crossed over within 36-inches of vertical clearance by the newly installed gravity sewer main or force main or the HRSD force main or gravity main is to be installed within 36-inch vertical clearance under the jurisdictional gravity sanitary sewer mains, these jurisdictional mains shall be Closed Circuit Television (CCTV) inspected preconstruction and post construction by the HRSD Contractor as a record for potential settling or misalignment issues.
g. Obtain information on existing subsurface utilities to the applicable Utility Quality Level as defined in the A.S.C.E. Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data (A.S.C.E. 38-02). Locate utilities in pipeline corridor in accordance with Utility Quality Level B. Utilities crossing the proposed pipe shall be located in accordance with Utility Quality Level A.

h. Maintain a minimum of ten feet from the centerline of the pipe to the edge of the easement or right of way. Where easements are through parcels (vs. along the edge), provide minimum of 30 foot wide easement. Refer to Section 36 - Standard Details section for standard easement plat requirements.

i. Provide bollards to protect and locate air vents, valve boxes, manholes, etc. in fields and areas where these structures are likely to be damaged or covered by vegetation or soil. Potential areas include cultivated fields or woods.

j. Do not install lined ductile iron pipe or fittings within 8 feet of chemical injection stations as pipe, gaskets, and the ceramic epoxy lining may be damaged. Consult with the lining manufacturer in such situations.

k. When existing pipe is to be abandoned, consider the need to abandon in place and/or removal. For pipe abandoned in place, fill pipe with lightweight grout (flowable fill) when pipe is 24” in diameter and larger.

l. Installation records shall be kept in a digital spreadsheet containing X,Y,Z coordinates for top of pipe elevations at each joint, fitting, valve and connection points. Refer to Master Specification Section 01323 - Record Documents, for X,Y,Z accuracy requirements.

2. Corrosion Prevention:

a. Evaluate the need for and, if required, design for external corrosion protection based on soil conditions or stray currents from other utilities. Provide electrical isolation at outlet valves and connections to adjacent pipeline sections if cathodic protection or bonded joints are required.

b. Evaluate the need for interior and exterior linings and coatings based on specific site conditions.

c. Where force mains discharge into gravity systems, special consideration shall be given to corrosion protection of the force main, manhole and gravity sewer. The design must also minimize turbulence.

3. Protective Linings:
a. Corrosion Resistant Lining for pipelines – For ductile iron pipe and fittings, the products described below have been approved and shall be specified as acceptable alternatives. Unless specifically approved by HRSD, all ductile iron pipe and ductile or cast iron fittings used for force main shall be lined. Specific requirements associated with each of these linings are contained in Master Specification 02510 – Ductile Iron Pipe within this manual.

   i. Internal Lining – The lining material for pipe and fittings shall be Permox CTF, Induron Coatings Protecto 401 or TNEMEC Series 431.

4. Bid Document Development


   b. Provide details on the drawings indicating bedding, backfill and surface restoration requirements for the project.

   c. Pavement replacement details, traffic control and similar type issues must be coordinated with the appropriate municipalities, VDOT, etc.

   d. Include adequate survey data, including pipeline centerline stationing. State Plane coordinates – Virginia South / NAVD 88 Datum required. Accuracy should be within 0.1 of foot in the horizontal and vertical plane. All fittings/appurtenances to be GPS surveyed. References on drawings to allow for Contractor to perform field layout of proposed work. Refer to Section 6 - Drawings, Record Drawings, and Valve Guides in this manual for specific requirements.

   e. Handling of Lined Ductile Iron Pipe and Fittings – Ductile iron pipe and fittings lined with any of the standard corrosion resistant linings must be handled only from the outside of the pipe and fittings. No forks, chains, choker cables, hooks, or straps shall be placed inside the pipe or fittings for lifting, rigging, positioning, or laying. Straps will be used for lifting.

C. Force Mains

   1. Design Specifics:

      a. Use c=130 for force mains for all flow calculations.

      b. Maintain a minimum cover of three (3) feet. Maximum cover is eight (8) feet with exceptions made on a case by case basis by HRSD’s Project Manager.

      c. Consider potential for future development in determining depth of cover.
d. Design the vertical alignment of the force main to provide a positive grade. Minimum desirable slope is 0.20%. Include the slope and elevations on the profile drawing. Provide a copy of the continuous profile for HRSD’s review as soon as the majority of the crossing utilities have been identified.

e. Limit maximum pipe joint deflections to 50% of manufacturer’s maximum allowable deflection.

f. When HRSD installs new pipe or replaces force mains under major roadway intersections, the project should be designed and constructed to minimize the need for HRSD to perform future maintenance, repairs, and tie-ins within the intersection. Best practices include: replacing all old piping and valves within the intersection, not leaving any active portion of existing force main within the intersection (which may be a future failure point), and configuring the terminus points of the intersection work to facilitate connection of future pipelines leading to the intersection. Design consideration should be given to enhance future worker safety and minimize future traffic disruptions associated with the operation and maintenance of the new force main.

g. Verified high points in the pipe profile shall be field tapped for insertion of a corporation stop for an air vent assembly in lieu of factory taps for the air vents based on the Bid Document drawing locations. A stainless steel tapping saddle shall be used. Where field taps are made the protective lining shall be repaired in accordance with manufacturer recommendations.

h. Design new force mains for a minimum pressure of 100 psi at the high point in the line. Obtain anticipated range of operating pressures from the HRSD Project Manager. This may require higher design pressures but will not be used to justify lower design pressures.
   i. HRSD will run the Interceptor System model to verify positive pressures at minimum flows or indicate the need for pressure sustaining valves.

i. Provide positive means of removing air from the ends of the lines during testing and all operating modes.

j. Isolation valve placement shall be:
   i. Force main valve placement at 2,500 lf to 3,000 linear feet using best engineering judgment. All mainline valves shall be restrained.
   ii. All pump stations shall have a mainline valve on both sides of the emergency pump connection.
   iii. All major creek crossings shall have a mainline valve, tee and branch valve on each side of the crossing.

k. Obtain local municipality and HRSD input on the location and size of outlet valves. Design in accordance with Section 36 - Standard Details in this manual.
l. The minimum distance between taps on an HRSD force main is 1,000 linear feet. Exceptions will be considered on a case by case basis by HRSD Interceptors and the HRSD Project Manager.

m. Indicate the limits of restrained pipe on the profile.

n. Specifics on pipe thrust restraint:
   i. Use manufacturer’s standard pipe restrained joints where restraint is required.
   ii. Do not use thrust blocks unless absolutely necessary at tie-ins to existing facilities and only after approval from HRSD Interceptor Operations and the HRSD Project Manager.
   iii. Wedge type retainer glands manufactured by EBAA, Sigma, Smith-Blair Camlok and Ford Meter box are acceptable.
   iv. Proprietary restraint systems, such as the U.S. Pipe “HP Lok” system, shall be considered on a case by case basis as recommended by the FIRM and HRSD Project Manager.

o. For ductile iron pipe, specify the following:
   i. Use special Class 51 minimum wall thickness.
   ii. Flanged joints, if used, shall be Class 125 per ANSI B16.1.
      1) The use of flanged pipe in buried conditions is not preferred. Use will be considered on a case by case basis by HRSD Interceptor Operations and the HRSD Project Manager.
   iii. Standard fittings shall be in accordance with AWWA C110 or AWWA C153.
   iv. Threaded bells shall not be used.

p. Use lined eccentric reducers; match grade at top of pipe.

q. The use of Foster® mechanical joint adaptors, as manufactured by Infact Corporation, for use on ductile iron pipe 6” through 36” diameter shall be allowed on a case by case basis. Justification for use shall be project specific and request for approval shall be provided in writing to the HRSD Project Manager.

r. In order to facilitate ease of pipeline tie-in and to correct for minor pipeline alignment discrepancies two (2) ductile iron long body sleeves to be designed at each tie-in. A single ductile iron long body sleeve may be used with the approval of HRSD Interceptors and the HRSD Project Manager based upon the alignment.

s. Provide sequence of construction and tie-in details for connections to ensure that connections can be accomplished without spills or interruptions to service. Use the checklist in Section 26 – “Checklist for Tie-Ins to Existing Interceptor Force Mains” within this manual.

t. Install tracer wire and utility marking tape on non-ferrous pipe installations, and utility marking tape on ferrous pipe installations unless otherwise directed. Tracer
wire access boxes shall be installed at a maximum distance of 400 feet. Do not use air vents or valve boxes as tracer wire access boxes. Section 36 – Standard Details, Detail No. 253 - Tracer Wire Locator Box shall be used for the tracer wire access point. There shall be adequate wire in the tracer wire access point to pull wire 24 inches outside of the box. Tracer wire to be tested for continuity as part of acceptance testing.

i. Copper tracer wire shall be 10 gauge, solid wire with plastic coating.

ii. Subsurface utility marking tape shall be of a durable, metalized, plastic film, for identification of all sanitary sewer lines. Bright green tape imprinted with the legend “Caution-Sewer Below” shall be used. The utility marking tape shall be manufactured by Griffolyn Co. or approved equal. Tape shall be placed no less than 6 inches and no more than 12 inches below the proposed finished grade.

u. For HDPE or PVC pipe, an appropriately sized mandrel may be required to be pulled through the pipe after installation to verify that allowable deflection has not been exceeded, if there are concerns about a section of installed pipe. Proper design and installation is required related to proper bedding, backfill, and compaction to prevent pipe deflection.

2. Hydrostatic Pressure Test Procedures:

a. Regarding use of the pressure gauge to be used for the hydrostatic test, the following options are identified. Coordinate with the HRSD Project Manager for the option to be utilized:

i. Contractor to provide the pressure gauge for acceptance test along with a certified validation of recent calibration of this gauge. Calibration shall be within 12 months of planned hydrostatic test date. Contractor to provide a valved connection point to allow installation and removal of the test gauge without affecting line pressure.

ii. HRSD to provide the pressure gauge for acceptance test along with a certified validation of recent calibration of this gauge. Contractor to provide a valved connection point to allow installation and removal of the test gauge without affecting line pressure.

b. Hydrostatic tests shall be a minimum duration of one hour. Test pressure at the high point in the new force main shall be 150% of operating pressure or 100 psi, whichever is less.

c. Contractor shall provide the capability to add water to the line during the test and will be required to add up to the allowable leakage at the end of the test period.

d. Allowable leakage shall be in accordance with Virginia Department of Environmental Quality (VDEQ) SCAT regulations and AWWA C-600 procedures.
e. Contractor shall open all outlet valves and end of line valves to allow testing of all blind flanges, plugs, etc.

f. Contractor shall install corporation stops at ends of line to remove air for testing. Plug these upon completion of testing.

g. Verify the appropriateness of the testing procedure for plastic pipe materials, if used. To account for expansion, prior to testing, HDPE pipe shall be filled to the required test pressure. The test pressure shall be maintained for a minimum of three (3) hours by adding make up water hourly as required. After three (3) hours water shall be added to reestablish test pressure and the actual test may begin.

h. The “Report of Hydrostatic Pressure Test” form to document the results is found in Attachment A to this Section.

i. Provide required pipe restraint to accomplish hydrostatic pressure test.

j. Pressure testing of new force main shall not take place against new or existing HRSD valves or extend into existing pipe or facilities without written approval from the HRSD Project Manager.

k. Hydrostatic pressure tests on taps to Prestressed Concrete Cylinder Pipe (PCCP) shall be for a duration of thirty (30) minutes at 50 psi for all tap sizes.

l. The Contractor or the FIRM shall notify the HRSD Pretreatment and Pollution Prevention (P3) Division and the appropriate Treatment Process Engineer for the receiving HRSD facility prior to discharging water used during hydrostatic testing. Notification shall be made a minimum of 24 hours in advance of the planned discharge.

D. Line Stops

1. The Design and Construction Divisions have seen the need for line stop and bypass system installations on force mains increase dramatically over the past decade. HRSD has also seen an increase in the number of line stop companies entering the wastewater market over this same period of time. The Master Specification 02531 – Line Stops on Sanitary Sewer Force Main Systems in Section 40 and the Checklist for Line Stop Installation in Section 25 of this manual are to be used for consistency for all line stop submittals and installations on HRSD force mains. This section establishes guidelines for HRSD staff and FIRMs for use and editing the HRSD Line Stop Master Specifications, including FIRM and personnel qualification requirements into the Bid Documents, and specific design considerations for line stops and bypass systems.

2. Design Considerations - The designer of line stops and bypass systems need to evaluate the following risks on a case by case basis:
a. How long will the line stop/bypass be in place? This issue needs to be discussed with HRSD Interceptor Systems and their knowledge of the force main system to determine if bypass through the line stop housing will be permitted verses a requirement to install additional tapping sleeves and valves for the bypass. The designer shall prepare head loss calculations for all bypass flows proposed through the line stop housing to compare different line stop companies and their published literature on housing design and head losses.

b. Does the interceptor system have a history of significant debris/rags at pump stations upstream and downstream of the project site? This issue is also important for a bypass design related to clogging risk and pressure spikes in the force main leading to a risk of pipeline failure and sanitary sewer overflows.

c. Can a zero or low flow (velocity 2 fps or less) situation be created to insert the line stop plug? This issue has arisen numerous times for recent past line stop installation, where the line stop field crew has requested a zero flow during insertion and removal of the stopper unit. This issue needs to be clarified with HRSD Interceptor Systems prior to the Bid Documents being advertised for construction bids.

d. What type of response would be necessary if the line stop housing becomes clogged and what are the overflow risks? Evaluate responses to include pump and haul scenarios at impacted pumping stations (HRSD, jurisdictional, private), response time to unclog the line stop housing, additional materials on site, and other backup plans. If bypass through the line stop housing is recommended by the designer and confirmed by HRSD, then the contingency plan development, submittal and approval must be incorporated into the Bid Documents.

3. Qualifications to be incorporated into Bid Documents - The following qualifications for the line stop firm and key personnel shall be incorporated into the Instructions To Bidders (Section 00200); Article 3 – Qualification of Bidders. Any revisions to these qualifications shall be coordinated and approved by HRSD’s Project Manager and the Engineering Contract Specialist.

3.01 To demonstrate needed qualifications for the Project, the apparent low Bidder and other Bidders as requested by the Owner or the Engineer shall submit a completed copy of the attached Questionnaire and documentation of experience required in Paragraphs 3.02, 3.03, and 3.04 within twenty-four (24) hours of the Bid opening. Additional information may be requested after the Questionnaires are received if, in the opinion of the Engineer, the information submitted is insufficient to complete the evaluation of the Bidder.

3.02 Bidders and sub-bidders shall be fully knowledgeable, competent, and experienced and shall meet the minimum requirements defined herein for the construction of line stops for similar projects. The Bidder and/or sub-bidder and their respective superintendents shall have successfully completed projects of similar length/size, material, diameter, and installation conditions as follows:
A. Line stop sub-bidder and the sub-bidder's on-site superintendent shall have experience with installation of at least five (5) line stops on 20-inch or larger cast iron, ductile iron, or prestressed concrete cylinder pressure pipelines over the past five (5) years. Additional line stop sub-bidder experience requirements are listed in Article 3.04 below.

B. Self-performing of line stops by the General contractor shall not be permitted. This includes installation of “bag stops”.

3.03 The Bidder shall provide required documentation for their experience, for sub-bidder’s experience, and for all on-site superintendents’ experience. Documentation shall include project titles, Owner’s and Engineer’s names, addresses and phone numbers, lengths, diameters, and materials of construction, and project values. Attach additional pages to the questionnaire as necessary to provide this information.

3.04 Qualifications of Line stop Sub-Bidder:

A. The line stop sub-bidder shall have a minimum of five (5) years documented, uninterrupted service with furnishing line stop equipment for sanitary sewer force mains on the type and size of pipe described in the description of work. Provide detailed reference information including:

1. Project name, location of the work, and start and completion dates.

2. Description of project including equipment provided, size of pipe, and type of force main.

3. Project owner contact information, including their contact name, address, phone and e-mail.

4. General contractor name, their contact person, address, phone and e-mail.

B. The line stop sub-bidder shall have completed five (5) successful line stop installations for sanitary sewer force main systems over the past five (5) years and shall provide the following information:

1. Project name, location of the work, and start and completion dates.

2. Description of project including services provided, size of pipe, and type of force main.

3. Project Owner contact information, including their contact name, address, phone and e-mail.
4. General contractor name, their contact person, address, phone and e-mail.

C. The line stop sub-bidder shall have a minimum of two (2) line stop superintendents currently employed with their company. Each line stop superintendent shall have a minimum of three (3) years continuous employment with the line stop company and shall provide the following information:

1. Names of a minimum of two (2) line stop superintendents currently employed with line stop sub-bidder, including number of years of employment with line stop sub-bidder’s company.

D. Each line stop superintendent shall have completed three (3) successful line stop installations for sanitary sewer force main systems over the past three (3) years. Provide the following information:

1. Project names, location of the work, and start and completion dates.
2. Description of projects including services provided, size of pipe, and type of force mains.
3. Project owner contact information, including their contact name, address, phone and e-mail.
4. General contractor name, their contact person, address, phone and e-mail.

E. The line stop sub-bidder shall have an established training program for their employed line stop superintendents. Copies of the line stop sub-bidder training program shall be submitted. The line stop superintendent shall have appropriate training on the equipment that is to be used. All line stop superintendents proposed for this work must be graduates of the training program. Submit copies of the following:

1. Copies of line stop sub-bidder training program.
2. Copies of training certifications for a minimum of two (2) line stop superintendents currently employed by line stop sub-bidder’s company.

F. The line stop sub-bidder shall utilize a qualified licensed professional engineer(s) to review all orders, ensure proper design, verify tolerances, and ensure that all services (standard or special) are completed in accordance with applicable AWWA, ANSI, and/or ASME codes. This
engineer(s) must be capable of quantifying the range of hydraulic loss through the line stop system and have sufficient pipe design and restraint experience/knowledge with (at a minimum) the pipes specifically listed in the description of work. All submittals from the line stop sub-bidder must be stamped by the referenced licensed professional engineer(s).

4. Liquidated Damages - consideration should be given by the designer for Liquidated Damages to be included in the Agreement for Emergency Designation Projects for late delivery and installation of line stops / bypass system after an agreed upon date by HRSD and the line stop company and/or General Contractor.

E. Valves

1. Gate valves and plug valves shall be considered in the design, and specified as appropriate per the particulars of each project. At present, HRSD allows both gate valves and plug valves for direct bury applications with approval by the valve manufacturer for such use with raw wastewater.

   a. For large diameter valves, consider the length of bonnet and location of valve nuts (main and bypass) when determining force main alignment.

   b. All valves shall be fully opened and closed for one cycle before installing to verify operation and record actual number of turns. Certified maximum operating torque on the valve shaft and the mechanical advantage of any geared actuator shall be provided by the manufacturer and shall be included on the shop drawing submittal provided to HRSD.

   c. Valves shall be capable of drip-tight, bi-directional shutoff.

   d. Bi-directional hydrostatic testing of valves shall be conducted by the valve manufacturer. A certificate of compliance, including test methods and results, shall be provided to HRSD for each valve and included with the shop drawing submittal to the HRSD Project Manager. Minimal acceptable test pressures shall be in accordance with applicable AWWA valve standards (C-500, C-509, C-515 and C-517) for the valve type specified.

   e. Mainline plug valves to be installed on concrete pipe force mains may require special bedding. The FIRM to evaluate the loading, strain, and settlement potential of the valve and the connecting pipes and develop installation details, plan notes, and technical specification language as needed for the development of the Bid Documents and Drawings.

   f. The following requirements shall be used for the specific type valve to be installed:

      i. Valves three inches and larger shall be designed for a cold working pressure of not less than 150 pounds per square inch and tested at a pressure of not less
than 300 pounds per square inch. Valves 16 inch and smaller shall operate in a vertical position and valves over 16 inches shall operate in a horizontal position. Gearing, 4:1 ratio, shall be provided on valves 16 inches and larger. Gear cases and shafts shall be the “totally enclosed type, suitable for buried service.” Valves shall be furnished with a standard wrench nut (two inch), shall be of non-rising stem configurations and shall open left (counter-clockwise). Valve ends shall be provided as indicated in the construction documents. Specified valves shall be in conformance with one of the following requirements.

1) Resilient wedge Seated Gate Valve – Shall conform to AWWA C509 or C515 and be fusion bonded epoxy coated on both the interior and exterior of the valve and in accordance with AWWA C550. Resilient seated gate valves shall not be used in the horizontal position.

2) Double Disc, Parallel Seat Gate Valve – Shall conform to AWWA C500 and shall be coated with an asphaltic varnish in compliance with NSF-61. Seats in the body shall be replaceable without removing the valve from the pipeline. Discs are to be free to revolve 360 degrees. Discs shall be cast iron and bronze faced. Valves installed in the horizontal position shall be furnished with bronze rollers, bronze tracks and bronze scrapers. Valves in accordance with Section 4.4.8.1.1 of AWWA C500 will not be allowed. Bypasses shall be provided on double disc gate valves 36 inches and larger.

3) Eccentric Plug Valve – Shall conform to AWWA C517 and shall have an exterior and interior coating of epoxy. Valve body and plugs shall be ASTM A 126 Class B cast iron. Plugs shall be solid one piece with a cylindrical seating surface eccentrically offset from the center of the shaft. Plug facing shall be Buna-N with a minimum hardness (Shore A) of 70 durometer. Seats shall be welded in overlay of minimum 1/8” inch thick nickel raised surface. Bearings shall be permanently lubricated 316 stainless steel. Packing shall be multiple v-type or u-cup type. Washers at the top and bottom of the plug journal shall be provided to keep grit and debris out of the bearings and packing. Plug valves in the horizontal position shall be installed so that the plug rotates upward as the valve opens. The operator nut and stem shall be protected with a collar during shipping and installation.

For exposed service applications plug valve shaft seals shall be externally adjustable and repackable without removing the actuator or bonnet from the valve under pressure. The actuator mounting bracket shall allow access to the packing gland and provide an air gap to visually inspect the packing.

For buried service applications shaft seals shall be fully enclosed and protected from the surrounding groundwater and soil via full
circumferential metal to metal contact between the bonnet and the actuator body or by other means as approved by HRSD.

2. Disposition of existing inline valves to be taken out of active service is as follows:
   a. Valves oriented horizontally shall be opened fully and abandoned in place after the valve is inspected for deterioration. If HRSD, or FIRM, determines deterioration may compromise future integrity of the interceptor force main the valve shall be removed.
   b. Valves oriented vertically shall be removed unless otherwise approved by HRSD Project Manager.
      i. For vertically aligned valves that are not practical to remove, then develop a sequence to remove the actuator and working components, and then install a gasketed flange plate.
   c. All existing branch valves on the affected section of the interceptor force main shall be replaced.

3. Automatic air release valves may be approved for use in the HRSD system on a case by case basis, reviewed for use and approval by the HRSD Project Manager and with concurrence from HRSD’s Operations Department.

F. Gravity Interceptors and Manholes

1. Use n=0.013 for gravity interceptors for all flow calculations.

2. General flow information will be provided based on HRSD’s Regional Hydraulic Model. Final line sizing must consider the pump capacity of the pump stations discharging into the line.

3. Provide smooth transitions at connections, manholes and structures to minimize turbulence and release of hydrogen sulfide.

4. For manholes on large diameter lines (>20”), at force main discharge manholes, and at heavily traversed or difficult operating locations, manholes shall be made of corrosion proof materials. Use of corrosion proof materials for manholes, frames and covers at all other locations will be considered on a case by case basis as recommended by the FIRM and HRSD Project Manager.

5. Testing
   a. Perform infiltration, exfiltration or air testing in accordance with VDEQ SCAT regulations.
   b. Consider pulling mandrel through completed lines to verify that the pipe is not deflected beyond the manufacturer’s specified deflection limits.
### Report of Hydrostatic Pressure Test

<table>
<thead>
<tr>
<th>Date</th>
<th>Contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Pipe</td>
<td></td>
</tr>
<tr>
<td>Pipe Diameter (inch) [D]</td>
<td></td>
</tr>
<tr>
<td>Length Tested (feet) [S]</td>
<td></td>
</tr>
<tr>
<td>From Station</td>
<td></td>
</tr>
<tr>
<td>To Station</td>
<td></td>
</tr>
<tr>
<td>Location of Test Gauge</td>
<td></td>
</tr>
<tr>
<td>Line Filled for 24 Hours?</td>
<td>Yes</td>
</tr>
<tr>
<td>Test Pressure Used (psi) [P]</td>
<td></td>
</tr>
<tr>
<td>Start Time of Test</td>
<td>AM</td>
</tr>
<tr>
<td>End Time of Test</td>
<td>AM</td>
</tr>
<tr>
<td>Allowable Leakage (gal/hr) [L]</td>
<td></td>
</tr>
<tr>
<td>Actual Leakage (gallons)</td>
<td></td>
</tr>
<tr>
<td>Test Passed?</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Hydrostatic Test Formula:

\[
L = \frac{SD(P)^{0.5}}{148,000}
\]

Where:

- \(L\) = Allowable leakage, in gallons/hr.
- \(S\) = Length of pipe tested, in feet.
- \(D\) = Nominal diameter of the pipe, in inches
- \((P)^{0.5}\) = Square Root of average test pressure during leakage test, in psig

### Remarks:

- 
- 
- 

### Signatures:

<table>
<thead>
<tr>
<th>Inspector</th>
<th>Contractor Individual</th>
<th>HRSD Individual</th>
</tr>
</thead>
</table>

### Distribution:

HRSD / Engineer / Contractor
Section 25 - Checklist for Line Stop Installations

A. Introduction - The Design and Construction Divisions have seen the need for line stop and bypass system installations on force mains increase dramatically over the past decade. HRSD has also seen an increase in the number of line stop companies entering the wastewater market over this same period of time. The Line Stop Master Specification 02531 included in Section 40 of this manual strives for consistency for all line stop submittals and installations on HRSD force mains. This section establishes procedures for use of the developed Line Stop Checklist for HRSD staff and Professional Services firms (FIRM).

B. Completion and Submittal of “Checklist for Line Stop Installations”

1. The FIRM shall use the attached template form to coordinate with the Contractor to confirm that each step in the planning process for upcoming line stops is well thought out and resources are available.

2. The FIRM shall submit a copy of the completed checklist to the HRSD Project Manager at the completion of each line stop.

3. The Project Manager shall file a digital version of each checklist in the appropriate location.

End of Section
Attachment A

Checklist for Line Stop Installations

This checklist is to be used by the Line Stop contractor as a planning worksheet and progressive sign off on listed steps accomplished during the line stop procedures. This completed form to be presented to HRSD, or acting site representative, at the conclusion of each line stop installation.

<table>
<thead>
<tr>
<th>√ Pre-installation and Site Review</th>
<th>Technician sign off</th>
<th>Inspector sign off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Force main pressure (psi at intended line stop time)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Force main pipe material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Force main pipe outside diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Force main schedule / classification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Force main flow rate (gpm at intended line stop time)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verification of minimum distance needed from pipe joint or observed fittings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verification of egress requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verification of rigging and equipment support requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verification of line stop insertion time of day and date</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Determination of need for shift crews to complete job</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verification that necessary work permits acquired</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verification of handling / disposal plan for any sanitary sewage discharge from the pipe when line stop is removed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verification of line stop pressure withdrawal equalization procedures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verification of completion plug equalization procedures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect hot tap machine, cutter size, pilot length, line stop machine and verify all measurements prior to commencing the hot tap.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect all pre-assembled joints for integrity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>√ Equipment / Materials</th>
<th>Technician sign off</th>
<th>Inspector sign off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot tap fitting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full opening valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line stop fitting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot tapping machine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line stop cutter and pilot assembly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot tap adapter with vent valve and pressure gauge port</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulic power unit and hoses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line stop machine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line stop housing with pressure gauge port</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line stop head</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completion plug holder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure gauge and needed piping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soapstone and indicator collet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extra varying sized stopple gaskets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Properly sized HDPE bypass pipe (if bypass flow through the housing body is required)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation Procedures</td>
<td>Technician sign off</td>
<td>Inspector sign off</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------------</td>
<td>---------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Verify HDPE pipe has been properly fused together along with required fittings, that</td>
<td></td>
<td></td>
</tr>
<tr>
<td>proper length has been measured between line stop housings, and that pipe has been</td>
<td></td>
<td></td>
</tr>
<tr>
<td>successfully hydrostatically tested if a bypass system using through the line stop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>housing is to be utilized for required work.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify alignment of the valve bore with the inside diameter of the fitting after</td>
<td></td>
<td></td>
</tr>
<tr>
<td>installation of the service valve on the line stop fitting.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify inspection of service valve and fitting for foreign materials, proper operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and bore size.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify installation of the hot tap machine, centering it to the service valve.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify marking for the “Lower In” on the hot tap machine using soapstone or indicator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>collet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify lowering of the boring bar into position.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify the “Lower In” distance.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify joint integrity test on final makeup. If joint integrity test is greater than</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 times the operating pressure, retract the boring bar and close the hot tap valve.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify marking the “Pilot To Cutter” and “Cutter On Pipe” using soapstone.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify marking the “Maximum Cut Out” on the hot tap machine using an indicator collet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify the gauge on the air caddy indicates the minimum air pressure (or hydraulic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pressure) to operate hot tap machine.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify pilot penetrates the pipe prior to lowering the “Cutter on Pipe”.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify the “Pilot to Cutter”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify cutter is tight with a measuring rod when the machine is off.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify cut out by extending the cutter to the “Maximum Cut Out” mark after cutter has</td>
<td></td>
<td></td>
</tr>
<tr>
<td>reached the “Book Cut Out” mark.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify the “Maximum Cut Out” distance has not been exceeded.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify the boring bar has been retracted and service valve has been closed following</td>
<td></td>
<td></td>
</tr>
<tr>
<td>completion of tap.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify the tap has been depressurized prior to removing the hot tap machine.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify venting fluids have been collected for proper disposal.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Record the wall thickness of the removed pipe coupon and present this information along</td>
<td></td>
<td></td>
</tr>
<tr>
<td>with the coupon to the Inspector.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify the pipe wall thickness is consistent with wall thickness that line stop based</td>
<td></td>
<td></td>
</tr>
<tr>
<td>upon prior to installing the line stop machine.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify a joint integrity test performed on final makeup.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify with the Owner's representative that flow in the pipe is as per approved plan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>for successful line stop insertion.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify the line stop head is in the proper set position.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify proper seal and depressurize downstream of the line stop head.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Install HDPE pipe between line stop units if design specifies a bypass through the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>line stop housing to accomplish required work downstream of line stop(s).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task</td>
<td>Completion</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>Verify completion of required work downstream of the line stop head</td>
<td></td>
<td></td>
</tr>
<tr>
<td>prior to equalizing pressure on the downstream side of the line stop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify equalization of pressure on each side of the line stop plug</td>
<td></td>
<td></td>
</tr>
<tr>
<td>using a pressure gauge following completion of necessary pipe work.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify closure of service valve following retracting line stop head.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify depressurization of line stop machine prior to removing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify proper installation of the completion plug into the hot tap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>adapter following removal of line stop machine.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify joint integrity test performed on final makeup following</td>
<td></td>
<td></td>
</tr>
<tr>
<td>attachment of the hot tap machine to the service valve.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify pressure equalized on the top of the completion plug following</td>
<td></td>
<td></td>
</tr>
<tr>
<td>opening of the service valve.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify the completion plug is in the proper set position by</td>
<td></td>
<td></td>
</tr>
<tr>
<td>measurements.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify the recommended tightening procedures have been completed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>prior to attempting to extend and retract plug, assuring completion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>plug properly set.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Release tapping machine from completion plug and retract boring bar.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify completion plug seal by depressurizing the hot tap machine.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fully retract boring bar and remove hot tap machine.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify removal of service valve and completion plug holder.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify proper installation of blind flange to the fitting.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 26 - Checklist for Tie-Ins to Existing Interceptor Force Mains

A. **Introduction** - Professional Services firms (FIRM), under the direction of HRSD’s Engineering Department, Design and Construction Divisions, are required to work closely with Contractors who are preparing to connect to or work on an active force main. HRSD developed tie-in checklists that have been based upon our progressive learning throughout the years of doing and preparing for tie-ins. The attached checklist is to be used in conjunction with Specification Section 01520 Maintenance of Pipeline Operations in this manual to properly plan and execute the plan for a successful tie-in.

B. **Completion and Submittal of “HRSD Checklist for Tie-Ins to Existing Interceptor Force Mains”**

1. The FIRM shall use the attached template form to coordinate with the Contractor to confirm that each step in the planning process for upcoming tie-ins is well thought out and resources are available.

2. The FIRM shall submit a copy of the completed checklist to the HRSD Project Manager / Task Manager at the conclusion of a successful tie-in.

3. The Project Manager / Task Manager shall file a digital version of each checklist in the appropriate location.

End of Section
### Attachment A

**HRSD**

**CHECKLIST FOR TIE-INS TO EXISTING INTERCEPTOR FORCE MAINS**

(to be used in conjunction with Maintenance of Pipeline Operations Specification)

<table>
<thead>
<tr>
<th>Project Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of Tie-In:</td>
</tr>
<tr>
<td>Size:</td>
</tr>
<tr>
<td>Scheduled Date of Tie-In:</td>
</tr>
<tr>
<td>Alternate Date:</td>
</tr>
<tr>
<td>Date of Pre-Tie-In Meeting:</td>
</tr>
<tr>
<td>Time of Pre-Tie-In Meeting:</td>
</tr>
<tr>
<td><strong>CONTRACTOR:</strong></td>
</tr>
<tr>
<td>CONTRACTOR’S Contact Person:</td>
</tr>
<tr>
<td>Cell Phone:</td>
</tr>
<tr>
<td>HRSD Project Manager:</td>
</tr>
<tr>
<td>Cell Phone:</td>
</tr>
<tr>
<td>FIRM’s Contact Person:</td>
</tr>
<tr>
<td>Cell Phone:</td>
</tr>
<tr>
<td>FIRM’s Inspector:</td>
</tr>
<tr>
<td>Cell Phone:</td>
</tr>
<tr>
<td>City/County where Tie-In will take place:</td>
</tr>
<tr>
<td>City /County Contact Person:</td>
</tr>
<tr>
<td>Cell Phone:</td>
</tr>
<tr>
<td>Jurisdictional Pump Station(s) to be Shut Down:</td>
</tr>
<tr>
<td>Time of Shutdown:</td>
</tr>
<tr>
<td>Other Jurisdictional / Government / Private Pump Station(s) affected by Shut Down:</td>
</tr>
<tr>
<td>Why:</td>
</tr>
<tr>
<td>Location to take Sewage from Shutdown:</td>
</tr>
<tr>
<td>(include map and details on receiving facilities)</td>
</tr>
<tr>
<td>Location to take Grit/Material from Shutdown:</td>
</tr>
<tr>
<td>(include map and details on receiving facilities)</td>
</tr>
<tr>
<td><strong>CONTRACTOR will Blow Air:</strong> YES NO</td>
</tr>
<tr>
<td>Start Time:</td>
</tr>
<tr>
<td>Air Injection Location:</td>
</tr>
<tr>
<td>Planned time at which service will be restored: A.M. / P.M.</td>
</tr>
<tr>
<td>Latest worst-case time at which service will be restored: A.M. / P.M.</td>
</tr>
<tr>
<td>Special Conditions or Requirements:</td>
</tr>
</tbody>
</table>
Attach Contractor's Work Plan Below

**Contractor's Work Plan**
(List detailed step-by-step procedure with approximate times for each step / milestone)

**Contractor's Contingency Plan**
(List steps to be taken by the Contractor / Subcontractors if something goes wrong)
Preparation Checklist:
Have the following issues been brought to the Contractor's attention and adequately addressed?

☐ Interim Valve Guides submitted and approved
☐ Interim Record Drawings submitted and approved
☐ Jurisdictional approved Traffic Control Plan
☐ Dewatering System; Method __________________________
☐ Number of Crews _____; Number of Workers _____
  (separate crews required for each 12-hour or longer shift)
☐ Pipe exposed to limit of tie-in. No additional excavation required for tie-in.
☐ Check and confirm dimensions of existing pipe and proposed pipe
☐ Stone in Excavation to provide working area
☐ Tanker Trucks; number of trucks _____
☐ Staging Area of Tanker Trunks near Excavation
☐ Confirm length of Vac-haul / Tanker Truck suction hose adequate length for desired wetwell sewage level during pump & haul
☐ Suction pipe/well point discharge must be hauled to sanitary sewer
☐ HRSD Pump Around & No Charge Policy (4/29/2011)
Air Vent must be at high point; will be used to blow off air when pipe is pressurized; Contractor to have a valve and riser pipe available for immediate installation. Contractor to provide a 50 gallon drum at designated Air Vent for any sewage release during air venting.

Compressor (Blowing Air); Include a map of the compressor location if to be used

Confirmation that HRSD has exercised valves per the Valve Operations Request and is prepared for the valve closure / opening support.

Lights on-site and in working condition

Material Checklist:

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>REQ'D #/LENGTH</th>
<th>QUANTITY ON-SITE</th>
<th>VERIFIED BY</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bends / Fittings</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleeves (minimum of 2 long body type)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restrained Pipe</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mega-Lugs or approved equal</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Extra Pipe</td>
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</tr>
<tr>
<td>Shrink Wrap or other approved pipe / fitting wrap</td>
<td></td>
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<tr>
<td>Adaptors to Existing Pipe</td>
<td></td>
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<tr>
<td>Insulated joint (polyethylene spool piece or as otherwise approved) if specified</td>
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<tr>
<td>Utility warning tape</td>
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<tr>
<td>#57 Stone</td>
<td></td>
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<tr>
<td>Project specific stone and other backfill materials in anticipation of backfilling in</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATERIAL</td>
<td>REQ'D #/LENGTH</td>
<td>QUANTITY ON-SITE</td>
<td>VERIFIED BY</td>
<td>DATE</td>
</tr>
<tr>
<td>-------------------------------------</td>
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<tr>
<td>heavy rain event.</td>
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<tr>
<td>Surveying Equipment / GPS Equipment</td>
<td></td>
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</tr>
<tr>
<td>Ladders per OSHA regs</td>
<td></td>
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<td></td>
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<tr>
<td>Trench Box / Sheeting</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Lights</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generator(s)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Pipe Saw</td>
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<tr>
<td>Air compressor and attachments / wrenchs</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Torque wrench(s)</td>
<td></td>
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<td></td>
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<tr>
<td>Fuel for generators and other critical equipment</td>
<td></td>
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</tr>
<tr>
<td>Other:</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Acceptance Checklist**  
Prior to Backfilling

- [ ] Adequate temporary thrust restraint
- [ ] Air Vent riser pipes are installed correctly; corporation stop is OPEN.
- [ ] Joints are to be left exposed while pressure is restored
- [ ] HRSD confirmed that line is ready for testing (air is out of line).
- [ ] Pre Shutdown Pressure has been restored to line for one hour.
- [ ] No leaks by visual check and feeling by hand around joints.
- [ ] Bolts on Mega-Lugs (or other approved system) are tight and wedging nuts are broken off.
- [ ] Measurements and X-Y-Z coordinate data have been taken in the connection area (for record drawings / Valve Guides).
- [ ] Photos of New Piping for GIS
Soil density compaction tests performed (if under pavement)

Pressure Before Shutdown: ____________ Time: ____________

End of Section
Section 27 - Trenchless Crossing Installations

A. Introduction – In this section, information is presented on trenchless crossing techniques under railroads, waterway, and environmentally sensitive areas.

B. General Evaluation Criteria

1. The FIRM shall consider and evaluate appropriate trenchless technologies including conventional techniques in the preliminary engineering report (PER) stage.

2. Consider space required for setup and installation equipment.

3. Require final acceptance leakage testing and use of a mandrel or other approved method to verify deflection and minimum internal diameter requirements as appropriate.

C. New Trenchless Pipe Installations - FIRM, under the direction of HRSD’s Engineering Department, Design and Construction Divisions, are required to work closely with contractors who are preparing to use approved trenchless crossing means and methods for installation of force mains or gravity sewer mains. HRSD developed a checklist that has been based upon our progressive learning by doing and preparing for jack and bore operations. This checklist is located in this standards manual in Section 28 – Jack and Bore Crossing Operations and is to be used, completed and submitted to HRSD jointly by the Inspector and Contractor.

1. Horizontal Directional Drilling (HDD) – HRSD has used HDD primarily for river crossings and other long crossings of environmentally sensitive areas. It can be considered for new construction or pipe replacement.

   a. Measurement and payment for HDD projects shall be on a lump sum basis paid to the Contractor upon successful completion (as defined in the Bid Documents) of each crossing. Success installation includes verification of hydrostatic and other specified testing requirements,

   b. The FIRM to consider the limitations of materials for use with HDD projects on a case by case basis, and make a recommendation to HRSD during the preliminary engineering phase.

   c. For WSP, provide external coatings on steel pipe using fusion-bonded epoxy. Internal linings are also required and may vary depending on the pipe diameter. Perform a corrosion analysis study and specify a cathodic protection system as necessary.
d. Removal of internal weld beads for 24-inch pipe diameter and larger is required for fused HDPE due to the size of the bead and likely impact on velocity and debris accumulation.

e. Require a ground grid system or other equipment to ensure accuracy of the pipe at the exit point.

f. Require the Contractor to provide a pilot hole survey alignment, to be approved by the FIRM, prior to commencement of the reaming operation.

g. Locate soil borings so that they will not be over the centerline of the pipe. Borings are a potential blowout point for drilling mud.

h. Consider the environmental impacts of this construction method including location of entry and exit points, depth of cover and disposal of drilling mud and spoils.

i. Consider the land and alignment requirements needed for both the drill rig and the pull-back pipe.

j. Delineate a water source for drilling mud make-up in the contract documents.

k. At the conclusion of a successful HDD project and prior to connection to other pipe sections, XYZ coordinates to be collected by the HDD installer and tied to project coordinates to create accurate recorded installation information to be incorporated into HRSD’s record drawings and GIS. This requirement may be waived only with advance approval by HRSD’s Project Manager.

2. Jack & Bore and Microtunneling - HRSD has used jack & bore and microtunneling methods in various locations where traditional open cut and HDD are not accessible and/or economically feasible. It should be considered where applicable for new construction or replacement.

a. Measurement and payment for jack & bore, microtunneling, and similar trenchless methods for installation of casings and pipeline projects shall be on a lump sum basis paid to the Contractor upon successful completion (as defined in the Bid Documents) of each crossing.

b. Steel pipe shall be used as the casing material and shall be in accordance with the latest edition of applicable ASTM standards unless otherwise approved in writing by HRSD’s Project Manager and allowed by the permitting agency.

c. Permalok pipe joining system may be considered on a case-by-case basis as an acceptable method to butt welds for adjoining steel casing pipe sections.

d. Casing pipe design shall include casing spacers, bulkhead at each pipe end, and leak detection.
e. High density polyethylene (HDPE), Ductile Iron (DI), and Polyvinyl Chloride (PVC) should be evaluated as pipe material for the carrier pipe. Removal of internal weld beads for 24-inch pipe diameter and larger is required for fused HDPE.

f. FIRM shall give special consideration to the extents of the casing pipe in the design to account for future road improvements and for maintenance or repair of the installed pipeline.

g. The bored hole shall be minimally larger than the outside diameter of the casing pipe as over-cutting by the cutting head could lead to excessive soil removal and possible ground settlement.

h. The FIRM shall evaluate if corrosion protection is required on the casing pipes.

i. Consider the environmental impacts of this construction method including location of entry and exit points, depth of cover and disposal of drilling mud and spoils.

j. For slurry microtunneling installations, locate soil borings so that they will not be over the centerline of the pipe. Borings are a potential blowout point for drilling mud. Consider requiring the Contractor to grout the bore holes with cement if practical to reduce a soil fracture.

k. Consider the area needed for both the jacking pit and receiving pit.

l. Jack & bore historically has been used for relatively short crossings or under secondary roadways. Evaluation of appropriateness of this method by the Engineer for each installation is needed.

m. Microtunneling historically has been used for long crossings or heavily traveled roadways. Evaluation of appropriateness of this method by the Engineer for each installation is needed.

3. Ground Penetrating Radar (GPR) shall be considered for use on all projects involving trenchless pipe installation. The GPR testing is recommended for the following:

a. Pre-construction to help identify near surface voids, unknown utilities and obstructions not identified by subsurface utility designation.

b. Following dewatering of the trenchless launching / receiving pits to the planned groundwater elevation and prior to advancing casing or pipe.

c. Post-construction to help identify any voids created as part of the trenchless pipe operation.
d. GPR testing requirements when utilized, including the limits of testing, shall be written into the contract documents by the FIRM and shall be included as a bid item. When used, GPR testing shall include a real time imaging, recordable output that can be viewed on a computer screen and printed without the use of proprietary software. The test area shall be laid out in a grid fashion over the existing plans and shall be referenced using swing ties, State Plane Coordinates, latitude/longitude or other means to allow the contractor to reestablish the grid in order to conduct post-construction GPR testing. The FIRM shall evaluate the subsurface conditions and make recommendations as to the type of GPR required. At a minimum 2D scans and reports shall be required and discussion on the testing done and technology used in final submitted reports. One of the scans to be performed following lowering of the groundwater table to the elevation necessary for preparation for the trenchless installation. Note that GPR results are not reliable below ground water levels.
Section 28 - Checklist for Trenchless Crossing Installations

A. Introduction - Professional Services firms (FIRM), under the direction of HRSD’s Engineering Department, Design and Construction Divisions, are required to work closely with Contractors who are preparing to use approved trenchless crossing means and methods for installation of force mains or gravity sewer mains under roadways and waterways. HRSD developed a trenchless crossing checklist that has been based upon our progressive learning by doing and preparing for these installations. The attached checklist is to be used in conjunction with Section 27 – “Trenchless Crossing Installations” of this manual.

B. Completion and Submittal of “Checklist for Trenchless Crossing Installations”

1. The FIRM shall use the attached template form to coordinate with the Contractor to confirm that each step in the planning process for upcoming trenchless crossings is well thought out and resources are available.

2. The FIRM shall submit a copy of the completed checklist to the HRSD Project Manager / Task Manager prior to the trenchless crossing attempt.

3. The Project Manager / Task Manager shall file a digital version of each checklist in the appropriate location.

End of Section
## Checklist for Trenchless Crossing Installations

### JACK AND BORE INFORMATION

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Description</th>
<th>Information Provided (By Contractor)</th>
<th>Verified in Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Schedule of Trenchless Operations (Projected Start Date &amp; End Date)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Location of Trenchless Crossing (Intersection, Cross Street, Etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Length of Casing Pipe (ft.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Casing Pipe Diameter (in.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Carrier Pipe Diameter (in.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### CONTRACTOR WORK PLAN

(List step-by-step procedures with approximate dates/times)

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
<th>Approximate Dates/Times</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

### CONTRACTOR’S ROADWAY SETTLEMENT CONTINGENCY PLAN

(List actions to be taken if settlement is observed in roadway due to trenchless crossing operations)

<table>
<thead>
<tr>
<th>Action</th>
<th>If Settlement Occurs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Due to Trenchless Crossing Operations</td>
</tr>
</tbody>
</table>

### CONTRACTOR’S OPERATIONAL CONTINGENCY PLAN

(List actions to be taken if an unexpected object is encountered which prevents casing pipe progression)

<table>
<thead>
<tr>
<th>Action</th>
<th>If Unexpected Object Encountered</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prevents Casing Pipe Progression</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CONTRACTOR’S EQUIPMENT CONTINGENCY PLAN

(List actions to be taken if an unexpected mechanical failures are encountered)

EXISTING UTILITY COORDINATION CHECKLIST (CHECK IF NOTIFIED)

√  EX. UTILITY (INSERT JURISDICTION)  Emergency Contact  Contact Number
<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>________</td>
<td>________</td>
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<td>________</td>
<td>________</td>
</tr>
</tbody>
</table>

**SPECIAL CONDITIONS OR REQUIREMENTS**

- Verizon
- Cox Communications
- Dominion Virginia Power
- Virginia Natural Gas
- Level 3 Communications
- Other:_________________
- Other:_________________
- Other:_________________
- Other:_________________
# PREPARATION CHECKLIST (PRIOR TO TRENCHLESS CROSSING OPERATIONS)

<table>
<thead>
<tr>
<th>Checklist Item</th>
<th>Notes/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have proper maintenance of traffic been implemented suitable for this work?</td>
<td></td>
</tr>
<tr>
<td>Have proper shoring (well sheeted and braced) and dewatering methods been implemented as necessary to provide safe and adequate access?</td>
<td></td>
</tr>
<tr>
<td>Are there areas outside the excavation where the roadway and/or utilities have been undermined?</td>
<td></td>
</tr>
<tr>
<td>Are required gas detecting meters on site and operational for pit entry and welding operations?</td>
<td></td>
</tr>
<tr>
<td>Are all components of trenchless crossing equipment required to successfully complete the bore on site and/or readily available?</td>
<td></td>
</tr>
<tr>
<td>Are typical spare parts for the trenchless crossing equipment on site and/or readily available?</td>
<td></td>
</tr>
<tr>
<td>Has the Contractor familiarized himself with the available surface and subsurface data?</td>
<td></td>
</tr>
<tr>
<td>Has the Contractor, the Owner’s Representative, and Jurisdictional Representative surveyed the area to identify existing areas of settlement?</td>
<td></td>
</tr>
<tr>
<td>Has the Contractor, the Owner’s Representative, and Jurisdictional Representative surveyed the area to identify any existing cracking of pavement?</td>
<td></td>
</tr>
<tr>
<td>Has the contractor performed a subsurface survey utilizing Ground Penetrating Radar (GPR)?</td>
<td></td>
</tr>
<tr>
<td>Are specialized bits/augers readily available if hard/course materials are encountered?</td>
<td></td>
</tr>
<tr>
<td>Are specialized bits/augers readily available if extremely soft materials in encountered?</td>
<td></td>
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<tr>
<td>Has a surface settlement monitoring grid system been implemented as required?</td>
<td></td>
</tr>
<tr>
<td>Has any existing utilities been disturbed, offset, or relocated as a result of jack and bore pit excavation?</td>
<td></td>
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<tr>
<td>Other:___________________________</td>
<td></td>
</tr>
<tr>
<td>Other:___________________________</td>
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</tbody>
</table>
## ACCEPTANCE CHECKLIST (AFTER JACK AND BORE OPERATIONS)

<table>
<thead>
<tr>
<th>√</th>
<th>Checklist Item</th>
<th>Notes/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Has the Contractor backfilled the entry/receiving pits in accordance with the contract documents?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Has all site restoration been completed in accordance with the contract documents and considered acceptable to the Jurisdiction?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Did the surface settlement monitoring grid system indicate any surface settlement?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Has the Contractor, the Owner’s Representative, and Jurisdictional Representative surveyed the area to identify new areas of settlement?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Has the Contractor, the Owner’s Representative, and Jurisdictional Representative surveyed the area to identify any new cracking of pavement?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Has the contractor performed a subsurface survey utilizing Ground Penetrating Radar (GPR)?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Were record documents marked up to record any offsets or replacements of existing utilities?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other:___________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other:___________________________</td>
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</tr>
</tbody>
</table>

## SPECIAL CONDITIONS OR REQUIREMENTS


End of Section
Section 29 - Rehabilitation of Sanitary Sewer Systems

A. Introduction – In this section, information is presented on processes for rehabilitation projects. Separate sections are also included on cleaning, closed-circuit television (CCTV), diversion pumping, and general items, which apply to most rehabilitation projects. The FIRM shall also be familiar with the HRPDC Regional Construction Standards latest edition for the sanitary sewer system rehabilitation means and methods.

B. General Evaluation Criteria

1. The FIRM shall consider and evaluate all appropriate technologies including conventional techniques in the preliminary engineering report (PER) stage.

2. When sizing new piping or bypass systems, the FIRM should seek input from the HRSD Project Manager who will contact appropriate personnel. HRSD has numerous resources available to aid in development of design calculations including both modeled and metered data.

3. Evaluate carefully the special features of existing lines to be rehabilitated (i.e. concrete pipe cradles, previous repair history, etc.) that may have a strong bearing on the techniques or processes recommended.

4. Evaluate potable water needs and availability for installation and testing.

5. Consider space required for installation equipment.

6. Require final acceptance leakage testing and use of a mandrel or other approved method to verify deflection and minimum internal diameter requirements as applicable to rehabilitation method.

7. Consider option of continuing liners through manholes. Specify limits of liner to be removed in manholes.

8. Evaluate effect of ground water infiltration on methods proposed.

C. Sanitary Sewer System Rehabilitation

1. Cleaning – All gravity sewers must be cleaned before any rehabilitation process can be utilized. The following items should be considered and specified in cleaning.

   a. Estimate the amount of material that needs to be removed from the line.
b. Outline or require the Contractor to submit a detailed procedure for removal of obstructions and capturing any loose material removed when cleaning pipe and structures such as manholes and wet wells.

c. Consider where and how the cleaned material will be disposed.

d. Consider the need to build sediment traps to capture grit or the requirement for diversion pumping during cleaning operations.

e. Require close communication with HRSD Interceptor Operations, HRSD Treatment Plants fed by the line being cleaned and the affected municipalities to coordinate upstream cleaning efforts so that excessive material is not fed to this project while cleaning and lining is in progress.

f. Consider structural integrity of pipe to be cleaned before choosing method of cleaning.

2. Closed-Circuit Television Video (CCTV) – CCTV inspection is required for all rehabilitation projects. HRSD generally has a pre-design CCTV of each proposed project. Require the following minimum requirements for performing CCTV.

   a. Require videos immediately following cleaning and at the completion of the project. If lining is not installed immediately after cleaning, the pipe shall be inspected immediately prior to installation of liner with additional cleaning as required. The first CCTV inspection should be made with no articulation of the camera. A second run should then be made utilizing an articulating camera to evaluate laterals and other points of concern.

   b. Specify the maximum amount of water in the pipe when CCTV is performed. Determine if diversion pumping is required.

   c. Use a lamp to evaluate lines for straightness.

   d. Recommend that the FIRM be present during the CCTV process. Specify that Contractor shall complete the post-CCTV of each section and receive FIRM approval prior to moving to the next section.

   e. NASSCO PACP, MACP and LACP shall be adhered to for the coding and reporting of any defects encountered during CCTV operations.

3. Diversion Pumping

   a. HRSD will provide the maximum flows and average flows to be handled by diversion pumping. For low flow collection systems as determined by HRSD, exceptions to the requirements of master specification section 01520 – Maintenance of Pipeline and Pumping Operations will be considered.
b. Specify the maximum dB limits for the diversion pumping equipment.

c. No leaking is allowed on diversion piping or pumping equipment.

d. Maintain sewer service to all customers along the line.

e. Consider routing for diversion pipe during the PER or design phase. This should typically include approval from the locality where the work is taking place, as well as identification of private property needs.

4. Gravity Sewer Rehabilitation – The following methods have been used or considered by HRSD. Other methods may be considered as appropriate in this rapidly changing market. During the PER phase of design the FIRM shall evaluate rehabilitation methods for suitability and shall perform pipeline assessment certification program (PACP), manhole assessment certification program (MACP) and/or lateral assessment certification program (LACP) inspections on the proposed sections of gravity pipeline designated for rehabilitation in accordance with National Associations of Sewer Service Companies (NASSCO) guidelines.

a. Cured In Place Pipe (CIPP)

   i. The FIRM shall specify minimum liner thickness. The minimum may be different for different CIPP processes.

   ii. CIPP shall be designed based on the assumption the host pipe is fully deteriorated.

   iii. Determine if material samples are required for post-cure testing. If so, determine how samples will be obtained.

   iv. Provide performance specification for the liners. Require a Professional Engineer, licensed in the Commonwealth of Virginia, to seal the liner structural design.

   v. Utilize existing standards such as ASTM, NASTT, NASSCO, PRC, etc. where ever possible.

   vi. Require verification tickets for each liner section installed. Each ticket should include resin manufacturer and type, time and date of wet-out and other critical information.

   vii. Provide a water tight seal between the liner and the existing pipe at the manhole.
viii. Rework the flow line through the manhole to account for the thickness of the liner.

ix. Require that all water/wastewater be removed from pipe prior to and during installation of liner.

x. Require that all inflow into pipe (groundwater, laterals and side lines) shall be stopped prior to installation of liner.

xi. Require that diversion pumping system be activated and flow removed from pipe during cleaning and CCTV inspection.

xii. Require a detailed submittal from the contractor that states design assumptions, calculation methods, material properties, and proposed installation approach.

xiii. Continuous temperature monitoring system (Zia Systems or approved equal), shall be utilized as an additional QA/QC measure during the curing process.

xiv. If continuous temperature monitoring is used, require final submittal of all temperature data.

b. Folded and Reformed Liners

   i. Specify minimum thickness required.

   ii. Evaluate available material types.

   iii. Require that diversion pumping system be activated and flow removed from pipe during cleaning.

c. Formed In Place Pipe (FIPP)

   i. Specify grouting procedures to be used.

   ii. Where man entry is possible, require tapping test with a hammer as a part of the final inspection.

   iii. Require that diversion pumping system be activated and flow removed from pipe during cleaning.

d. Sliplining

   i. HRSD has used HDPE, FRP and A2 as sliplining materials.

   ii. Require grouting of the annular space for all sliplining projects.
iii. Design and detail a watertight bulkhead between the slipliner and the host pipe at the manholes.

iv. Do not use clamps to join sections of pipe liner.

v. Require certified fusion welder if HDPE or fusible PVC is used.

vi. Require removal of internal beads flush with pipe wall on HDPE pipe before installing the liner.

vii. Specify minimum SDR or other appropriate thickness.

viii. Evaluate whether diversion pumping is required for installation or if liner can be installed under flow.

e. Pipe Bursting – HRSD has limited experience with this rehabilitation technology.

5. Lateral Reinstatement – When external excavation is required, HRSD has had success with products such as Insert–A-Tee (or approved equal). When laterals are internally reinstated and lined, HRSD has had success with one piece main and lateral systems as manufactured by BLD or LMK (or approved equal). The lining system should include a method of providing a permanent seal between the host pipe and liner at both the lateral to main connection, and the upstream portion of the lateral. This is a developing area and considerable research should be performed before making recommendations.

6. Manhole Rehabilitation – This section covers rehabilitation of manholes and junction chambers.

a. Utilize diversion pumping if work below the bench is required.

b. Modify the inverts to provide a smooth flow line through the manhole.

c. Raise the bench to the top of the pipe, forming a “U” channel through the manhole and provide sufficient slope to make benches self cleaning when benches must be modified.

d. Require a system to capture and remove cleaning material from the manhole without entry into the flow line.

e. Stop all leaks in the manhole before resurfacing, repair, or lining materials are applied.

f. Evaluate conditions of the frames and covers. The Contractor shall provide frames and covers as required.
g. Remove any steps entirely (minimum one inch recess), and do not replace. Restore surfaces before applying coatings.

h. Sanitary manholes are often exposed to environments with various degrees of aggressiveness thereby degrading the concrete and reinforcing, and shortening the useful life of the structures. Choosing the appropriate protective measure should be determined during the preliminary engineering evaluation of the project. For Protective Coatings and Liners for manholes, the FIRM shall evaluate the current conditions of the structure and report findings in accordance with NASSCO MACP Guidelines. Any protective system must be applied in strict accordance with the protective system Manufacturer’s recommendations. HRSD has had success with cementitious coatings, both Portland based and calcium aluminates, and various epoxies. If severe structural degradation has taken place, the use of Cast-In-Place rehabilitation has been successful, as well as the procedures for restoring structural integrity. An anti-microbial additive, such as Conshield, should be considered for any type of cementitious rehabilitation.

7. Post Construction & Rehabilitation Evaluation for Gravity Sewer Mains and Manholes

a. Existing gravity sewer mains or storm mains that are within 36” vertical clearance of the pipeline to be burst shall be CCTV inspected prior to any pipe bursting and following completion of pipe installation by the Contractor as a record for potential future settling or misalignment issues.

b. For manhole rehabilitation projects, bonding of the coating material will be checked during the inspection and photo documentation will be provided. Special care will also be taken to inspect the bulkheads between the host pipe and the rehabilitated pipes in the manholes.

End of Section
Section 30 - Pump Stations

A. Introduction - HRSD owns and operates wet well stations and pressure reducing stations. Wet well stations are sized to receive projected flows from gravity sewers and discharge to force mains. Pressures reducing stations and/or other facilities are sized to maintain the pressure head in force mains within HRSD operating limits. Wet well stations, force mains and pressure reducing stations are all sized and operated in accordance with HRSD’s Hydraulic Grade Line (HGL) policy.

1. Wet Well Pump Station - Flows are discharged by gravity sewers or force mains into a wet well from which they are pumped into a force main. The pumps are designed for a flooded suction condition and are located in a separate dry well adjacent to the wet well with intake piping leading from the wet well to the pumps. HRSD does own, operate, and maintain several submersible pump stations, although these are typically for small locality served systems.

2. Pressure Reducing Station (PRS) - A pressure reducing station is connected directly to a force main and is used to maintain the pressure on the suction side of the pumps.

B. Description of Operations

1. Wet Well Pump Station

   a. Wet well stations typically use variable speed pumps to match flow fluctuations and minimize turbulence in the wet well to reduce odor, corrosion and air entrainment.

   b. A proportional integral derivative (PID) level controller shall be configured in the programmable controller to control the sewage level in the wet well. The level controller shall vary the speed of the pumps as required to match the pump discharge flow rate to the wet well influent rate. The desired level to be maintained in the wet well will be programmed in the programmable controller as the set point for the level controller. The level controller will compare the actual wet well level to the set point level and output a 4-20mA speed reference signal to the variable frequency drive (VFD) for operating the sewage pumps to increase or decrease the speed of the pump or pumps as required to maintain the set point level.

   c. A standby pump shall be called to operate at the high water alarm level.

2. Pressure Reducing Station

   a. Pressure reducing stations typically use variable speed pumps to match flow fluctuations to lower the pressure on the suction side of the station. Pressure reducing stations do not typically run continuously and are not normally required to operate until the force main flow reaches approximately two-thirds of the design flow.

   b. Pressure reducing stations operate by starting the lead pump when the force main discharge pressure increases to a preset high limit. The lead pump speeds up and
slows down to maintain the force main suction pressure within a preset range. If the lead pump cannot maintain the force main suction pressure within the preset range, an additional pump or pumps are started and operated together to maintain the suction pressure within the preset range. As the force main discharge pressure decreases to preset lower limits, the pumps are stopped in the reverse order as needed until all pumps are stopped.

c. Provide for piping and valves inside of the pump station so that the force main flows can be pumped in either direction as appropriate with the operation of a minimum number of valves.

C. General

1. Pump stations shall meet the requirements of the *Virginia Department of Environmental Quality Sewage Collection and Treatment (SCAT) Regulations.*

2. Pump stations shall be designed to Hydraulic Institute (HI) Standards to the extent possible. Exceptions to the HI Standards to be discussed with HRSD and approved on a case-by-case basis.

3. Pump station shall be designed based on the following:

   a. Initial operating range
      
      i. Low night time diurnal
      ii. Average daily flow
      iii. Peak hourly flow (wet weather level of service (LOS))

   b. Future operating range
      
      i. Low night time diurnal
      ii. Average daily flow
      iii. Peak hourly flow (wet weather LOS)

   c. Minimal changes to accommodate increasing flows/pressures due to future flow conditions, e.g. a motor or impeller change.

   d. Both the initial and future operating ranges shall be provided in the specifications.

   e. Under typical operating conditions for variable speed systems, pumps shall be capable of maintaining wet well level without cycling on/off.

   f. Pumps shall operate within the pump's preferred operating range (POR) under all possible flow scenarios and operating conditions.
4. Pump station shall be capable of meeting the peak design flow condition with the largest pump out of service.

5. Pump stations shall be designed to comply with locality flood elevation construction requirements. The current locality requirements, available at the time of publication of this manual, that need to be verified for each project, are listed in Section 10 – “Flood Elevation Requirements”.

6. Provide a separate generator room or building with adequate space for maintenance and heat rejection from the engine block and exhaust system or isolate remaining areas from generator noise and heat.

7. Provide a slope on the pump room floor that will convey seepage from pump packing and drainage from wash down to a sump. Provide Zoeller Model 137D sump pump unless otherwise approved by HRSD’s Project Manager.

8. Provide a commode in a separate room or enclosure. Provide a washbasin in the pump station.

9. Design shall incorporate measures to facilitate the maintenance and removal of equipment and pumps in both dry well and wet well areas.

10. Provide access to dry well and wet well by stairs.
    a. Spiral stairs and ship ladders are not acceptable.
    b. Stairs shall be a minimum width of 36 inches and shall include handrails on both sides.
    c. Stair riser heights and tread depths shall comply with the International Building Code (IBC), latest addition.

11. Design wet well and influent piping to minimize turbulence and air entrainment in the wet well.

12. Provide minimum submergence required to eliminate vortex at pump suction intake.

13. Evaluate the need for odor control and make provisions as necessary.

14. Locate discharges for sump pump, pump air release and restroom discharge away from pump intakes in the wet well and design to minimize turbulence and air entrainment.

15. Furnish and install a removable stainless-steel bar screen. Channel shall be designed to accommodate a hydraulic grinder system and a bar screen interchangeably. The electrical system shall be designed with the necessary capacity for the grinder system.

16. Provide wet wells that slope toward the pump suctions and do not create areas where solids can collect and build up.
17. Concrete in the wet well shall be protected from corrosion by the use of polymer concrete, anti-microbial additive, surface applied coating system or a thermoplastic sheet liner.

   a. Thermoplastic sheet liner shall not be used on influent channels.

18. Provide smooth interior wet well surfaces. When installing thermoplastic sheet liner system, ensure that it is anchored into the new concrete and protect all interior concrete surfaces except the surfaces 1'-0" below the lowest water level in the wet well, i.e. the floor and lower walls. Use light-colored thermoplastic only, never black or other dark colors.

   a. The approved thermoplastic sheet linings for new pump station wet wells are:

      i. T-Lock Amerplate by Ameron International of Brea, California. (PVC Sheet Linings), or
      ii. GSE Studliner by GSE Lining Technology, Inc. of Houston, Texas. (High Density Polyethylene Liner), or

   b. The anchored thermoplastic sheet linings shall be installed in strict accordance with the manufacturer’s recommendations and shall be installed to ensure a pinhole free lining system. Particular care must be taken to ensure that lining terminations and transitions at changes in direction and at metal pipe penetrations, and leading edges are properly treated.

   c. Hot air welding on liners.

      i. PVC liners shall be performed by certified welders trained by the selected manufacturer in strict accordance with the manufacturer’s instructions. Welding shall fuse both sheets and weld strips or filler material together to provide a continuous joint equal in corrosion resistance and impermeability to the basic liner sheets.
      ii. Joints on HDPE liners shall be filled using extrusion welding performed by personnel trained by the liner manufacturer.

   d. Quality Control Testing

      Once the thermoplastic sheet liners have been installed, the concrete forms removed, and all welding performed, the lining shall be inspected and tested by an independent testing firm as follows:

      i. The entire lining shall be carefully visually inspected for pinholes or damage.
      ii. All welds shall be probed with a blunt instrument like a putty knife to identify any weld defects.

      All surfaces of the sheet linings shall be tested with an approved (by the
manufacturer) electrical holiday detector with the instrument set at the voltage range recommended by the manufacturer. This testing should only be performed by a certified technician trained by the manufacturer of the sheet lining or qualified previously to do so.

19. All below grade concrete structures shall have an exterior vapor barrier and/or waterproofing approved by HRSD.

20. Pump Station Substantial Completion Checklist – refer to Attachment A.

D. Site Issues and Layout

1. Pumping station building and site shall be designed and configured to be in harmony with the surrounding setting. Architectural and landscaping designs and renderings will be submitted to and approved by HRSD at the PER stage. Refer to Section 2 – “Architectural and Landscaping Design and Review Process” in this standards manual.

2. Real-estate setbacks: Property shall accommodate existing and future HRSD development requirements, taking into consideration setbacks and zoning restrictions.
   a. Minimum property dimensions for a Pump Station is 150 feet x 150 feet.
   b. Minimum property dimensions for a Pressure Reducing Station is 200 feet x 200 feet.

3. Evaluate the need for the acquisition of additional property to accommodate future pump station replacement, off-line storage and/or other HRSD facilities.

4. Design must consider potential off-site impacts including noise, odors, excessive light and other impacts to adjacent property owners.

5. Provide concrete entrance and a paved driveway for off-street parking, access to building and provision to turn around a crew truck.

6. Include a site plan showing property lines, building, piping, existing & proposed utilities, valves, emergency pump connection, physical features, topography, etc. and any other requirements by the local approving authority.

7. Set a new benchmark at each new pump station or PRS and provide a data sheet to include a site map, coordinates, elevations, descriptions at a minimum. Coordinate accuracy should be within 1/100 of a foot.
   a. This applies to the following if a benchmark does not exist:
      i. Rehabilitation projects
      ii. Acquired assets (PS, PRS)

8. Refer to Section 34 – “Miscellaneous” in this standards manual for additional site
layout information.

E. Masonry

1. Refer to Section 34 – “Miscellaneous” in this standards manual for additional information.

2. Building walls shall be concrete block with exterior brick veneer or as otherwise determined by HRSD's Architectural Review Committee and referenced in Section 2 – “Architectural and Landscaping Design and Review Process”.

3. All lintels shall be stainless steel.

F. Equipment

1. Pumps shall be centrifugal, non-clog, solids-handling pumps, capable of passing a 3-inch solid.

2. Pump manufacturer shall certify that the pump will meet the design requirements.

3. In typical installations, pumps shall be dry-pit submersible, close-coupled or extended shaft-driven pumps. Pumps will be evaluated and recommended for use by the FIRM.
   a. The FIRM shall carefully evaluate the size and dimensions of each manufacturer's product for compatibility with the space where the pump and accessories will be installed. This is especially important for rehabilitation projects where different pumps and motors are required within limited available space. Consideration must be given by the FIRM for maintenance access and removal of the pump and motor within existing spaces due to varying dimensions between manufacturers for similar products.

4. Pump, motor and impeller shall be balanced as a unit at the factory prior to shipment. Motor shall be inverter duty rated.

5. For submersible pumps, motor shall be equipped with two (2) moisture detection sensors, one in the mechanical seal oil bath and one in the lower portion of the armature area.

6. Accommodations shall be made to properly cool all electrical equipment and motors to effectively dissipate heat.

7. Pumps shall operate at speeds below 1,000 RPM unless otherwise approved by HRSD's Project Manager.

8. Spare parts to be provided by the contractor shall typically include the following. A requirement to furnish a spare volute and/or other major mechanical or electrical parts is project specific and should be discussed with HRSD.
a. For each size pump, provide the following:
   i. One spare full-size impeller
   ii. One spare stainless-steel shaft and sleeve (shaft-driven only)
   iii. One spare set of wear rings
b. For close-coupled pumps, provide the following:
   i. One spare coupling for each pump.

9. OSHA approved safety rails (load rated):
   a. All safety railings shall be load rated, meet OSHA Safety Railing Standards, and support a vertical and horizontal load of 200 pounds.
   b. Mounts for safety railings shall be designed and cast in place as part of the station.
   c. Handrails, guardrails, and/or safety chains shall be 42 inches in height with a 21-inch mid-rail/chain and 4-inch toe boards.
   d. All stairs, safety railings and decking within the wet well shall be fiberglass reinforced plastic (FRP). All mounting brackets and exposed metal shall be stainless steel.

10. Pumps Performance Testing – pumps shall meet all specified requirements and have measured vibrations within the acceptable limits prescribed in the HI standards.

G. Conveying Systems

1. Provide a load rated monorail, trolley, and hoist with appropriate hatches and doors to directly access and remove the pumps and motors for maintenance. Use removable load rated grating to cover interior openings that are to be used for removal of equipment. Indicate the load ratings on the plans, stencil load ratings on the trolley, hoist, and monorail, and provide three copies of certified load testing documentation. The monorail/trolley/hoist shall be load tested in accordance with OSHA requirements during construction by the contractor.

2. Consider the provision for electric trolley and/or hoist.

3. Provide direct access to monorail and hoist (or install separate lifting devices) for removal of sump/submersible pumps, as needed.

4. Provide rated lifting eyes to assist with equipment removal.

H. Mechanical
1. Interior Piping

a. Provide ductile iron flanged joint.

b. Provide a valve on the suction and discharge sides of each pump.

c. Provide a shut off valve or sluice gate on the gravity influent pipe. Preferred means of isolation is a 316 stainless steel, fabricated, heavy-duty sluice gate.

d. Gate valves shall be OS&Y or have a visual indicator, open left, and be coated with fusion-bonded epoxy.

i. Chain wheel actuators shall not be permitted.

e. All valves shall be easily and safely accessible for maintenance and operation. Provide OSHA approved fixed platform sufficient for a 2-person maintenance crew, as needed.

f. Provide a check valve on the discharge side of each pump between the discharge valve and the pump.

i. Check valves shall not be installed in the vertical position.

g. Provide check valves with iron body, bronze seat check and bronze ring on disc. Check valves shall be provided with packing glands and external lever and spring in accordance with AWWA C508.

h. Provide adequate pipe support and thrust restraint with base elbows, base pads or hangers as required. Metallic pipe supports and hardware shall be stainless steel.

i. Use eccentric reducers (match elevations at top of pipe) on the suction and discharge piping in order to prevent the entrapment of air.

j. Provide a manual air release on the discharge of each pump. Reduce from tap on pump volute to ½-inch pipe and ½-inch ball valve. Provide a union to transition to ¾-inch HDPE air release piping to wet well. All pipe valves and fittings except HDPE shall be stainless steel.

k. Exterior wall penetrations shall be accomplished with a wall sleeve. Seal between sleeve and carrier pipe with a "Link Seal" type seal with stainless steel hardware. Bolts on the link seal shall be oriented so that they are tightened from inside the station. Penetrations between the pump room and wet well for pump suction piping shall utilize wall pipe with a cast integral seep ring.

l. Provide an eyewash station near the generator batteries in accordance with the current safety requirements.
m. Provide flexible connections on suction and discharge of pump to ensure motion and vibration is absorbed.

2. Exterior Piping (Force Main)

a. Refer to Section 24 – “Pipelines and Appurtenances” in this standards manual for additional requirements for force mains.

b. All pump stations shall have a mainline valve on both sides of the emergency pump connection.

c. Wet Well Pump Station - Provide an emergency pump connection with valves and blind flange(s). Also, provide an HDPE suction leg into the well. The connection or transition from HDPE to ductile shall be outside the wet well. Size pipe for emergency connection based on pump station design flow rate.

3. Provide for space heating to prevent freezing of pump station facilities, as appropriate.

4. Ventilation of the wet well shall meet SCAT regulations. Provide for 12 air changes per hour for continuous ventilation and 30 air changes per hour for intermittent ventilation. The ventilation system shall be designed to ventilate all areas of the wet well and prevent "short circuiting" of the air.

5. Provide potable water for the restroom and hose bibs from the municipal water system or from a well if municipal water system is not available.

6. Provide a Virginia Department of Health (VDH) approved reduced pressure principal backflow preventer to be installed on the main potable water line where it enters the pump station and prior to any outlets in the pump station. Backflow preventer shall be tested and certified after installation.

7. Provide for the discharge of restroom drainage and the sump pump.

a. Pressure Reducing Station - Discharge restroom drainage to the municipal sanitary sewer system, if available or pump discharge into the pump station suction leg utilizing a small package grinder pump. Grinder pump shall meet the maximum inlet head conditions.

b. Wet Well Pump Station - Discharge restroom drainage to the pump station wet well.

I. Electrical & Instrumentation

1. Refer to Section 32 – “Electrical and Instrumentation” in this standards manual for additional information regarding electrical and instrumentation systems.

2. Provide a standby generator in order to meet Class I reliability. The generator shall be designed to meet the design capacity of the pump station with the primary power
3. Install electrical equipment and motors above the 100-year flood elevation or otherwise protect from the 100-year flood. Refer to Section 10 – “Flood Elevation Requirements” in this standards manual.

4. Require Contractor to install wiring for alarm system to the transmitter and to the front door for the card swipe. A new SCADA system will be on the panel (OIT) and alarm panel. Alarm points to be determined by HRSD. Alarm transmitter, card swipe, and alarm panel shall be provided by HRSD.

5. Provide variable frequency drive controllers to control pump speed.

   a. Pressure Reducing Station
      i. Pump speed shall be controlled in response to suction pressure.
      ii. Provide two pressure sensors (one 0-10 psi and one 0-70 psi) on the suction piping and one pressure sensor on the discharge piping. All mounted on 4-inch Red Valves. Refer to Section 34 - Standard Details in this standards manual.

   b. Wet Well Pump Station
      i. Pump speed shall be controlled in response to wet well level.
      ii. On the pump discharge header, provide a 4" pressure sensor as manufactured by Red Valve or approved equal. Provide a tee with a 4" branch and install a 4" gate valve on the branch prior to the pressure sensor and install a blind flange on the outside of the pressure sensor.
      iii. Wet well levels to be monitored by means of level sensors or bubbler system. If level sensors are utilized, two level sensors shall be installed, one for SCADA and one for control. Provide a maintenance port for the level transmitter in the wet well.

6. Consider the inclusion of contacts to operate the pumps across the line in the event that the variable frequency drives fail. The alarm system will notify the operators of a variable frequency drive failure and the drives must be switched to the across the line contacts manually. The pumps can be started sequentially in the across the line mode of operation. Evaluate other means of providing variable frequency drive backup when motor horsepower exceeds 200 HP. In all cases, investigate the capacity of the local power grid to accommodate the across the line motor starting.

7. Include a flow meter and pressure sensor sized based on the design flow rate for the pump station. Location of the flow meter shall be downstream of the emergency pump connection.

8. Provide a high-level float ball and a low-level float ball in the wet well and a float ball in the pump room.


11. All new pump stations and PRS's shall include an electrical interface located at the pump station to integrate the Advanced Prime Guard Controller used on Xylem (Godwin) pumps with the existing HRSD SCADA system.

12. Temporary Portable Pump Alarms and Setup Standards – refer to Attachment B.

End of Section
## ATTACHMENT A
### PUMP STATION SUBSTANTIAL COMPLETION CHECKLIST*

*This list is provided as a general guideline and is not all inclusive.

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ATTACHMENT B

Temporary Portable Pump Alarms and Setup Standards

When a project requires a temporary portable pump to be alarmed, the following guidelines need to be followed.

- **When work is performed at station:** If power is available, all alarms are to be routed through existing HRSD’s SCADA system. Portable pump manufacture call box is not acceptable unless otherwise approved for site specific situations. If power is not available then, HRSD solar SCADA panel will be provided. A portable generator may be required depending on site specific situations.

- **When work is performed at a manhole:** If power is available, all alarms are to be routed through existing HRSD’s SCADA system. Portable pump manufacture call box is not acceptable unless otherwise approved for site specific situations. If power is not available then, HRSD solar SCADA panel will be provided. A portable generator may be required depending on site specific situations. Naming of the alarms from a manhole should indicate the location of the manhole (i.e. Pearl and Ligon)

- The name of the site is to be used followed by temporary lead, lag or second lag, depending on the number of pumps. (Example: Arctic Temporary Lead, Arctic Temporary Lag and Arctic Second Lag.)

- Both contractor and HRSD will be alerted in the event of a pump alarm. The contractor is responsible to be primary responder with the support of HRSD staff.

- All pump maintenance and fuel requirement are the contractors responsibility.

- Pump maintenance records are to be provided monthly through the duration of the project by contractor, depending on length of project.

- Battery chargers are required with all pumps. In situations where power is not available a portable generator may be required.

- All discharge piping is to be pressure rated flanged or fused pipe. Isolations valves are required at each pump along with an additional external swing check valve. A means to bleed air off the discharge piping is required.

- Float balls, level transducers and pressure transducers are acceptable. In a Lift station or manhole application, level transducers are preferred. If float balls are used for control, a two float setup is required per pump. All floats are to be secured in manhole or wet well so as not to become tangled, hindering pump operation. In a temporary PRS setup, owner furnished sensor valve will be provided to allow contractor to connect pressure transducers for control. An isolation valve is required to be furnished by contractor at this location.

- If work is to be performed during cold weather, the contractor is responsible for providing freeze protection on pumps and controls, specifically transducers.
• Depending on location and duration of job, concrete protective barrier wall may be required.
• All manholes and wet wells where temporary pumps are being used must be secured to prevent trip hazards, fall risks and odor issues.

The following standard alarms are required. Site specific alarms will be evaluated on a as need basis.

**Two Pump Lift station Or Manhole (Diesel Pumps)**

<table>
<thead>
<tr>
<th></th>
<th>Lead</th>
<th>Lag</th>
<th>High well</th>
<th>Overflow</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fail / Normal</td>
<td>On / off</td>
<td>Alarm / Normal</td>
<td>Alarm / Normal</td>
</tr>
</tbody>
</table>

- (HRSD furnished float ball if station alarms cannot be used)
- (Determined necessary according to length of Job. HRSD furnished float ball if station alarms cannot be used.)

**Three Pump Lift station Or Manhole (Diesel Pumps)**

<table>
<thead>
<tr>
<th></th>
<th>Lead</th>
<th>Lag</th>
<th>Second Lag</th>
<th>High well</th>
<th>Overflow</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fail / Normal</td>
<td>On / off</td>
<td>On / Off</td>
<td>Alarm / Normal</td>
<td>Alarm / Normal</td>
</tr>
</tbody>
</table>

- (HRSD furnished float ball if station alarms cannot be used)
- (Determined necessary according to length of Job. HRSD furnished float ball if station alarms cannot be used.)

**Two Pump Lift Station or Manhole (Diesel Pumps) New Prime Guard Controller**

<table>
<thead>
<tr>
<th></th>
<th>Lead</th>
<th>Lag</th>
<th>High well</th>
<th>Overflow</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fail / Normal</td>
<td>On / off</td>
<td>Alarm / Normal</td>
<td>Alarm / Normal</td>
</tr>
</tbody>
</table>

- (HRSD furnished float ball if station alarms cannot be used)
- (Determined necessary according to length of Job. HRSD furnished float ball if station alarms cannot be used.)
Two Pump Lift Station or Manhole (One electric one diesel pump) New Prime Guard Controller

Dominion Power       On / OFF

Lead               Fail / Normal  (Electric)
Lag               On / off and Fail / Normal

High well   Alarm / Normal  (HRSD furnished float ball if station alarms cannot be used)
Overflow    Alarm / Normal  (Determined necessary according to length of Job. HRSD furnished float ball if station alarms cannot be used.)

(For HRSD monitoring purposes only, provide well level.)

Three Pump Lift Station or Manhole (One electric two diesel pump) New Prime Guard Controller

Dominion Power       On / OFF

Lead               Fail / Normal  (Electric)
Lag               On / off and Fail / Normal
Second Lag     On / off and Fail / Normal

High well   Alarm / Normal  (HRSD furnished float ball if station alarms cannot be used)
Overflow    Alarm / Normal  (Determined necessary according to length of Job. HRSD furnished float ball if station alarms cannot be used.)

(For HRSD monitoring purposes only, provide well level.)

Two Pump PRS (Diesel Pumps) New Prime Guard Controller

Lead               Fail / Normal
Lag               On / off and Fail / Normal

(For HRSD monitoring purposes only, provide Suction and Discharge pressures.)

Three Pump PRS (Diesel Pumps) New Prime Guard Controller

Lead               Fail / Normal
Lag               On / off and Fail / Normal
Second Lag     On / off and Fail / Normal
(For HRSD monitoring purposes only, provide Suction and Discharge pressures.)

**Two Pump PRS (One electric one diesel pump) New Prime Guard Controller**

Dominion Power  On / OFF

Lead  Fail / Normal (Electric)

Lag  On / off and Fail / Normal

(For HRSD monitoring purposes only, provide Suction and Discharge pressures.)

**Three Pump PRS (One electric two diesel pump) New Prime Guard Controller**

Dominion Power  On / OFF

Lead  Fail / Normal (Electric)

Lag  On / off and Fail / Normal

Second Lag  On / off and Fail / Normal

(For HRSD monitoring purposes only, provide Suction and Discharge pressures.)

---

**Required Contractor Supplied Bypass Pumping Alarm Outputs for HRSD SCADA System interface**

<table>
<thead>
<tr>
<th>Pump Alarms</th>
<th>Level Alarms</th>
<th>Analogs</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEAD PUMP RUNNING/ OFF</td>
<td>1st LAG PUMP ON/ OFF</td>
<td>FLOATBALL HIGH LEVEL</td>
</tr>
<tr>
<td>LEAD PUMP NORMAL/ FAIL</td>
<td>2nd LAG PUMP NORMAL/ FAIL</td>
<td>FLOATBALL LOW LEVEL</td>
</tr>
<tr>
<td>Alarm (OPEN) on LEAD PUMP OFF</td>
<td>Alarm (OPEN) on 1st LAG PUMP OFF</td>
<td>Alarm (OPEN) on 1st LAG PUMP FAIL</td>
</tr>
<tr>
<td>Alarm (OPEN) on LEAD PUMP FAIL</td>
<td>Alarm (OPEN) on 2nd LAG PUMP FAIL</td>
<td>Alarm (OPEN) on OVERFLOW</td>
</tr>
<tr>
<td>Alarm (OPEN) on 1st LAG PUMP ON</td>
<td>Alarm (OPEN) on 2nd LAG PUMP ON</td>
<td>Alarm (OPEN) on LOW LEVEL</td>
</tr>
<tr>
<td>Alarm (OPEN) on 1st LAG PUMP OFF</td>
<td>Alarm (OPEN) on 2nd LAG PUMP OFF</td>
<td>4-20 mA Isolated Output</td>
</tr>
<tr>
<td>Alarm (OPEN) on 1st LAG PUMP FAIL</td>
<td>Alarm (OPEN) on 2nd LAG PUMP FAIL</td>
<td>+ -</td>
</tr>
</tbody>
</table>

*A normally CLOSED contact state is required during normal operation.*

*Any OPEN contact will generate an Alarm Condition.*
Section 31 - Treatment Plants

A. Purpose – HRSD has historically had a broad range of experience with many different types of treatment processes and equipment. This section documents best practices and criteria for the design and operation of HRSD treatment plants. This section is intended to be practical and prudent based on HRSD’s history and experience. This section is to be followed wherever practical and used in conjunction with the other documents listed herein for standardization and consistency. This section is not meant to be a definitive design manual for treatment plant projects. This section provides typical standards and/or guidelines for work associated with the construction, modification and/or rehabilitation of HRSD Treatment Plants and associated infrastructure. The information herein has been developed based previous experience which includes successes, failures and lessons learned.

1. HRSD owns and operates various wastewater treatment plants. These plants consist of various unit processes, which are divided into Sewage Treatment and Solids Handling.
   a. Sewage Treatment: These processes typically consist of a preliminary process, a primary process, and a secondary process, which purify the liquid wastewater entering the treatment plant before it is discharged to the receiving stream or recycled for water reuse.
   b. Solids Handling: These processes typically consist of a thickening process, a dewatering process, and a solids disposal process, which dispose of or recycle the solid residuals produced from purifying the liquid wastewater.

2. HRSD treatment plants are designed and operated to:
   a. Meet all regulatory requirements.
   b. Prevent offsite nuisance conditions.
   c. Be safe and reliable.
   d. Use proven equipment where applicable.
   e. Use automation and technology to minimize operating cost and maximize efficiency.
   f. Optimize life cycle cost.

3. Planning for new HRSD treatment plant facilities and projects is outlined in these documents:
   a. Solids Management Master Plan – Provides long-term planning to evaluate solids production, solids handling capabilities and deficiencies, and required new solids handling facilities for current and future conditions.
   b. Capital Improvement Program (CIP) – Provides planning to initiate new projects.

4. Design and operating criteria for HRSD treatment plants are also outlined in the following documents:
   a. Interceptor System Policies – Provides design and operating criteria for HRSD interceptor systems and local collection systems.
b. **HRSD Design and Construction Standards** – Provides design and construction standards for new projects.

c. Commonwealth of Virginia Sewage Collection and Treatment (SCAT) Regulations – Provides design and operating criteria for sewerage systems and sewage treatment works in Virginia.

d. Hydraulic Institute Standards – Provides industry standards for the design, material, methods, performance, testing, etc. for hydraulic pumps and associated elements.

e. HRSD Standard Functional Descriptions.

5. The design and operation of HRSD treatment plants shall seek balance between design based on the way treatment plants are operated and operation based on the way treatment plants are designed.

6. Design of HRSD facilities should provide for occupancy, maintenance, and storage requirements such as conference rooms, restroom and locker room facilities, lunch room, storage area, maintenance work areas, office areas, etc.

7. Design for power failures and power failure restarts to ensure equipment fails and restarts in appropriate condition to protect personnel, facilities, and process.

B. **Abbreviations** - The following abbreviations shall be used on the construction documents for all treatment plant related projects.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANOX</td>
<td>Anoxic</td>
</tr>
<tr>
<td>ANAE</td>
<td>Anaerobic</td>
</tr>
<tr>
<td>AER</td>
<td>Aerobic</td>
</tr>
<tr>
<td>AAA</td>
<td>Anaerobic/Anoxic/Aerobic</td>
</tr>
<tr>
<td>AAE</td>
<td>Anaerobic/Anoxic Effluent</td>
</tr>
<tr>
<td>AI</td>
<td>Aeration Influent</td>
</tr>
<tr>
<td>ALUM</td>
<td>Alum Solution</td>
</tr>
<tr>
<td>ANE</td>
<td>Anaerobic Effluent</td>
</tr>
<tr>
<td>APD</td>
<td>Acid Phase Digester</td>
</tr>
<tr>
<td>APDS</td>
<td>Acid Phase Digester Solids</td>
</tr>
<tr>
<td>API</td>
<td>Acid Phase Influent</td>
</tr>
<tr>
<td>APRS</td>
<td>Acid Phase Recirculation Solids</td>
</tr>
<tr>
<td>ARCY</td>
<td>Anoxic Recycle</td>
</tr>
<tr>
<td>ARE</td>
<td>Aerated Effluent</td>
</tr>
<tr>
<td>AS</td>
<td>Air Supply (Low Pressure Process Air)</td>
</tr>
<tr>
<td>ASR</td>
<td>Aerated Supernatant Return</td>
</tr>
<tr>
<td>AXE</td>
<td>Anoxic Effluent</td>
</tr>
<tr>
<td>BAS</td>
<td>Backwash Air Supply</td>
</tr>
<tr>
<td>BLWR</td>
<td>Blower</td>
</tr>
<tr>
<td>BWS</td>
<td>Backwash Water Supply</td>
</tr>
<tr>
<td>BWW</td>
<td>Backwash Waste</td>
</tr>
<tr>
<td>BWWR</td>
<td>Backwash Waste Recycle</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>CCK</td>
<td>Centrifuge Biosolids Cake</td>
</tr>
<tr>
<td>CCT</td>
<td>Centrifuge Dewatering Centrate/ Chlorine Contact Tank</td>
</tr>
<tr>
<td>CENT</td>
<td>Centrifuge</td>
</tr>
<tr>
<td>CNE</td>
<td>Centrate Equalization</td>
</tr>
<tr>
<td>CLS</td>
<td>Chlorine Solution</td>
</tr>
<tr>
<td>CSP</td>
<td>Cake Storage Pad</td>
</tr>
<tr>
<td>CST</td>
<td>Caustic Storage Tank</td>
</tr>
<tr>
<td>CTC</td>
<td>Centrifuge Thickening Centrate</td>
</tr>
<tr>
<td>CTI</td>
<td>Centrate Treatment Influent</td>
</tr>
<tr>
<td>CTP</td>
<td>Centrate Treatment Process</td>
</tr>
<tr>
<td>CTS</td>
<td>Centrifuge Thickened Biosolids</td>
</tr>
<tr>
<td>CTE</td>
<td>Centrate Treatment System Effluent</td>
</tr>
<tr>
<td>DA</td>
<td>Polymer Dry Air</td>
</tr>
<tr>
<td>DAF</td>
<td>Dissolved Air Flotation Thickener</td>
</tr>
<tr>
<td>DGAS</td>
<td>Digester Gas</td>
</tr>
<tr>
<td>DIG</td>
<td>Digester</td>
</tr>
<tr>
<td>DIST CH</td>
<td>Distribution Chamber</td>
</tr>
<tr>
<td>DPOLY</td>
<td>Dry Polymer</td>
</tr>
<tr>
<td>DPSD</td>
<td>Drain Pump Station Discharge</td>
</tr>
<tr>
<td>DS</td>
<td>Digested Solids</td>
</tr>
<tr>
<td>DSR</td>
<td>Decant Supernatant Return</td>
</tr>
<tr>
<td>DTD</td>
<td>Decant Tank Drain</td>
</tr>
<tr>
<td>FD</td>
<td>Floor Drain</td>
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<tr>
<td>FE</td>
<td>Filtrate Effluent</td>
</tr>
<tr>
<td>FERRIC</td>
<td>Ferric Chloride/Sulfate</td>
</tr>
<tr>
<td>FI</td>
<td>Filtrate Influent</td>
</tr>
<tr>
<td>FNE</td>
<td>Final Effluent</td>
</tr>
<tr>
<td>FOG</td>
<td>Fats, Oils, and Grease</td>
</tr>
<tr>
<td>FOP</td>
<td>Fuel Oil Pump</td>
</tr>
<tr>
<td>FOS</td>
<td>Fuel Oil Supply</td>
</tr>
<tr>
<td>FOR</td>
<td>Fuel Oil Return</td>
</tr>
<tr>
<td>FSB</td>
<td>Dissolved Air Flotation Thickener Subnatant</td>
</tr>
<tr>
<td>FTS</td>
<td>Dissolved Air Flotation Thickener Solids</td>
</tr>
<tr>
<td>GBFL</td>
<td>Gravity Belt Filtrate</td>
</tr>
<tr>
<td>GBT</td>
<td>Gravity Belt Thickener</td>
</tr>
<tr>
<td>GBTS</td>
<td>Gravity Belt Thickened Solids</td>
</tr>
<tr>
<td>GPD</td>
<td>Gas Phase Digester</td>
</tr>
<tr>
<td>GPDS</td>
<td>Gas Phase Digested Solids</td>
</tr>
<tr>
<td>GPE</td>
<td>Gas Phase Effluent</td>
</tr>
<tr>
<td>GPI</td>
<td>Gas Phase Influent</td>
</tr>
<tr>
<td>GPRS</td>
<td>Gas Phase Recirculation Solids</td>
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<tr>
<td>GRT</td>
<td>Grit</td>
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<tr>
<td>GSP</td>
<td>Gravity Thickener Overflow/Supernatant</td>
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<td>GTS</td>
<td>Gravity Thickened Solids</td>
</tr>
<tr>
<td>HDOIL</td>
<td>Hydraulic Oil</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>HW</td>
<td>Headworks</td>
</tr>
<tr>
<td>HWP</td>
<td>Hot Water Pump</td>
</tr>
<tr>
<td>HPW</td>
<td>Hot Potable Water</td>
</tr>
<tr>
<td>HWR</td>
<td>Hot Water Return</td>
</tr>
<tr>
<td>HWS</td>
<td>Hot Water Supply</td>
</tr>
<tr>
<td>IPS</td>
<td>Intermediate Pump Station</td>
</tr>
<tr>
<td>ISW</td>
<td>Incinerator Scrubber Water</td>
</tr>
<tr>
<td>LPROP</td>
<td>Liquid Propane</td>
</tr>
<tr>
<td>LPOLY</td>
<td>Liquid Polymer</td>
</tr>
<tr>
<td>METH</td>
<td>Methanol</td>
</tr>
<tr>
<td>MLSS</td>
<td>Mixed Liquor Suspended Solids</td>
</tr>
<tr>
<td>MURIATIC</td>
<td>Muriatic Acid</td>
</tr>
<tr>
<td>NAT GAS</td>
<td>Natural Gas</td>
</tr>
<tr>
<td>NPW</td>
<td>Non-Potable Water</td>
</tr>
<tr>
<td>NRCY</td>
<td>Nitrified Recycle</td>
</tr>
<tr>
<td>OA</td>
<td>Odorous Air</td>
</tr>
<tr>
<td>OCF</td>
<td>Odor Control Fan</td>
</tr>
<tr>
<td>OCS</td>
<td>Odor Control Scrubber</td>
</tr>
<tr>
<td>PCE</td>
<td>Primary Clarifier Effluent</td>
</tr>
<tr>
<td>PCI</td>
<td>Primary Clarifier Influent</td>
</tr>
<tr>
<td>PCS</td>
<td>Primary Clarifier Solids</td>
</tr>
<tr>
<td>PD</td>
<td>Process Drain</td>
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<tr>
<td>PDS</td>
<td>Primary Digested Solids</td>
</tr>
<tr>
<td>PDSP</td>
<td>Primary Digester Supernatant</td>
</tr>
<tr>
<td>POLYS</td>
<td>Polymer Solution</td>
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<tr>
<td>PTF</td>
<td>Preliminary Treatment Facility</td>
</tr>
<tr>
<td>PW</td>
<td>Potable Water</td>
</tr>
<tr>
<td>RAS</td>
<td>Return Activated Solids</td>
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<tr>
<td>RCP</td>
<td>Recirculation Pump</td>
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<td>RD</td>
<td>Roof Drain</td>
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<tr>
<td>REAER</td>
<td>Reaeration</td>
</tr>
<tr>
<td>RWI</td>
<td>Raw Wastewater Influent</td>
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<tr>
<td>SA</td>
<td>Service Air</td>
</tr>
<tr>
<td>SAMP</td>
<td>Sample</td>
</tr>
<tr>
<td>SBD</td>
<td>Scrubber Blowdown</td>
</tr>
<tr>
<td>SBR</td>
<td>Sequencing Batch Reactor</td>
</tr>
<tr>
<td>SC</td>
<td>Secondary Clarifier</td>
</tr>
<tr>
<td>SCB</td>
<td>Scum Concentrator Subnatant</td>
</tr>
<tr>
<td>SCE</td>
<td>Secondary Clarifier Effluent</td>
</tr>
<tr>
<td>SCI</td>
<td>Secondary Clarifier Influent</td>
</tr>
<tr>
<td>ST</td>
<td>Sidestream Treatment</td>
</tr>
<tr>
<td>SCN</td>
<td>Supplemental Carbon Neat/Screen</td>
</tr>
<tr>
<td>SCS</td>
<td>Supplemental Carbon Solution</td>
</tr>
<tr>
<td>SCUM</td>
<td>Scum</td>
</tr>
<tr>
<td>SD</td>
<td>Storm Drain</td>
</tr>
</tbody>
</table>
C. **Sewage Treatment Design and Operation:**

1. **Regulations** – The design and operation of sewage treatment facilities should be in accordance with all provisions of the approved SCAT Regulations.

2. **Design Life** – The design life of sewage treatment facilities should be greater than or equal to the following:
   
   a. Structures: 50 years  
   b. Piping and Conveyance: 50 years  
   c. Mechanical Equipment: 20 years  
   d. Electrical Power Equipment: 20 years  
   e. Instrumentation And Control Equipment: 5 to 10 years

3. **Flood Elevations** – The flood elevations for sewage treatment unit processes should be based on the historical flood elevations listed below except on a case by case basis to meet existing or unusual conditions or where the discharge is to sensitive receiving waters:

   a. 25 Year Flood Elevation to remain fully operational.  
   b. 100 Year Flood Elevation to protect structures housing critical operating equipment from flooding.
4. Operating Elevation, Design Flow – Consult with the Hydraulic Analysis Review Team (HART) report to determine design criteria if applicable or obtain hydraulic data from HRSD Hydraulic Analysis Managers.

5. Nutrient Removal
   
a. Provide consistent tank nomenclature at Biological Nutrient Removal (BNR) plants. Engineering documents and drawings should use this nomenclature.
      
i. “1st Anoxic Zone” is correct. Do not use “Pre-anoxic zone”.
   
ii. “2nd Anoxic Zone” is correct. Do not use “Post-anoxic zone”.
   
iii. Number multiple cells within an Anoxic or Aerobic zone according to the flow direction in the tank; for example: 2nd Anoxic Zone, Cell 1; 2nd Anoxic Zone, Cell 2; 2nd Anoxic Zone, Cell 3.
   
iv. For step feed process, use “1st Anoxic Zone”, “2nd Anoxic Zone”, “3rd Anoxic Zone”, etc and “1st Aerobic”, “2nd Aerobic”, “3rd Aerobic”, etc.
   
v. For Bardenpho processes, use “Aerobic Zone” and “Reaeration Zone”.

6. Design Loadings – The design loadings for sewage treatment unit processes should be based on the maximum monthly wastewater flow and the maximum month mass loading for CBOD, COD, TSS, TP, and TN. The maximum month loading and projected growth should be based on historical records, field sampling or similar experience. Include the impacts of septage discharge, chemical addition and recycle loads on the maximum monthly concentrations. Base recycle loads on historical records. If accurate data is not available, consider a minimum of a 10% recycle of CBOD, TSS, P and N as appropriate from solids handling. Peak loadings (such as peak weekly loadings or peak hourly loadings where typically used for process design) should be as recommended by the design engineer. Identify all flows, concentrations and loadings used for the design of unit processes in the design documents.

Water conservation has caused a general decrease in flow and corresponding increase in concentrations of CBOD, TSS, P and N. This trend may significantly change the original design loadings at some treatment plants where sewage treatment and/or solids handling unit processes become limited by CBOD and TSS loadings before the design flow is reached unless additional aeration and/or solids handling capacity is available. Sewage treatment and solids handling unit processes should be designed to accommodate this trend by using higher influent concentrations as appropriate so as to fully utilize the design flow of the treatment plants. Low Impact Development and water conservation efforts such as low flush toilets, flushless urinals, and grey-water reuse will further increase CBOD, TSS, TP, and TN concentrations. Sewage treatment and solids handling unit processes should be designed to accommodate this trend by using higher influent concentrations. Recommended values for new residential neighborhoods are: BOD = 299 mg/l, TSS = 261 mg/l, TKN = 50.3 mg/l, and TP = 6.23 mg/l (“HRSD Domestic Wastewater Survey” Memorandum, December 8, 2014).

7. Design For Initial Plant Startup – The design for initial plant startup should provide for efficient and economical operation of sewage treatment unit processes without problems
caused by oversized tanks and equipment if low flows are expected during early years of operation. The design for initial plant startup may incorporate:

a. Sufficient turndown capability
b. Additional smaller initial equipment to be operated only at lower flows.
c. Multiple smaller initial equipment to be operated together at higher flows.

8. Outfalls And Outfall Diffusers – Consult with the Hydraulic Analysis Review Team (HART) report to determine design criteria if applicable or obtain hydraulic data from HRSD Hydraulic Analysis Managers.

9. Reliability And Redundancy – The reliability and redundancy of major sewage treatment equipment should be the ability to take any one unit process train out of service at design flow as long as all unit process trains of all other unit processes remain in service. Verify that the design complies with SCAT Regulations.

10. Equipment Selection – The current, approved list of sole-source equipment can be found on Sharepoint site under Finance / Sole Source/ COMMISSION APPROVED SOLE SOURCE ITEMS. Users without Sharepoint access may request this document by contacting the Engineering Department.

11. Minimum Requirements:

<table>
<thead>
<tr>
<th>Sewage Treatment Unit Process</th>
<th>Min. No. of Units Installed</th>
<th>No. of Units Out of Service</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Measurement</td>
<td>1</td>
<td>0</td>
<td>Provide flow measurement with totalizer. FNE is preferred over RWI. Internal recycle streams are to be separate (after RWI measurement or prior to FNE measurement). Consider parshall flume, venturi, or magmeter. Employ only flow meter equipment that is accurate and non-ragging/self-cleaning.</td>
</tr>
<tr>
<td>Influent Pumping</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sewage Treatment Unit Process</td>
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</tr>
<tr>
<td>-------------------------------</td>
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</tr>
<tr>
<td>Pumps</td>
<td>Minimum 3 units (includes one spare) Firm capacity to be determined by HRSD Planning &amp; Analysis of 2.5 times design flow Meet firm capacity with largest unit out of service</td>
<td>1</td>
<td>Provide for all pumps to be variable speed. The 1st pump runs continuously, the 2nd pump starts when 1st pump cannot handle all of the flow. Additional pumps run when 1st and 2nd pumps cannot handle flow or upon failure of 1st or 2nd pump.</td>
</tr>
<tr>
<td>Wet Wells/Channels</td>
<td>As required</td>
<td>As required</td>
<td>Consider self-cleaning wet wells. Match size and controls to pumping requirements to prevent frequent start/stop of pumps. Consider means to remove wet wells and enclosed channels from service in the future for maintenance of concrete and coatings. Provide for personnel access into wet well. Provide protective lining or coating at linear trench style self-cleaning wet wells for RWI service.</td>
</tr>
<tr>
<td>Automatic Actuators</td>
<td>-</td>
<td>-</td>
<td>Provide automatic actuators on all critical control gates and valves. Consider remote DCS control and provide at a minimum position indication.</td>
</tr>
</tbody>
</table>
| Isolation Gates               | -                           | -                           | Provide secondary means of closure at all gates. Stop logs or Stop Gates may be considered provided they:  
  - meet the same AWWA leakage rates specified for slide gates  
  - are engineered and composed of: |
<table>
<thead>
<tr>
<th>Sewage Treatment Unit Process</th>
<th>Min. No. of Units Installed</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>• FRP encapsulated A36 steel or 304 SST for the stop log / stop gate panel</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>o neoprene rubber for the seals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>o SST for the slide frame and hardware with replaceable UHMW guide strips and neoprene guide seals.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• have logs that are a minimum of 3-1/2” thick with opposing bottom-mounted dual “J” seals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• have surface mounted slide channel frame guides permanently installed in channel walls with a flat bottom sealing surface (no sealing keyway/grove) for the stop logs to seal against,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• have a mechanical galvanized lifting beam assembly to place and retrieve the stop log or stop gates</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• are mounted in areas accessible to a portable gantry for use with the lifting beam assembly. If not, a permanent gantry or jib must be installed and positioned to accommodate log/gate installation and extraction.</td>
</tr>
<tr>
<td>Sewage Treatment Unit Process</td>
<td>Min. No. of Units Installed</td>
<td>No. of Units Out of Service</td>
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<tr>
<td>-------------------------------</td>
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<td>----------</td>
</tr>
<tr>
<td>Bar Screens</td>
<td>2 minimum; Sized for 2.5 x annual average wastewater flow rate with largest unit out of service</td>
<td>1</td>
<td>Size to protect plant during severe storm flow conditions. Provide coarse screen bypass channel. Screenings are to be sluiced to a compactor. Discharge screenings into bulk storage containers. Minimum two containers, each sized for one screen. Manifold discharge screenings to multiple containers. Locate containers inside enclosed building with odor control.</td>
</tr>
<tr>
<td>Center Flow Band Screens and Drum Screens</td>
<td>2 minimum; Sized for 2.5 x annual average wastewater flow rate with largest unit out of service</td>
<td>1</td>
<td>Size to protect plant during severe flow conditions. Band screens are to have internal bypass overflows (bypass channel not required). Screenings are to be sluiced to a compactor. Discharge screenings into bulk storage containers. Minimum two containers, each sized for one screen. Manifold discharge screenings to multiple containers. Locate containers inside enclosed building with odor control.</td>
</tr>
<tr>
<td>Step Screens</td>
<td>2 minimum; Sized for 2.5 x annual average wastewater flow rate with largest unit out of service</td>
<td>1</td>
<td>Size to protect plant during severe flow conditions. Provide coarse screen bypass channel for emergency use. Screenings are to be sluiced to a compactor. Discharge screenings into bulk storage containers. Minimum two containers, each sized for one screen. Manifold discharge screenings to multiple containers. Locate containers inside enclosed building with odor control.</td>
</tr>
<tr>
<td>Sewage Treatment Unit Process</td>
<td>Min. No. of Units Installed</td>
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<tr>
<td>-------------------------------</td>
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</tr>
<tr>
<td><strong>Grit Removal Tanks</strong></td>
<td>2 minimum; Sized for 2.0 x annual average wastewater flow with largest unit out of service</td>
<td>1</td>
<td>Size to protect plant during severe storm flow conditions. Consider only detritors, stacked vortex (Head Cell), or structured vortex (Grit King). Avoid aerated grit, forced vortex, and velocity channels (grit channels). Consider collection system diurnal velocities for deposition of grit and storm slug loads.</td>
</tr>
<tr>
<td><strong>Grit Pumps</strong></td>
<td>2 per tank</td>
<td>1</td>
<td>Size each unit to handle total tank loading. Do not provide interconnection between tanks. Minimum grit pipe diameter is 6-inch. Minimum grit pump suction / discharge size is 4-inch / 4-inch. Provide flushing water on suction side of pumps.</td>
</tr>
<tr>
<td><strong>Classifiers</strong></td>
<td>2 per tank</td>
<td>1</td>
<td>Size each unit to handle total tank loading.</td>
</tr>
<tr>
<td><strong>Hopper</strong></td>
<td>1</td>
<td>0</td>
<td>Discharge all classifiers into 1 hopper. Locate hopper inside enclosed building with odor control.</td>
</tr>
<tr>
<td><strong>Pre-Aeration</strong></td>
<td>-</td>
<td>-</td>
<td>Do not use.</td>
</tr>
<tr>
<td><strong>Primary Clarifiers Tanks</strong></td>
<td>3 sized for design loadings</td>
<td>1</td>
<td>Prefer circular units if space available due to less maintenance and better thickening. Consider separate fermenter for BNR if circular units used. For circular tanks, evaluate stainless steel rake and scum systems, FRP weirs/wells, SS center pier.</td>
</tr>
<tr>
<td>Sewage Treatment Unit Process</td>
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</tr>
<tr>
<td>Solids Pumps</td>
<td>1 dedicated pump per clarifier with 1 spare pump per 2 or 3 clarifiers</td>
<td>1</td>
<td>Provide turndown capability or smaller pumps for low flow requirements at initial plant startup with provisions to replace smaller pumps as plant expands. Provide grinder or solids screen with bypass line ahead of each pump. Pumps with internal cutting blades can be considered if grinder installation is not practical due to space limitations.</td>
</tr>
<tr>
<td>Intermediate Pumping</td>
<td></td>
<td>Refer to Pump subheading in Influent Pumping.</td>
<td></td>
</tr>
<tr>
<td>Aeration Tanks</td>
<td>3 minimum; accommodate 2.5 times design flow with one tank out of service</td>
<td>1</td>
<td>Provide foam re-entrainment and/or foam removal.</td>
</tr>
<tr>
<td>Blowers</td>
<td>3 sized for design loadings with largest unit out of service</td>
<td>1</td>
<td>Provide turndown capability or 2 smaller blowers approximating 1 larger blower for low air requirements at initial plant startup with provisions to replace smaller blowers or install additional blowers as plant expands. Provide automatic start/stop and air control. Refer to HRSD Standard Functional Descriptions for control regimes. Locate blowers near aeration tanks to minimize air piping.</td>
</tr>
<tr>
<td>Air Piping</td>
<td>-</td>
<td>-</td>
<td>Locate air piping above ground or in tunnels; do not bury.</td>
</tr>
<tr>
<td>Air Diffusers</td>
<td>-</td>
<td>-</td>
<td>Fine bubble diffused air system.</td>
</tr>
<tr>
<td>Sewage Treatment Unit Process</td>
<td>Min. No. of Units Installed</td>
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</tr>
<tr>
<td>Secondary Clarifiers Tanks</td>
<td>3 minimum; accommodate 2.5 times design flow with one tank out of service</td>
<td>1</td>
<td>Provide variable speed pumps sized for total dedicated pump capacity of 1.0 x maximum monthly wastewater flow.</td>
</tr>
<tr>
<td>RAS Pumps</td>
<td>1 dedicated pump per clarifier with provision for adequate number of spare pumps</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>WAS Pumps</td>
<td>2 typically pulling off RAS discharge</td>
<td>1</td>
<td>Provide turndown capability or smaller pumps for low flow requirements at initial plant startup with provisions to replace smaller pumps as plant expands.</td>
</tr>
<tr>
<td>Chlorine Contact Tanks</td>
<td>2 sized for design flows</td>
<td>1</td>
<td>Provide 30 minutes detention time at maximum monthly wastewater flow (corresponding to SCAT terminology of average daily wastewater flow) or 20 minutes at 2.0 x maximum monthly wastewater flow (corresponding to SCAT terminology of maximum daily wastewater flow) whichever is greater with largest unit out of service. Provide scum removal system.</td>
</tr>
<tr>
<td>Effluent Pumping Pumps</td>
<td>3 sized for 2.5 x design wastewater flow with largest unit out of service</td>
<td>1</td>
<td>Provide variable speed pumps. Controls shall conform to HRSD Standard Functional Description.</td>
</tr>
<tr>
<td>Sewage Treatment Unit Process</td>
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<td>No. of Units Out of Service</td>
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</tr>
<tr>
<td>-------------------------------------------------------------------</td>
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<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Wet Well                                                          -</td>
<td>-</td>
<td>Match size and controls to pumping requirements to prevent frequent start/stop of pumps. Locate close to chlorine contact tanks. Provide scum removal system.</td>
<td></td>
</tr>
<tr>
<td>Non-Potable Pumps and Automatic Strainers</td>
<td>3</td>
<td>1</td>
<td>May need additional pumps for multiple purposes, wide flow range, or low flow requirements at initial plant startup. Locate suction before dechlorination. Refer to HRSD Standard Functional Descriptions for control. Ensure complete by-pass capabilities for strainer maintenance.</td>
</tr>
<tr>
<td>Scum Removal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wells and Holding Tanks</td>
<td>-</td>
<td>-</td>
<td>Provide for agitation to break up crusted scum and automatic pump out of scum without excessive water. Consider morning glory / tee valve to minimize water content of pumped scum.</td>
</tr>
<tr>
<td>Scum Transfer Pumps</td>
<td>2 per well or holding tank</td>
<td>1</td>
<td>Provide grinder ahead of each pump. Do not use air operated diaphragm pumps.</td>
</tr>
<tr>
<td>Scum Piping</td>
<td>-</td>
<td>-</td>
<td>Minimum 4-inch diameter. Corrosion-resistant glass lined ductile iron, HDPE, or PVC. Long radius bends, cleanouts, NPW flushing connections.</td>
</tr>
<tr>
<td>Concentrator</td>
<td>2</td>
<td>1</td>
<td>Do not use air operated diaphragm pumps.</td>
</tr>
<tr>
<td>Concentrated Scum Pumps</td>
<td>2 per concentrator</td>
<td>1</td>
<td>Do not use air operated diaphragm pumps.</td>
</tr>
<tr>
<td>Sewage Treatment Unit Process</td>
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</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------</td>
<td>-----------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Concentrated Scum Piping</td>
<td>-</td>
<td>-</td>
<td>Maximum 4-inch diameter. Corrosion-resistant glass lined ductile iron, PVC, or HDPE. Long radius bends, cleanouts, NPW flushing connections, and air connection at injection point to furnace.</td>
</tr>
<tr>
<td>Chemical Feed Systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pumps</td>
<td>1 dedicated pump per feed point with 1 spare pump connected to manifold</td>
<td>-</td>
<td>Provide turndown capability or range of pump sizes to accommodate low flow and high flow requirements. Flow meters to read accurately at all anticipated flow ranges.</td>
</tr>
<tr>
<td>Odor Control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enclosed Facilities and Covered Tanks</td>
<td></td>
<td></td>
<td>Consider on case by case basis.</td>
</tr>
<tr>
<td>Scrubbers</td>
<td>2 trains of 2 scrubbers each including standby train for sewage treatment</td>
<td>1 train</td>
<td>Consider 1 large odor control station versus multiple smaller odor control stations on case by case basis. Provide additional trains for large air flows. Consider bioscrubbers and carbon scrubbers where applicable.</td>
</tr>
<tr>
<td></td>
<td>2 scrubbers including standby scrubber for solids handling where single stage scrubbing is appropriate or as above for sewage treatment</td>
<td>1 scrubber</td>
<td>Provide for chemical cleaning of scrubbers.</td>
</tr>
<tr>
<td>Sewage Treatment Unit Process</td>
<td>Min. No. of Units Installed</td>
<td>No. of Units Out of Service</td>
<td>Comments</td>
</tr>
<tr>
<td>------------------------------</td>
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</tr>
<tr>
<td>Emergency Power Generators</td>
<td>1 sized on case by case basis to power all sewage treatment operations at 2.5 x maximum monthly wastewater flow plus critical solids handling operations on a case by case basis</td>
<td>0</td>
<td>Satisfy Class I Reliability requirements. Provide emergency generator(s) rated to adequately power required plant loads. Provide sufficient fuel storage for a 7 consecutive day utility outage at full load.</td>
</tr>
<tr>
<td>UPS</td>
<td>-</td>
<td>-</td>
<td>Provide backup power for sufficient time at control stations for critical computer, data collection and I&amp;C functions.</td>
</tr>
</tbody>
</table>

D. Solids Handling Design and Operation:

1. The planning and selection of solids handling facilities, unit processes and final solids use or disposal should be in accordance with the Solids Management Plan on HRSD SharePoint site. The evaluation of new solids handling facilities should consider alternative and multiple methods and backup plans to provide for flexibility and contingencies in case of process failure or new regulatory requirements. The design and operation of solids handling facilities should be in accordance with all provisions of the approved SCAT Regulations. Solids handling design and operation should also comply with the requirements of the 40 CFR Part 503, MACT 129, and Title V regulations.

2. Design Life – The design life for various elements of solids handling facilities should be greater than or equal to the following:

   a. Structures: 50 years
   b. Piping and Conveyance: 50 years
   c. Mechanical Equipment: 20 years
   d. Electrical Power Equipment: 20 years
3. Solids Capacity – The solids capacity for solids handling unit processes should be based on the following criteria:

   a. Plant Solids Capacity – The plant solids capacity of the overall solids handling facilities should be based on solids production at maximum monthly flow and load.
   
   b. Process Solids Capacity – The process solids capacity for individual solids handling unit processes including recycle loadings and peak loadings (such as peak weekly loadings or peak hourly loadings) should be as recommended by the design engineer.
   
   c. Limiting Solids Capacity – The limiting solids capacity of the overall solids handling facilities should be based on the individual solids handling unit process having the lowest monthly solids capacity (i.e. the bottleneck).

   Note: Observations on loadings and capacity of solids handling unit processes based on HRSD analysis and experience are as follows:
   
   - Peak daily loadings are buffered (absorbed) by peak weekly loadings.
   - Incinerator capacity is related as follows:

     | Peak Daily Capacity | = Equipment Rated Max. Capacity |
     | Peak Weekly Capacity | ≈ Peak Daily Capacity due to buffering capacity |
     |                      | = Equipment Rated Max. Capacity |
     | Max. Monthly Capacity | = 85% x Peak Weekly Capacity |
     |                      | = 85% x Equipment Rated Max. Capacity |
     | Avg. Monthly Capacity | = 85% x Max. Monthly Capacity |
     |                      | = 85% x 85% x Peak Weekly Capacity |
     |                      | = 72% x Peak Weekly Capacity |
     |                      | = 72% x Equipment Rated Max. Capacity |

4. Design Loadings – The design loadings for solids handling unit processes are to be as recommended by the design engineer. The design loadings should be based on historical records, field sampling, or similar experience. The design loadings should include the impacts of septage discharge, chemical addition, and solids from other plants.

5. Design For Initial Plant Startup – The design for initial plant startup should provide for efficient and economical operation of sewage treatment unit processes without problems caused by oversized tanks and equipment if low flows are expected during early years of operation. The design for initial plant startup may incorporate:

   a. Sufficient turndown capability
   b. Additional smaller initial equipment to be operated only at lower flows.
   c. Multiple smaller initial equipment to be operated together at higher flows.
6. Intermittent Operation – The intermittent operation of solids handling unit processes should be evaluated carefully to determine the impacts on other sewage treatment and solids handling unit processes and operations at both initial plant startup and design loadings. A plan for intermittent operations, if applicable, should be developed by HRSD and forwarded to the design engineer early in the design process.

7. Impact On Sewage Treatment – The impact of solids handling unit processes on other sewage treatment unit processes and operations should be evaluated carefully at both initial plant startup and design loadings. Such impacts from solids handling may be detrimental to performance of sewage treatment unit processes or operating efficiency of facilities. The evaluation should consider factors such as:

a. Initial and design loadings
b. Size of equipment and turndown capability
c. Intermittent operation and hours of operation
d. Recycle load impact on unit processes
e. Interdependent onsite and offsite unit processes and operations

8. Reliability And Redundancy – The reliability and redundancy of solids handling unit processes should be based on operating with the largest unit out of service. The reliability and redundancy of major solids handling equipment should be based on having a spare unit of the largest size. Verify that the design complies with the SCAT Regulations.

9. Equipment Selection – The current, approved list of sole-source equipment can be found on Sharepoint site under Finance / Sole Source/ COMMISSION APPROVED SOLE SOURCE ITEMS. Users without Sharepoint access may request this document by contacting the Engineering Department.

10. Minimum Requirements:

<table>
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<tr>
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<th>No. of Units Out of Service</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holding Tanks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>1 minimum, 2 preferred</td>
<td>1</td>
<td>Need to evaluate mixing requirements. Consider Confined Space Entry Permit requirements when designing access for cleaning and inspection. Provide odor scrubbing of the Holding Tanks</td>
</tr>
<tr>
<td>Day</td>
<td>1 minimum, 2 preferred</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Blend</td>
<td>1 minimum, 2 preferred</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Thickeners</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>-----------------------------</td>
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<td>-----------------------------</td>
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</tr>
<tr>
<td>Gravity</td>
<td>2 sized for design loadings</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Flotation</td>
<td>2 sized for design loadings w/ largest unit out of service</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Gravity Belt</td>
<td>2 sized for design loadings w/ largest unit out of service</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Thickened Solids Pumps</td>
<td>1 dedicated pump per unit with one spare pump where applicable</td>
<td>1</td>
<td>Provide VFD/pump system turndown capability or smaller pumps for low flow requirements at initial plant startup with provisions to replace smaller pumps as plant expands.</td>
</tr>
<tr>
<td>Hopper</td>
<td>1</td>
<td>0</td>
<td>Provide useable hopper volume to match operational and process requirements. Provide hopper level monitoring to control the Thickened Solids Pumps.</td>
</tr>
</tbody>
</table>

<p>| Anaerobic Digesters         |                             |                             |          |
| Primary                     | 2 sized for design loadings w/ largest unit out of service to meet Class B requirements | 1 | Requires 6 months to clean and repair digester. Both primary and secondary digesters shall be dual-purpose. |
| Secondary                   | 1 sized for design loadings | 1                           | Consider alternate gas storage on a case by case basis. Both primary and secondary digesters shall be dual-purpose. |</p>
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>2 Stage Acid Phase</td>
<td>2 sized for design loadings w/ one unit out of service</td>
<td>1</td>
<td>Avoid P-traps on drawoffs due to gas/liquid binding.</td>
</tr>
<tr>
<td>Gas Phase</td>
<td>2 sized for design loadings w/ one unit out of service</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Pumps</td>
<td>1 dedicated pump per unit with one spare pump per every two units</td>
<td>1</td>
<td>Provide turndown capability or smaller pumps for low flow requirements at initial plant startup with provisions to replace smaller pumps as plant expands.</td>
</tr>
<tr>
<td>Heat Exchangers</td>
<td>-</td>
<td>-</td>
<td>Shell and tube. Do not install spiral heat exchangers.</td>
</tr>
<tr>
<td>Foam Control</td>
<td>-</td>
<td>-</td>
<td>Consider foam control measures</td>
</tr>
<tr>
<td><strong>Dewatering</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belt Filter Press</td>
<td>2 sized for design loadings w/ one unit out of service</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Centrifuge</td>
<td>2 sized for design loadings w/ one unit out of service</td>
<td>1</td>
<td>Provide 1 spare uninstalled rotating assembly or 1 additional installed centrifuge. Requires 6 months for outside repair of centrifuge.</td>
</tr>
<tr>
<td>Pumps</td>
<td>1 pump per unit</td>
<td>1</td>
<td>Provide turndown capability or smaller pumps for low flow requirements at initial plant startup with provisions to replace smaller pumps as plant expands. Provide grinder ahead of each pump.</td>
</tr>
<tr>
<td>Solids Handling Unit Process</td>
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</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------</td>
<td>-----------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Hopper</td>
<td>2</td>
<td>1</td>
<td>Design system to be flexible for discharge into any / all hoppers. Provide usable hopper volume to match operational and process requirements. Account for working volume lost to angle of repose of dewatered solids.</td>
</tr>
<tr>
<td><strong>Biosolids Receiving Facility</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loading Hopper</td>
<td>2 sized for usable volume to hold a minimum of 60 yd³ each</td>
<td>1</td>
<td>Design system to be flexible for discharge into any / all hoppers. Provide usable hopper volume to match operational and process requirements at both the loading and receiving plants. Account for working volume lost to angle of repose of dewatered solids.</td>
</tr>
<tr>
<td>Receiving Hopper</td>
<td>2 sized for usable volume to hold a minimum of 60 yd³ each</td>
<td>1</td>
<td>Provide usable hopper volume to match operational and process requirements at both the loading and receiving plants. Provide for unloading from different types of trucks where possible. Account for working volume lost to angle of repose of dewatered solids.</td>
</tr>
<tr>
<td>Pumps</td>
<td>1 dedicated pump per unit with one spare pump</td>
<td>1</td>
<td>Provide pump range and turndown capability to match operational and process requirements at both the loading and receiving plants.</td>
</tr>
<tr>
<td>Incinerators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluidized Bed</td>
<td>2 sized for design loadings w/ largest unit out of service</td>
<td>1</td>
<td>Provide for MACT 129 requirements.</td>
</tr>
</tbody>
</table>
E. Access to Unit Processes and Equipment

1. Provide access into enclosed and partially enclosed tanks, channels, and other structures to perform required inspection and maintenance. Design access points to minimize the impact on confined space entry through the use of gates, removable handrail sections, hatches with built in fall protection, anchor points, etc. Provide ground level access for above ground tanks.

2. Provide permanent stairs, ladders, or other assemblies to access tanks, buildings, structures, equipment, valves, components, etc. in accordance with OSHA regulations. Provide landings with handrail systems at the top, and intermediate (as required) elevations of access assemblies. For ladder systems, elevate the first rung approximately 12-inches from the top-of-landing. Do not use Fiberglass Reinforced Plastic (FRP).

3. Provide elevated walkways with handrails in accordance with OSHA requirements to access multiple tanks and/or structures that are located in close proximity to each other. The minimum width of walkways shall be four (4) feet.

4. Provide isolation valves upstream of all devices and appurtenances to allow for maintenance or removal. Provide isolation valves from other tanks that are commonly piped together. Provide manway access into the tank for maintenance and internal inspections.

5. Refer to Section 21 HRSD Safety Standards within this manual for additional requirements.

F. Sampling

1. Sampling is required for process monitoring and control and regulatory reporting. Sampling must be representative and reliable.
2. Sampling hatches shall be provided at designated sampling locations. All sample points shall be provided with 120V outlet connections. Raw influent and final effluent sample points shall be provided with a flow signal.

3. Sampling points are to be planned, designed and designated for all process flows and other samples routinely monitored. Sampling points are to provide representative samples under all operating conditions. In general, sampling points are to be:
   a. Located to include or exclude recycle streams as appropriate.
   b. Well mixed to avoid solids separation.
   c. Representative when process units are taken out of service.
   d. Easily accessible for sampling or maintenance.


5. Automatic Samplers:
   a. Provide “composite-only” or “sequential/composite” samplers designed for outdoor/corrosive environments and manufactured with an exterior shell made of UV resistant fiberglass. Enclosures shall be refrigerated and heated to control temperatures inside the unit. Place samplers on housekeeping pads.
   b. Provide for external inputs for flow pacing and local receptacles for power.
   c. Coordinate with HRSD Technical Services Division to provide a bracket and pole for support of the sample tubing, where appropriate.
   d. Provide for training of the plant staff for this piece of equipment. The training is to be included with the purchase price and/or construction contract.
   e. Do not locate samplers in a classified space.

G. Chemical Containment

1. Provide a negative slope (minimum 1/8 inch per foot) on all floors to a sump or drain.

2. Select valves, piping, supports, and sump pump materials to be resistant to chemicals stored.

3. Generally, a sump and pump are preferred over a drain system. Sumps to be recessed to completely drain tank floor.

4. No equipment inside containment area – limit to piping and appurtenances. All tank instrument read-outs are to be located outside of the containment. All pump shutdown HOAs are to be located outside of the containment. If equipment must be located inside containment, locate above expected elevation of contained liquid. All piping is to be located above expected elevation of contained liquid.
5. Size containment areas to meet local building code. At a minimum, provide storage volume of 110% of the largest tank.

6. Minimize the installation of electrical conduit and heat trace systems within containment areas.

7. Provide for potable or non-potable water for cleaning of the containment areas. For hose connections, provide male polyethylene camlock connections with caps.

8. Consider the following questions when designing a sump pump system:
   a. Will the pump be located in the sump or elevated on rails?
   b. Will the pump be designed to handle the chemical or to be replaced after each use?
   c. Is suction lift a problem?
   d. What is the ultimate discharge point for the pump and where will a spilled chemical be pumped?
   e. Will the pump handle rainwater?
   f. Can a NPW eductor system be used in-lieu of an actual pump system?

   NOTE: Draining chemical containment systems shall be a manual operation to ensure that chemicals are not accidentally discharged to the storm drain or plant drain system.

9. Provide suitable access into containment areas.

10. Avoid piping and conduit penetrations through containment walls and floors.

11. Locate feed pump suction piping within the containment area.

12. Conduct a hydrostatic test of the containment area to ensure that there are no leaks.

13. Provide appropriate waterstop material in all concrete joints.

14. Provide close inspection of concrete workmanship and coating systems prior to the placement of tanks and other equipment.

15. Provide local high level alarm for containment sump that is also capable of being displayed on plant DCS.

H. Chemical Feed Systems

1. General
   a. Fill Stations
      i. Provide adequate venting in the design of the chemical storage tanks and fill piping. Consider the impact of vent discharge points on equipment and
personnel. Chemical suppliers often use compressed air to deliver the chemical into the storage tanks and to remove the contents of the supply hoses into the storage tanks.

ii. Provide male end polyethylene quick disconnect at fill stations. A dry-break fitting is not required.

iii. Consider use of duplex strainers in parallel on fill line.

iv. Review the diameter of the quick disconnect with the plant staff to limit the possibility of contamination with other chemicals on the plant site.

v. Provide containment to connections and fill stations and provide a drain to a proper discharge point.

vi. Provide suitable ground connection for truck unloading of flammable chemicals. Interlock fill valve permissive with ground connection.

b. Storage Tanks

i. Review sizing criteria for the tank(s) with the plant staff. Carefully consider the number of days of storage, volume needed for dilution, the number of tanks to allow for inspection and maintenance and minimum delivery volumes. A suggested method for calculating the volume of chemical to be stored is:

(a) 15 day peak use at plant capacity, or
(b) 30 day average use at plant capacity (whichever is greater).
(c) For chemicals which degrade significantly with time, such as sodium hypochlorite, use a 7 day peak/15 day average demand to calculate storage volumes.

ii. Consider if level indication is needed with the tank. Ultrasonic type level indicator is preferred except for flammable applications such as methanol, for which radar is preferred. Ultrasonic level indicators should be located in the top/center portion of the tank using a flanged connection. If vertical space is not available above the tank for installation or maintenance of the level indicator, consider the use of a differential pressure cell at the base of the tank. Refer to Section 30 - Electrical and Instrumentation in this manual for further details regarding level indicators. Provide sight glasses only if a redundant system is needed. If a sight glass is required, provide valves at both the top and bottom.

iii. Set relative elevations of tank and pumps to allow drawoff of full tank volume.

iv. Provide storage tanks with ladders, safety cages, platforms with rails, etc. in accordance with OSHA requirements. Adjacent piping should not limit access to these ladders or critical isolation valves. Isolation valves must be connected directly to the tank. Consider consolidating piping adjacent to tanks to minimize access and maintenance problems. Proper vertical clearance is also important to access tank manways and maintain equipment located on top of these tanks.
v. Provide multiple manway openings for access and ventilation on tanks with volumes greater than 1,000 gallons. Consider placement of manway openings for ease of access.

vi. Provide sloped tank bottoms to allow tanks to be completely emptied using installed drains or pumps.

vii. Design storage tanks considering compatibility with chemicals stored and concentrations anticipated.

viii. Permanently attach each tank’s nameplate information including manufacturer, year of manufacture, working volume, empty volume, material of construction, diameter, and product designed to store.

c. Piping & Appurtenances

i. Manifold piping, tanks, and pumps and provide valves and check valves in appropriate locations to allow maximum operational and maintenance flexibility for any tank/pump/process train combination.

ii. Bolt critical valves directly to tank to simplify locating leaks.

iii. Provide an appropriate discharge point for pressure relief valves used for chemical feed systems. Detail or describe the ultimate discharge point if it is not adjacent to the limits of the work for the project.

iv. Provide ventilation lines for calibration columns plumbed to appropriate ventilation discharge points.

v. Provide a permanent pressure gauge on the suction and discharge of each pump with gauge isolation valve.

vi. Provide flushing connections at appropriate locations in each chemical feed system. Provide a hose connection on the suction and discharge piping manifold for flushing the system.

vii. Design piping located under or adjacent to roadways for H-20 loading.

viii. Overhead chemical piping should be avoided whenever possible.

d. Feed Pumps

i. Provide pumps with a calibration column (manufacturer recommended or HRSD Standard). Provide pulsation dampener, elapsed-time meter, back pressure and relief valve as recommended by the Manufacturer.

e. Flow Metering – Provide a valved bypass or other method to allow for removal and maintenance of meters without spilling large amounts of chemical or shutting down critical plant processes.

f. Operations/Maintenance/Accessibility

i. Locate eyewash and emergency shower stations adjacent to new chemical feed systems in accordance with OSHA regulations. The location of these stations should be designed to facilitate access with existing facilities. Review the location of existing eye wash stations to determine if these station locations are satisfactory for the new work. See the Emergency Eyewash and Showers paragraph in this Section for further information.
ii. Elevate pumps or other equipment which require regular maintenance at least two feet above the floor or access platform to facilitate maintenance. This preference should not take precedence over the hydraulic requirements of the pump.

iii. Provide duplex unit strainers accessible for maintenance when strainers are required for chemical systems.

iv. Provide access to items of regular use or maintenance (i.e. pump wet ends, isolation valves, etc.) without the need to enter tank containment areas whenever possible. Access to these items should also be provided with as little interference and obstructions as possible.

g. Chemical Off-Gassing – Provide storage tanks with vents larger in diameter (minimum 2 to 5 times) than the fill piping. Carefully consider vent orientation and discharge to limit impacts to worker safety and corrosivity to adjacent facilities. Consider the use of scrubber systems if the discharge of the vent will negatively impact the adjacent area.

h. Electrical Equipment

i. Refer to Section 30 - Electrical and Instrumentation in this manual for further information regarding electrical equipment used for chemical feed systems.

2. Caustic (NaOH) Systems

a. General – Caustic is primarily used by HRSD as part of the odor control process. The product is normally delivered at 50% strength and immediately diluted to a strength of 25%.

b. Storage Tanks

i. Provide steel tanks due to the heat released during the dilution procedure. Utilize a post-weld heat treatment procedure in tank manufacturing.

ii. Provide an automatic batch control system with a metered water source for dilution. Utilize non-potable water for dilution purposes. Provide strainer on the non-potable water source.

iii. Provide for continuous mixing of the storage tank. The pump should be a air operated diaphragm or centrifugal type. Pump to be compatible with heat generated during dilution. Heat tracing and insulation of the tank is not required since the chemical is diluted immediately upon delivery. Insulation and heat tracing of the non-potable water piping is required for outdoor applications.

c. Piping & Appurtenances

i. Provide Schedule 80 CPVC. For buried locations use piping shall be double contained, either fusion welded high-density polyethylene (HDPE) or PVC with nylon braided reinforced tubing inside a PVC jacket pipe.
ii. Minimize or eliminate threaded fittings and unions whenever possible. Use flanged connections at all fittings, valves and other appurtenances. Gasket, O-rings, and pulsation dampener material shall be EPDM.

iii. Provide metal ball valves for diameters of less than or equal to three inches and metal or fiberglass composite ball valves for diameters over three inches. Provide backpressure valves designed to consider the caustic feed pump discharge pressure range.

iv. Heat trace and insulate all outside pipework.

d. Feed Pumps

i. Provide a minimum of two feed pumps for this application. Pumps should be positive displacement.

e. Flow Metering - Provide magnetic (Mag) type flow meters with a valved bypass for each feed point. Mag meters must be mounted so that they are measuring a full pipe and so that they do not trap gases.

3. Sodium Hypochlorite (NaOCl) Systems

a. General – Sodium hypochlorite is used in the chlorine contact tanks, in the odor control scrubbers, for filamentous control in the returned activated biosolids system, and in other locations throughout the plant. The product is normally delivered at a strength between 12 – 15%.

b. Storage Tanks

i. Storage tanks to be manufactured of fiberglass reinforced plastic (FRP). Material selected to be compatible with field installation of bulkhead fittings. Design flexible connection with tank piping due to expansion / flexure at connection points.
The reservoir is made from 4” PVC pipe (larger can be used for pumps with higher volume deliveries) with glued caps that are tapped and threaded for NPT threads for whatever size pipe is needed. The sight glass is made from 1” clear PVC. The sight glass is bench calibrated using standard volume containers (beakers, graduated cylinders etc) to suit the system needs.
ii. Locate storage tanks indoors or in a covered location outdoors. For indoor locations, consider carefully room ventilation to limit the corrosive fumes common from this chemical. Provide insulation for all tanks located outdoors.

iii. Provide a transfer pump for this application to move product from storage tank to storage tank. Design the system to protect the transfer pump from running dry or provide a pump that is capable of running dry without causing damage to the pump.

iv.

c. Piping & Appurtenances

i. Design piping to feed the product in neat (undiluted) form to the final application point to eliminate scaling when mixed with non-potable water. Piping shall be rigid PVC (Schedule 80) for exposed locations and PVC braided tubing for buried locations. The tubing shall be encased in a suitable PVC conduit to limit accidental damage, to provide containment and to allow for removal of the tubing in case of a leak. Provide redundant feed for buried piping for both disinfection and odor control applications. Provide access manholes at buried piping junction points and bends. Design manhole to provide containment of the chemical. Use Weld-On 724 piping glue by IPS Corporation or approved equal. Every effort should be used to minimize fittings and joints. Minimize or eliminate threaded fittings and unions if possible.

ii. Isolation valves shall be of diaphragm type.

iii. Evaluate manifold venting back to storage tank.

iv. Locate pressure relief / venting back to storage tank

d. Feed Pumps

i. Provide a redundant pump for each application. Give careful consideration to the range of flows to be handled with this system. The feed pump system must handle both nighttime low flows and peak high flow conditions. The pumps shall be positive displacement. Provide a variable frequency drive with each disinfection and odor control metering pump.

ii. Provide isolated vent systems back to the storage tanks, flush connections at each pump and calibration column vent piping.

iii. Avoid Viton seats on ball check valves used as part of the pump assembly. HRSD has found that EPDM or teflon coated EPDM is an acceptable elastomer for this application.

e. Flow Metering – Provide magnetic type flow meters with a valved bypass for each disinfection and odor control feed point.

f. Operations/Maintenance/Accessibility

i. Consider the use of a submersible mixing unit at the disinfection application feed point.
ii. Locate all exposed piping in areas that allow easy access for repair and which will not negatively affect adjacent equipment if a leak or spill occurs.

iii. Due to the strong odors resulting from this chemical, scrubber system on all vents are required if storage tanks are located indoors. Leak/fume detection is required if storage tanks are located indoors. Consider room ventilation and the use of 2 speed fans to evacuate excess odors.

4. Sodium Bisulfite (NaHSO₃) Systems

a. General – Sodium bisulfite is used to dechlorinate the treated effluent prior to discharge at each plant (except for Atlantic Plant). The product is normally delivered at a strength of 38%.

b. Storage Tanks - See Sodium Hypochlorite Systems in this Section for tank requirements except for the following:

   i. Locate tanks indoors in a controlled environment due to the likelihood of this chemical freezing.

   ii. Provide tanks with insulation.

   iii. Provide a two inch diameter fill station quick disconnect. Consider use of a lockable cover on the quick disconnect.

   iv. Provide tanks with a recirculation pump to keep the product well mixed and limit crystallization at the air-liquid interface.

c. Piping & Appurtenances

   i. Provide Nylon braided reinforcement tubing in PVC. Larger piping using NPW as carrying water is not preferred.

   ii. Provide all piping with heat tracing and insulation. Consider providing heat panels in-lieu of heat tracing and insulation at the feed pumps.

d. Feed Pumps – See Sodium Hypochlorite Systems in this Section for pump requirements except for Viton. Viton is an acceptable material for ball check valve o-rings.

e. Flow Metering - Provide magnetic type flow metering with a valved bypass for both non-potable water and sodium bisulfite service.

f. Operations/Maintenance/Accessibility

   i. Due to the strong odors resulting from this chemical:

      (a) Scrubber systems on all vents are required.

      (b) Leak/fume detection equipment is required.

      (c) Consider carefully room ventilation and the use of two speed fans to evacuate excess odors.

   ii. Due to concerns with chemical freezing (<55 degrees Fahrenheit):

      (a) HRSD will provide a large face thermometer in all sodium bisulfite areas.
(b) Consider temperature control alarms in all sodium bisulfite areas.

5. Muriatic Acid (HCL) Systems - Important Note: This chemical is very dangerous and very corrosive. Close attention needs to be paid to materials and the pump/pipe arrangement for safety. Corrosion of electrical components also needs considered.

   a. General – Muriatic acid is used as a process chemical in some odor control systems, to clean odor control scrubbers and for other maintenance purposes. The product is normally delivered at a strength between 25% – 30%.

   b. Storage Tanks - Review the tank sizing criteria with plant staff. The tank volume sizing should include both process and cleaning requirements. It may be more economical to provide multiple tanks at multiple locations.

      i. Provide tanks manufactured of either FRP or HDPE. Design flexible connection with tank piping due to expansion / flexure at connection points.

      ii. Provide tank level measurement.

      iii. Provide a tank vent to an appropriate discharge point. One option for the discharge location of this vent is the odor control scrubber system duct.

   c. Piping & Appurtenances – PVC (Schedule 80) piping is acceptable. PVC braided tubing for buried locations. The tubing shall be encased in a suitable PVC conduit to limit accidental damage, to provide containment and to allow for removal of the tubing in case of a leak.

   d. Feed Pumps – Provide redundant pumps only if the chemical is used as part of the odor control process. Provide a flushing connection at each pump.

   e. Flow Metering - Provide a magnetic type flow meter with a valved bypass only if the chemical is used as part of the odor control process.

   f. Operations/Maintenance/Accessibility

      i. Design based on a batch feed process if the chemical is used for cleaning purposes only.

      ii. Minimize the use of metallic components within the tank containment area.

6. Ferric and Ferrous Chloride/Sulfate (FeCl$_3$, FeCl$_2$, FeSO$_4$) Systems

   a. General

      i. Ferric chloride (30-33% typical delivery concentration) solution is used to remove phosphorus through precipitation at various locations in the treatment process.

      ii. Provide for ferric / ferrous to be fed to the primary, secondary clarifiers and sidestream treatment.

      iii. Dilution of this chemical is normally not required. The product is normally fed neat to the application point.
iv. Locate proposed ferric/ferrous feed points in areas where metallic gates and/or piping will not be negatively affected.

b. Storage Tanks

   i. Provide FRP tanks due to the corrosive nature of this chemical. Locate tanks outdoors and provide insulation only (no heat tracing) for temperature control. Provide a minimum of two tanks. Design flexible connection with tank piping due to expansion/flexure at connection points.

   ii. Consider the need for continuous mixing of the storage tank. If a recirculation system is provided then a pumped system sized for 100% turnover each day should be used. The pump provided shall be a non-metallic type.

   iii. Provide a level indicator for level monitoring. A sight glass on the tank is not required.

   iv. Consider the use of a storage tank fill manifold with duplex basket strainer.

c. Piping & Appurtenances – Provide PVC piping and appurtenances. Valves shall be PVC true union ball type. Support systems for piping and appurtenances shall be non-metallic. For buried applications, use PVC braided tubing encased in PVC conduit to limit accidental damage, to provide containment, and to allow for replacement of the tubing in case of a leak. Install buried utility warning tape and tracer wire approximately 18 inches above all installed pipelines.

d. Feed Pumps

   i. Provide units similar to the requirements for caustic systems.

e. Flow Metering – Provide magnetic type flow meters with valved bypass.

f. Operations/Maintenance/Accessibility – Provide proper ventilation of the corrosive fumes if ferric/ferrous system is located indoors. All items within the tank containment areas and exhaust fans and any associated items shall be non-metallic. All existing metallic equipment in areas where ferric/ferrous will be located must be replaced or protected from corrosive fumes.

7. Aqua-Ammonia (NH₄OH) Systems

   a. General – Aqua-Ammonia (less than 20% by weight) is used as a nutrient source to enhance biological growth or is used to control chlorine demand during periods of partial nitrification. This chemical has a high pH, which results in operational problems similar to those found with caustic. The product is normally fed neat to the application point.

   b. Storage Tanks - Provide steel or HDPE tanks. The tanks are normally under a small amount of internal pressure, which requires special attention to venting and gas relief systems. Special tank linings are not required. Containment of the tanks is required and an outdoor location for the tanks is acceptable. Provide tank level measurement. A sight glass is not required.
c. Piping & Appurtenances - Provide steel piping and appurtenances. The use of threaded fittings is acceptable. Valves shall be ball type, made of steel and rebuildable. For buried applications, use PVC braided tubing encased in PVC conduit to limit accidental damage, to provide containment, and to allow for replacement of the tubing in case of a leak. Install buried utility warning tape approximately 18 inches above all installed pipelines.

d. Feed Pumps - Provide units similar to the requirements for caustic systems. Pumps are normally operated at a constant feed rate.

e. Flow Metering - As required.

8. Polymer Systems

a. General - Polymer systems are used by HRSD for many process applications. Polymers are commonly used to increase solids concentration at thickeners, centrifuges, and for secondary clarification. Many different types of polymers are used by HRSD. Both dry and liquid systems are used at HRSD. Dry feed systems should be located in an indoor and/or controlled environment. A typical liquid polymer system is shown in Figure 29-2.

Figure 31-2: Liquid Feed Polymer System Configuration

b. Storage Tank

i. Size storage tank for the larger of a 15-day peak use or a 30-day average use. The product is stored neat. Size the mix and feed tanks according to dosage requirements and acceptable age of mix.

ii. Provide HDPE or FRP tanks with a conical bottom if possible. Provide side manway access for cleaning. Locate tanks indoors. Heat tracing and insulation are not required if the tanks are placed in an indoor and temperature-controlled environment. Design flexible connection with tank piping due to expansion / flexure at connection points.

iii. Provide a level indicator for level monitoring. A sight glass on the tank is not required. For automated sequence to control, refer to the HRSD Standard Functional Descriptions.
iv. Provide a mechanical mixer inside the mix tank.

c. Piping & Appurtenances
   i. Provide PVC piping and appurtenances. Some polymer products tend to cause interior chemical build-up on the piping system. Provide appropriate flanged connections and unions to allow for removal and replacement. For small diameter piping (< 2 inches) provide PVC ball valves and for large diameter piping (>2 inches) provide PVC plug or ball valves.

d. Storage, Mix and Feed Pumps - Provide rotary or gear type storage pumps for liquid feed applications and progressive cavity type mix/feed pumps.

e. Flow Metering - Provide a magnetic type flow meter and a valved bypass on the discharge of the feed pump combination.

f. Operations/Maintenance/Accessibility – Consider carefully room ventilation. Direct tank vents to a suitable outdoor location.

9. Methanol
   a. Refer to HRSD Safety Department’s Safe Work Practice and Methanol Response Procedures Documents for this information.

I. Drain Systems

1. Consider plant drain system hydraulic capacity. A hydraulic grade line should be plotted with each new plant drain. Surcharging of gravity systems should be controlled. Design system to convey contents of the largest tank in less than 12-hours.

2. Gravity drain systems are preferred over pumped systems for all processes except primary and BNR unit process tanks. Provide valves for isolation and throttling of each tank or process. Provide regular access points (manholes) in gravity systems and cleanouts in pumped systems. Provide ability to pump out primary and BNR unit process tanks and return to in-service unit process/tank.

3. Grit, solids handling and polymer process areas require special plant drain considerations due to the likelihood of plugging. Limit fittings, provide flushing connections and cleanouts, provide adequate diameter/slope of gravity drain system. Use long radius fittings.

4. Provide trench drains for pump galleries and evaluate trench drains for containment areas. Grating to be easily removable and corrosion resistant.

5. Provide flushing and cleaning locations with plant drain systems. If multiple processes are connected to the plant drain a method of isolation is needed to allow for effective cleaning operations.
6. Drain systems shall be tested as described in the Pipeline portion of this Section.

7. All concrete embedded drain inlets must be poured with a slope to the drain inlets.

8. Provide drain located under each emergency eyewash and shower.

9. All process tank drains are to be sump, trench, or negative slope floor drains.

10. All process buildings are to have either trench drains to sump or at minimum one floor drain for every 500 square feet of floor area. Floor drains are to be within three feet of process equipment.

11. Plant drains shall return upstream of influent screens.

J. **Emergency Eyewash and Showers**

1. Refer to Section 22 - HRSD Safety Programs for specific requirements.

K. **Equipment Numbering Sequences**

1. Equipment designations shall correspond to the existing Operations Department equipment identification number (EID) system and/or asset ID and plant unit process designations. All design drawings, specifications and Operations Manuals shall incorporate the plant unit process designation. The EID numbers shall be shown on the Record Drawings. The following alpha-numeric functional coding system is used to determine the EID: Plant Abbreviation/ST or SH/ Unit process – System – Subsystem – Component

   a. Plant Abbreviation – Letter designation for each plant as follows:

   i. Army Base – AB
   ii. Atlantic – AT
   iii. Boat Harbor – BH
   iv. Central Middlesex - CM
   v. Chesapeake-Elizabeth – CE
   vi. County Treatment Plant - CSY
   vii. James River – JR
   viii. King William - KW
   ix. Middle Peninsula – MP
   x. Nansemond – NP
   xi. Town Plant - TSY
   xii. Urbana - U
   xiii. Virginia Initiative Plant – VIP
   xiv. West Point - WP
b. ST or SH – Designates sewage treatment (ST) or solids handling (SH)

c. Unit Process – Letter designation as follows:

<table>
<thead>
<tr>
<th>Code</th>
<th>Unit Process</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>Administrative Facilities</td>
</tr>
<tr>
<td>B</td>
<td>Plant Utilities</td>
</tr>
<tr>
<td>C</td>
<td>Flow Storage/Equalization</td>
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<tr>
<td>D</td>
<td>Preliminary Treatment</td>
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<td>E</td>
<td>Primary Treatment</td>
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<td>F</td>
<td>Intermediate Treatment</td>
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<td>G</td>
<td>Secondary Treatment</td>
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<td>H</td>
<td>Sidestream Treatment</td>
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<td>I</td>
<td>Tertiary Treatment</td>
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<td>J</td>
<td>Disinfection</td>
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<tr>
<td>K</td>
<td>Effluent Pumping/Water Reclamation</td>
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<tr>
<td>L</td>
<td>Scum Disposal</td>
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<tr>
<td>M</td>
<td>Biosolids Thickening</td>
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<tr>
<td>N</td>
<td>Biosolids Anaerobic Digestion</td>
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<tr>
<td>O</td>
<td>Biosolids Heat Treatment</td>
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<tr>
<td>P</td>
<td>Biosolids Storage</td>
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<tr>
<td>Q</td>
<td>Biosolids Dewatering</td>
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<td>R</td>
<td>Biosolids Incineration</td>
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<td>S</td>
<td>Biosolids Composting</td>
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<tr>
<td>T</td>
<td>Biosolids Land Application</td>
</tr>
<tr>
<td>U</td>
<td>Odor Control</td>
</tr>
</tbody>
</table>

d. The System, Subsystem, and Component designations are assigned by the Maintenance Planner.

2. New equipment shall be designated using a priority sequence based on original plant’s existing numbering sequence. The FIRM shall review the sequence with the plant staff early in the design stage of the project.

L. Equipment Spare Parts

1. It is HRSD’s goal to minimize the inventory of unnecessary spare parts. Review the plant’s needs for spare parts and recommended special equipment/tools with HRSD prior to including these components in the contract documents.
M. **Miscellaneous Pump Items**

1. **Seal Water Piping**
   
a. Use strained NPW or potable water for this application. Potable water should only be used as a back up seal water source should the NPW pumping system fail.
   
b. Provide manual bypass.

2. **Sump Pumps**
   
a. Sump pumps shall be designed to pass the product/chemicals in the area of the sump. If the materials of construction necessary to safely pass the product/chemical under consideration make the pump cost impractical, consider a lower cost, replaceable sump pump or manual NPW eductor system.

3. **Shaft Guards** – Manufacturer shall provide shaft guards to comply with OSHA requirements. Refer to 29 CFR 1910 Subpart O Machinery and Machine Guarding.

N. **Noise Abatement for installed stationary equipment**

1. Refer to Section 22 - HRSD Safety Programs section in this manual.

2. Consider sound attenuation in spaces that house equipment such as blowers, centrifuges, odor control fans, incinerator fans and generators.

3. Minimize location of equipment and control devices in areas with significant noise levels.

4. Design equipment installed in exterior locations such that no offsite noise nuisance will result.

O. **Non-Potable Water Systems**

1. Non-Potable Water (NPW) systems are used for certain plant treatment processes, cleaning and for flushing systems on some equipment seals. The NPW system should be designed to provide needed pressures at all locations of the plant while meeting regular water demands. A looped piping system that is isolated at each process should be provided.

2. Provide automatic cleaning strainers on the discharge of pumping systems.

3. Provide strainers at each major plant process or critical delivery point.

4. Consider how the NPW pumping system could be expanded in the future. Provide redundant NPW pump and/or an emergency pump connection.
5. NPW piping shall be ductile iron, PVC or HDPE.

6. Provide NPW hydrants at each process location. NPW hydrants shall be located to limit hose lengths to approximately 100 feet. Consider a quick disconnect, valve and drain in-lieu of a hydrant at process tank locations. Provide NPW hydrants with a self draining feature to limit freeze problems.

7. Exposed NPW systems to be painted and marked in accordance with the Miscellaneous, Painting and Coatings section of this document.

8. Provide a stainless steel hose reel and washdown station at each plant process that requires regular cleaning.

P. Odor Control and Room Ventilation

1. General

   a. The following text lists HRSD’s current standards for the design of odor control facilities with respect to H$_2$S. A different design approach will be required when there is a significant odor concern other than H$_2$S. This standard addresses chemical packed towers. Consider combination bio-filter-chemical packed tower systems when applicable.

   b. Design odor control facilities to to eliminate off-site nuisance odors. Odor control facilities typically include enclosing the odorous work areas and covering odorous process areas, ducting the odorous gases to scrubbers, and scrubbing the odorous gases in a two stage packed tower scrubber system. With respect to dual stage chemical packed tower scrubbers:

      i. Limit the first stage scrubber maximum influent H$_2$S concentration to 75 ppm.
      ii. Initially reducing the H$_2$S concentration to less than 5 ppm in the first stage scrubber using only caustic to maintain a scrubber recirculation water flow pH range of 10 to 12.
      iii. Achieving a first stage scrubber effluent H$_2$S concentration of 1 to 5 ppm with a maximum effluent H$_2$S concentration of 5 ppm.
      iv. Obtaining the remaining H$_2$S removal in the second stage scrubber using 6.12 gallons of hypochlorite per 1,000 cfm and sufficient caustic to maintain an optimum pH of 9.5 or greater.

   NOTE: Alternative oxidant chemicals may be evaluated and utilized. Alternative chemical feed control strategy such as ORP, or continuous H$_2$S or chlorine gas monitors may be used. Achieving a second stage scrubber maximum effluent H$_2$S concentration of 0.1 ppm.

2. Air Flow
a. Provide for sufficient air flow from enclosed work areas and covered process areas to provide adequate ventilation and odor control as appropriate. Entrance doors should be labeled with the design air changes per hour.

NOTE: Air flow for work areas occupied by personnel should be based on ventilation requirements as appropriate. Air flow for ventilation should not be routed through odor control facilities wherever practical. Air flow for odor control in some situations can be substantially reduced by pressurizing work areas otherwise requiring only ventilation and drawing off only a portion of the ventilation air flow through the unit process openings for odor control. Air flow for odor control in other situations can be substantially reduced in a work area by using covers or hoods on process equipment. The minimum air change requirement indicated below shall be maintained.

b. Provide air flow based on the more stringent of the NFPA 820 requirements, other applicable codes, or the following design criteria:

i. Air Changes - Provide for the minimum number of air changes as follows:

<table>
<thead>
<tr>
<th>Type of Area</th>
<th>Air Changes Per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosed work area directly exposed to wastewater or solids with normal access by personnel</td>
<td></td>
</tr>
<tr>
<td><strong>Examples</strong></td>
<td></td>
</tr>
<tr>
<td>Bar Screen Room</td>
<td>12 x per hour</td>
</tr>
<tr>
<td>Grit Classifier Room</td>
<td></td>
</tr>
<tr>
<td>Grit or Scum Dumpster Room</td>
<td></td>
</tr>
<tr>
<td>Solids or Scum Thickener Room (uncovered)</td>
<td></td>
</tr>
<tr>
<td>Solids Handling Filter Room</td>
<td></td>
</tr>
<tr>
<td>Solids Conveyor or Hopper Room</td>
<td></td>
</tr>
<tr>
<td>Truck Drive Through Room</td>
<td></td>
</tr>
<tr>
<td>Enclosed work area not directly exposed to wastewater or solids with normal access by personnel</td>
<td>6 x per hour</td>
</tr>
<tr>
<td><strong>Examples</strong></td>
<td></td>
</tr>
<tr>
<td>Solids Handling Centrifuge Room</td>
<td></td>
</tr>
<tr>
<td>Enclosed access, equipment or storage area not directly exposed to wastewater or solids with normal access by personnel</td>
<td>1.5 x per hour</td>
</tr>
<tr>
<td><strong>Examples</strong></td>
<td></td>
</tr>
<tr>
<td>Electrical Rooms</td>
<td></td>
</tr>
<tr>
<td>Stairwells</td>
<td></td>
</tr>
</tbody>
</table>
### Type of Area

<table>
<thead>
<tr>
<th>Type of Process Area</th>
<th>Air Changes Per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covered process area with extreme turbulence or H$_2$S levels without normal access by personnel</td>
<td>12 x per hour</td>
</tr>
</tbody>
</table>
| Examples | Screw Pumps  
Grit Tanks  
Pre-aeration Tanks |
| Covered process area directly exposed to relatively turbulent wastewater or solids without normal access by personnel | 6 x per hour |
| Examples | Splitter Boxes  
Solids Handling Tanks (based on empty) |
| Covered process area directly exposed to relatively quiescent wastewater or solids without normal access by personnel | 4 x per hour |
| Examples | Non-Aerated Channels  
Primary Clarifiers (including weirs)  
Anaerobic/Anoxic Tanks |
| Covered process area receiving process air without normal access by personnel | Max Process Air + 10% |
| Examples | Aerated Channels  
Aeration Tanks |

ii. Face Velocity - Provide for a minimum face velocity of 100 FPM for any indoor unit process opening. Provide for higher face velocities for outdoor unit process openings to counteract wind affects as appropriate.

iii. Sulfide Levels - Provide for a maximum sulfide concentration of 75 ppm at any point in the scrubber ductwork or scrubber influent so as to:

   - Prevent backdraft of toxic levels into enclosed work areas, and
   - Ensure destruction of H$_2$S in scrubber based on past operating experience.

3. Public Acceptance, Nuisance Prevention and Odor Control – Public acceptance, nuisance prevention and odor control for treatment plants must be achieved for HRSD to provide quality service. Adverse impacts to nearby neighbors and communities from treatment plant facilities must be prevented, eliminated or minimized to the extent practical.

   a. Public acceptance is critical for HRSD to build new treatment plant facilities to serve the public. Public acceptance should be paramount when siting, designing and
operating facilities, and these activities should be coordinated with the public information program to promote public acceptance. Nuisance prevention is required for treatment plants to be good neighbors. HRSD’s goal is to prevent offsite nuisances. Treatment plant facilities should be planned, designed and operated to mitigate offsite nuisances from odor, noise, light, traffic or other causes to the extent practical. Buffer areas should be in accordance with all provisions of the approved SCAT Regulations but in all cases should be at least 300 feet from any potentially nuisance process unit or activity to the property line for new treatment plants. The planning and design of facilities should also account for the inevitable encroachment of new residential, commercial and industrial neighbors on any nearby developable land.

4. Scrubber Equipment
   a. Provide for a scrubber train consisting of two packed tower scrubbers connected in series per the following:

<table>
<thead>
<tr>
<th>Packing detention time</th>
<th>1.3 – 1.6 seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packing depth</td>
<td>10 feet</td>
</tr>
<tr>
<td>Packing type</td>
<td>As appropriate</td>
</tr>
<tr>
<td>Packing support</td>
<td>Grating or gas injection plate</td>
</tr>
<tr>
<td>Recirculation liquid to air ratio</td>
<td>15 – 20 gpm/1,000 cfm</td>
</tr>
<tr>
<td>Liquid distribution</td>
<td>Single nozzle if less than 9 foot diameter, or a weir distribution system or multiple nozzle system with nine or more nozzles if greater than nine foot diameter.</td>
</tr>
<tr>
<td>Blowdown rate</td>
<td>To be provided</td>
</tr>
<tr>
<td>Mist eliminator</td>
<td>Use mesh or media type</td>
</tr>
</tbody>
</table>

   b. Provide for one or more individual scrubber trains connected and isolated in parallel to accommodate the required size as appropriate.

   c. Provide for one additional fully equipped standby scrubber train including induced draft fan connected and isolated in parallel with the other scrubber train(s).

   d. Provide for each scrubber train a discharge stack designed to discharge at sufficient height to disperse the emissions and eliminate offsite odors. Consider adding a directional stack piece on the stack discharge to direct air flow and air flow noise away from populated areas.

   e.

5. Chemical Feed
   a. Provide for all scrubbers to be fed with caustic and sodium hypochlorite.

   b. Provide for chemical feed rates per the following:
i. A minimum caustic feed to first stage scrubber of 3 pounds NaOH per pound of H₂S to obtain a maximum effluent H₂S concentration of 5 ppm.

ii. Sodium hypochlorite feed to the first stage scrubber (as an alternative sodium hypochlorite feed point in lieu of the second stage scrubber) of 2.1 gallons NaOCl per pound of H₂S removed to obtain a maximum effluent H₂S concentration of 5 ppm.

iii. Sodium hypochlorite feed to the second stage scrubber of 6.12 gallons of NaOCl/1,000 cfm and sufficient caustic to maintain a pH of 9.5 in the scrubber recirculation water flow or greater at a maximum influent H₂S concentration of 5 ppm.

c. Provide for new caustic feed and storage facilities located separately or at the existing caustic feed facilities utilizing the available caustic storage facilities to the extent possible. Size the caustic storage tanks for a minimum of 15-days peak use or 30-days average use.

d. Evaluate the use of existing hypochlorite storage facilities to the extent possible. Size sodium hypochlorite for a minimum 15-days storage at the average design feed rate.

e. Provide for at least one caustic feed pump for each operating scrubber with one standby caustic feed pump for the overall scrubber system.

f. Provide for at least one sodium hypochlorite pump for each operating two stage scrubber system and one standby hypochlorite pump for the overall scrubber system.

g. Provide for automatic pH control of caustic feed for each scrubber using pH monitoring of the scrubber overflow. Also provide for automatic control of caustic feed to the first stage scrubber using continuous H₂S monitors.

h. Provide for automatic control of sodium hypochlorite feed to each second stage scrubber for H₂S removal using ORP or continuous sulfide monitors.

i. Provide for adding chemicals to the suction or discharge side of the recirculation pump and/or to the scrubber sump if baffled to prevent short circuiting. Ensure chemicals are added downstream from the pH meter where feasible.

j. Provide for separate metering of caustic solution, sodium hypochlorite solution and makeup water flows to each scrubber.

k. Provide muriatic acid storage, pumping and containment for scrubber cleaning. Provide for manual control of acid feed.

i. If acid is fed to the first stage scrubber to decrease pH, then acid storage and containment should be sized appropriately. Automatic acid feed based on pH should be provided.
6. Coatings - Provide for coating protection for covered process areas to prevent corrosion due to H$_2$S attack per the following and refer to the Coatings Manual.

   a. Provide coatings on all exposed interior surfaces of covered process areas and extend coatings to one foot below the low water surface or to an appropriate termination point.

   b. Consider life cycle cost in the selection of coatings.

   c. For areas which can not be isolated and accessed for coatings maintenance using existing plant valving (i.e. splitter boxes, flow distribution chambers/channels, etc.) consider the cost of over pumping in determining life cycle costs. Stronger consideration will be given to anticipated life of the coatings in these areas.

7. Duct Work

   a. All duct shall be manufactured of fiberglass reinforced plastic (FRP). All FRP shall have UV protection. Ductwork in most cases should be elevated above ground. Consider access and maintenance of adjacent equipment when locating ductwork.

   b. Odorous air is almost always very humid. Provide a drain system at low points in ductwork. Extend drain piping to existing drains or tanks. Drains must have a P-trap sufficient to overcome system vacuum.

8. Room Ventilation (As related to Odor Control)

   a. See Air Flow at the beginning of this Section for air flow requirements.

   b. Review with plant staff the use of timers, manual overrides and switches for the proposed ventilation system in each area.

   c. Provide the maximum distance possible in each building space between intake and exhaust locations to limit short-circuiting of air flow.

   d. Utilize non-corrosive hardware for all exhaust fans and vent assemblies.

   e. Design screened louvers to be accessible for maintenance and to limit rainwater from entering the building space.

Q. Pipe Insulation and Heat Tracing

   1. Provide a fiberglass, PVC jacketed insulation system.

   2. Provide indicator (on/off) lights on all heat tracing systems.
3. Provide for piping insulation jacket to be color coded and/or stenciled in accordance with HRSD's Piping Identification and Color Code included in the “Miscellaneous” section of this manual.

4. Provide junction boxes/plugs on heat tracing systems to allow for removal of fittings, valves, etc.

5. For new construction, provide power source with appropriate equipment. For retrofits and improvements, indicate a location for the power feed to the proposed heat tracing system and verify that the existing power panel is suited for this application.

6. Refer to Section 32 - Electrical and Instrumentation in this manual for further information regarding electrical equipment and requirements.

R. **Primary and Secondary Clarifiers**

1. Provide circular clarifiers with center feed, peripheral weir layout.

2. The following system components should also be included in new or modified secondary clarifiers:
   
   a. Provide design which assures a watertight gearbox.
   
   b. Provide a biosolids withdrawal system that is compatible with flow proportion RAS flow and does not require manual adjustment when flow volume or concentration changes. A suction plenum or Tow-Bro type biosolids collection system is preferred. Organ pipe drawoff systems are not acceptable.
   
   c. All components shall be stainless steel.
   
   d. Provide a modular drive system that can be repaired or replaced without dismantling the clarifier structure.
   
   e. Provide fiberglass clarifier weir covers designed to allow cleaning of weir and launder channels, or provide weir covers to deter algae growth.
   
   f. Provide a gravity drain system if possible. Consider a method to fully drain clarifier to allow for inspection and cleaning. Refer to drain system section [insert section number] for additional information.
   
   g. Provide adequate NPW system to meet cleaning and tank filling needs.
   
   h. Provide positive control of RAS flow from each individual clarifier.
   
   i. Provide full diameter scum well and pump. Scum pump must not be hard piped to allow for easy removal during maintenance.
S. **Process Air Piping**

1. Process air piping shall be either stainless steel or welded carbon steel. Process air piping shall be placed in the following locations:
   
a. Above grade  
b. Direct bury with a proper coating and/or cathodic protection system. Avoid buried pipe whenever possible.

2. Thermal expansion and contraction must be carefully considered with this piping system. Methods for support and/or restraint must be coordinated with the possibility of thermal expansion and contraction.

T. **Process Flow Splitting**

1. Perform a hydraulic analysis to verify that adequate flow splitting occurs for the following conditions:
   
a. Daily Average Flows – existing and at the rated plant capacity.  
b. Diurnal Flows – average daily minimum and maximum at existing flow conditions.  
c. Unit out of Service – when multiple units are included in the design, consider the impacts of the largest unit out of service.
   
i. Provide for flow balancing between multiple units using low velocity channels where feasible. If channels are not possible, provide valves designed for throttling and/or adjustable gates/weirs.  
   
   ii. Buried valves designed for throttling shall be located in a vault and sized to allow for access and future removal of the equipment.
   
   iii. Review with HRSD the anticipated frequency of flow balancing and the value/cost of providing remote monitoring and control.

U. **Scum Handling, Piping and Pumping**

1. The type of scum received depends upon the grease loads of the collection system, type of screen equipment, and grease from septage receiving. Scum is any combination of: water, grease, plastics, rags, floatables, and foam (from the biological process). Some general design guidelines and considerations are listed below to limit scum handling problems:
   
a. Design preliminary treatment to remove plastics, rags, etc that cause scum conveyance issues. Screening equipment such as band screens and step screens are appropriate.
   
   b. Eliminate scum pits. The use of pits results in a batch process that tends to plug pipes, pumps and appurtenances.
c. Automate the handling process to allow for a direct feed system to the scum concentrator and/or incinerator.

d. Consider the reduction or elimination of scum gravity collection systems.

e. Locate the scum concentrator to minimize piping and materials handling.

f. If the WWTP uses bar screens, expect plastics and rags at every collection source; provide grinders at each source.

2. Scum piping is to be 4 inch minimum between the collection source and a concentrator. Provide clean outs at all bends and Y’s. Yard cleanouts are to be Y connections at a maximum every 50 feet. Scum is highly corrosive to carbon steel. PVC or HDPE is preferred.

3. Scum grinding is to be as close to the source as possible followed by scum pumping. Scum grinder must be replete with full bypassing capability to accommodate the grinder removal for maintenance.

4. Scum pumping shall be provided using screw, centrifugal or progressive cavity type units. Non-clogging pumps are not substitutes for grinders.

5. When using a well or decanting tank, consider the use of a continuously mixed system and/or heated system to limit the likelihood of the scum from separating or plugging handling equipment.

6. Provide an NPW flush system at the source of the scum collection.

7. Scum concentrators are to be have a minimum retention time of 20 minutes. Scum concentrator hoppers are to be heated.

8. Scum piping after concentration is to be heat traced. Hot water, steam and NPW flushing connections are to be provided at the point of origination and destination. All downstream piping is to use sweeps with Y cleanout connections at a maximum every 50 feet.

9. Scum in the form of foam collected from the biological process is to have provisions for hypochlorite addition and NPW sprays to collapse the foam and allow conveyance.

10. Disposal: Scum may be processed to a landfill after adding an appropriate amendment for the paint filter test (sand, rags, grit, etc.), or it may be incinerated as long as operational impacts are observed as well as adherence to 503 and MACT 129 regulations.

V. **Grit, Septage and Grease, and Biosolids**—Grit, septage and grease, and foreign biosolids require special consideration and facilities to handle these materials effectively, minimize required labor for operations and maintenance, and prevent nuisance conditions. Inadequate
facilities for handling these materials can have a significant adverse impact on overall treatment plant operations and costs.

1. Grit:

   a. Grit handling facilities should be sized based on the characteristics and quantity of grit at the individual treatment plant. Examine the impact of grit on the existing WWTP.

   b. Consider raw influent and plant influent grit characterization sampling to determine grit loading on the plant during dry and wet weather events.

   c. Review collection system infiltration as well as velocities during dry and wet weather to determine grit slug loads. Use 1 ft/sec rule for deposition of grit and 3 – 5 ft/sec rule for re-suspension of grit. Review diurnal flow patterns for the number of grit removal units during wet weather events. Grit removal units such as detritors, head cells, and vortex are to be considered at a minimum. Consider two times the recommended number of vortex units for peak wet weather events. Grit channels are not to be considered.

   d. Individual components including separators, cyclones, classifiers, pumps and piping should be sized for peak grit loadings occurring during storm flow conditions which may be significantly higher than the corresponding peak flows. Consider vertical cyclones over angled installations to minimize recycle loads on the plant.

   e. Provide plug style valves fitted with grit seals. No epoxy-coated plug valves. Provide for easy flushing with NPW at all elbows and tees.

   f. Grit handling facilities and grit containers should be located inside enclosed buildings with odor control. Grit containers should be designed for leveling and/or easy moving without significant operator attention. Provide plastic curtains around the dumpsters to minimize the impact of splatter. Provide 6-inch diameter at rollup doors to protect the door frames during grit container removal. Provide bollards or similar for stops upon placement of grit containers. Provide floor drains under grit containers with clean outs.

2. Septage and grease handling facilities should be designed to remove/process these materials and minimize adverse impact on sewage treatment operations in an unattended mode. Septage facilities shall be designed to unload a 6,000 gallon septage or grease truck within 15 to 20 minute period. Storage/equalization capacity for the facility shall be provided and based on historical data for peak week average of the total daily discharge volume. Preliminary screening, such as rock traps, grinders, package type screening systems, etc shall be provided to prevent debris from impacting transport and pumping of discharge through pipes and pumps. The combined discharge will be equalized and pumped back to the influent channel downstream of the raw influent sampling point, but before the plant screens. Facilities shall be capable of passing grit and grease. Septage and grease handling facilities and grease and grit containers should be located inside enclosed buildings with odor control. Grease only facilities should be
designed to collect, transport, concentrate, load grease containers or otherwise dispose of the grease. Receiving stations shall be integrated with Scale Automation and DCS systems for monitoring and control.

A washdown area with containment should be provided for each discharge location. Each discharge station shall include a trench drain with a sump located below the discharge station connection. The discharge station connection shall include a 12 inch section of clear tubing and have a single lever operated agricultural knife gate valve for isolation. All connections shall use camlock fittings. Trench drain should span the entire discharge area and slope from both sides to the center sump area. Trench drain grating shall support H20 loading. Trench drain to be a minimum depth of 12 inches and 12 inches wide with a 6% negative slope to sump intersection. Sump area shall be 4’0 x 4’0 x 1.5’. Sump shall include float operated grinder style sump pump that discharges to equalization tank, unless equalization is below grade. All connections to sump pump shall be camlock fittings.

All equalization tanks shall be accessible and unobstructed to allow cleanout using vac truck for cleaning operations. If equalization tank is above grade, a 36-inch diameter side manway shall be provided on all tanks and integral tank wash down system shall be provided.

3. Dewatered solids handling facilities shall include both receiving and loading facilities based on plants specific or HRSD solids management strategy. Dewatered solids handling facilities should be sized based on the volume/characteristics of biosolids to be handled at the individual treatment plant. The time period required to load or unload a truck or empty a receiving hopper shall be balanced to support both operational and process requirements at the loading and receiving facilities. Dewatered solids receiving facilities at incinerator plants should be designed to accept and hold multiple full truck loads and feed the incinerator in a batch process with or without blending with the treatment plant’s own biosolids. Dewatered solids receiving facilities should be designed to accept various truck designs on a case by case basis.

W. Site Lighting

1. Review the footprint of each light to ensure that the proper areas are being lit and that no off-site nuisance light will result. For all new lighting, consider use of high efficient LEDs.

2. Provide task lighting (low level) in-lieu of high mast lighting in areas where nighttime operation and maintenance efforts are required.

3. Use quick-strike capabilities when high-intensity discharge lights are used to allow for immediate access to the area being illuminated. Consider LED systems.

4. Design high-mast lights to meet minimum lighting level requirements. Refer to Section 22 - HRSD Safety Programs in the manual for specific lighting levels. High-mast lights
to operate on photocells. Provide on/off switches for additional lighting on and around individual process tanks.

5. Refer to Section 32 - Electrical and Instrumentation in this manual for further information regarding site lighting equipment and requirements.

X. Slide and Sluice Gates

1. Gates to be fabricated of cast iron, aluminum, stainless steel, or co-plastic and compatible with process flow and up/downstream chemical discharge.

2. Gates to be provided with double-seated configuration or single seat if flow is limited to one direction.

3. Provide electric operators on gates.

4. Provide redundant gates, stop log channel or other method to isolate gate for maintenance or replacement.

5. Provide for means of access and maintenance platforms at gate actuators, if the working elevation is greater than 5 feet.

6. Gate should be installed so that they can be removed vertically without impedance of overhead structures.

Y. Solids Piping

1. Piping should be stainless steel, HDPE or ductile iron.

2. Provide an NPW flush system.

3. Pumps for centrifuge or thickener feed to be progressive cavity, lobe, or centrifugal with variable frequency drives. Consider the use of grinders, solids screens, or integral pump grinding as part of the pumping system design.

4. Pumps for return and waste biosolids to be centrifugal with variable frequency drives.

5. Return activated solids (RAS) systems should be designed so that multiple pumps can be used to withdraw biosolids from different clarifiers. Operating flexibility and sufficient monitoring/control is critical. The system should be designed to allow for the balancing of solids within each clarifier. An accurate and reliable metering system is critical to the proper operation of this process. Consider flow and mass metering.

Z. Travel Path (Walkway) Alignment
1. Provide walkways in heavily traveled locations (i.e. adjacent to Administration Buildings).

2. Locate walkways for ease of access of plant staff to daily sampling points. Provide ramps for bicycle and cart access.

3. Provide drainage pipes under walkways in lieu of lowering sidewalk elevations at drainage swales.

4. Provide elevated walkways to connect above-grade unit process tanks.

AA. Yard Piping

1. Each piping system should be carefully evaluated for above ground use, buried use and the product being conveyed. The following materials of construction and design features should be considered:
   
   a. Ductile iron – Consider internal and external corrosion. Refer to Section 24 - Pipeline and Appurtenances in this manual for further information.
   
   b. Reinforced concrete pipe (RCP) and reinforced concrete cylinder pipe (RCCP) - Provide plastic liner on piping upstream of aeration basins (T-lock by Ameron, LinaBond or approved equal).
   
   c. Welded steel (WSP) – Consider internal and external corrosion. Refer to Section 24 – Pipeline and Appurtenances in this standards manual for further information.
   
   d. High Density Polyethylene (HDPE)
   
   e. Fiber Reinforced Plastic (FRP)

2. At locations of high flow consider the use of concrete channels in-lieu of yard piping. Provide internal coating or liner systems as required.

3. Consider the ability to access, inspect and maintain yard piping after construction is complete. Consider the use of access manways, isolation gates and valves to enter these pipelines.

BB. Functional Descriptions

1. HRSD has developed functional descriptions for each unit process. HRSD’s goal is to standardize the processes at the various plants as much as possible. Hence, the FIRM shall use the HRSD Functional Descriptions as a foundation for developing the P&IDs and functional descriptions for all projects. If a functional description is developed for a new process the FIRM shall follow the format of the HRSD functional descriptions.
The most up to date functional descriptions should be requested by the FIRM at the start of a new project.

CC. Operational Technical Information System (OTIS)

1. HRSD has developed a web based Operational Technical Information System that serves as a repository for plant information and is the basis for the Operational and Maintenance Manual that is submitted to the State. HRSD’s goal is to standardize the OTIS structure and layout for each treatment plant as much as possible. The FIRM shall provide HRSD with requested information to populate OTIS. The OTIS is accessed through HRSD’s SharePoint site.

DD. Equipment Startup, Training, and Turnover

1. Refer to Master Specification “01650 – Facility and System Startup System Startup” in Section 40 of this manual.

EE. Flow Metering

1. Provide flow metering for the final effluent regulatory flow. Locate meter to read a true final effluent flowrate. There shall be no recycles to subtract.
2. Provide a Parshall flume and manual verification scale to confirm instrumentation calibration.
3. Verify downstream hydraulics do not impact meter reading at a 10-year peak hourly flow.

End of Section
Section 32 - Electrical and Instrumentation

A. **Introduction** – The HRSD Operations Department has an Electrical and Instrumentation Division that provides electrical and instrumentation support for all of HRSD. The Engineering Department is responsible for coordinating the electrical review of plans and specifications and coordinating with the Operations Department on design and start-up issues. Based upon HRSD’s history with various products and manufacturers, we have developed requirements and needs for certain specific products. Manufacturers of equipment and products are listed in the tables that follow.

B. **General** – Unless otherwise agreed upon, the FIRM shall design facilities and specify equipment around the names listed in this Section. In all cases NEMA is preferred over IEC rated components. IEC and NEMA/IEC components are not acceptable. Place all electric/electronic equipment indoors whenever possible. The following sections provide independent tables of products and manufacturers for pump stations, interceptor system controls and treatment plants in order to accommodate the different requirements of the various operating departments within HRSD.

C. **Pump Station and Interceptor Systems** – Refer to following Table “Pump Station.”

D. **Treatment Plant** – Refer to following Table “Treatment Plant.” Equipment Numbering Sequences shall be in accordance with the Treatment Plant Section of this document.
## Electrical and Instrumentation

### Requirements

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I. Item No. 1

A. Switchgear and MCCs

1. Manufacturers
   a. Eaton
   b. Square D
   c. Allen Bradley

2. Specific Criteria
   a. Design to meet arc flash standard; Reduce incident energy to 12 Cal/Cm2 or lower (MCC and VFD’s incident energy should be designed to meet 1.2 Cal/Cm2 if attainable); Reference HRSD Arc Flash Mitigation Document Dated July 9-10, 2013 (refer to Exhibit A)
   b. MCCs must be placed indoors in NEMA 12 enclosures (gasketed)
   c. Switchgear must be placed indoors in NEMA 1A enclosure (gasketed)
   d. MCC’s providing rear access is not acceptable
   e. All horizontal / vertical bus must be accessible
   f. Everything to be face-mounted, motor controls in the MCC are to be marked, lead, 1st lag, 2nd lag selectable, (any combination) with automatic failover (This may be part of the bubbler panel.)
   g. Bottom entry versus Top entry routing must be evaluated for application.
   h. Provide with tin-plated copper bus.
   i. Provide feeder breakers with digital trip units.
   j. Provide extra fasteners for door cover.
   k. Provide phenolic labels with black backgrounds and white lettering.
   l. Provide spare terminals for intermediate terminal blocks for controls.
   m. Provide grounding for Switchgear (Ball type)

B. Breakers / Solid State Breakers

1. Manufacturers
   a. Eaton
   b. Square D

2. Specific Criteria
   a. Provide 20 amp minimum
   b. Provide remote open/close operator to protect personnel from Arc Flash Incident; operator should be outside of arc flash boundary where possible.
   c. Provide ARMS “Arc Reduction Maintenance Switch” or equal; when activating downstream breakers incident energy levels will be reduced. Also, add separate pilot light to indicate when maintenance mode is enabled or disabled.
   d. Provide LSIG digital trip unit if >= 1000 amps and LSI if < 1000 amps
   e. Provide trip units with fault indication to determine status (i.e. overloads or fault conditions)
C. Metering Package

1. Manufacturers
   a. Schweitzer Eneigneering Laboratories (SEL)
   b. Eaton
   c. Schneider Electric (Square D)
   d. GE
   e. Basler

2. Specific Criteria
   a. Volt Meter 3 phase & off
   b. Ammeter 3 phase & off
   c. kW
   d. Provide 3 phase undervoltage & overcurrent protection

D. CT Cabinet

1. Manufacturers
   a. Provided by Utility

2. Specific Criteria
   a. Locate meter base and CT cabinet on outside of pumping station

E. Selector Switches, Push Buttons, Lighted Push Buttons (NEMA 30mm)

1. Manufacturers
   a. Square D
   b. Eaton
   c. Allen Bradley

2. Specific Criteria
   a. Expandable contact blocks on operator
   b. IEC and NEMA/IEC rated switches are not acceptable.

F. Contactors

1. Manufacturers
   a. Eaton
   b. Square D (Contactor must be able to reclose after short power blips)
   c. Allen Bradley

2. Specific Criteria
   a. Provide with expandable auxiliary contacts for 120 volt control circuits
   b. IEC and NEMA/IEC rated contractors are not acceptable.

G. Fuses & Fuse Holders

1. Manufacturers
   a. Bussmann
   b. Shawmut

2. Specific Criteria
   a. Shall be locally available
H. Transformers
   1. Manufacturers
      a. Square D
      b. Eaton
      c. ACME
   2. Specific Criteria
      a. Copper coils
      b. Aluminum coils are unacceptable

I. Terminal Strips
   1. Manufacturers
      a. Phoenix Contact
      b. Square D
      c. Weidmuller
      d. Panduit Panduct DIN Rail Wiring Duct
   2. Specific Criteria
      a. DIN Rail mount if possible
      b. Industrial rated

J. Combination Starters (buckets)
   1. Manufacturers
      a. Square D
      b. Eaton
      c. Allen Bradley
   2. Specific Criteria
      a. Provide standalone combination starters in the proper enclosures (see junction/pull boxes and miscellaneous enclosures).
      b. 120 volt control voltage
      c. Run light – red
      d. Stop light – green
      e. Fault light – Amber
      f. Power available light – white
      g. Provide push to test indicator lights
      h. Elapsed time meters (Crompton, ENB)–pump motors graduated in 1/10 hours, non-resettable
      i. Externally mounted resets, operational from the front
      j. Provide with adjustable thermo-magnetic breakers
      k. Fused control transformer
      l. MCC mounted lighting panels shall be provided with 25% spare breakers
      m. Provide spare buckets (minimum 2)
      n. Provide connections for motor leads directly from the motors to the starters. Do not use intermediate terminal blocks.
      o. No IEC or NEMA/IEC rating (NEMA only).

K. Rubber Mats (in front of gear)
1. Manufacturers
   a. Grainger
   b. Chesapeake Bay Rubber

2. Specific Criteria
   a. Contractor will provide and install at substantial completion (OSHA approved electric safety rubber matting: Type II ASTM D178)

L. Pilot Lights
1. Manufacturers
   a. Square D
   b. Eaton

2. Specific Criteria
   a. Provide LED type pilot lights
   b. Provide push to test lamp
   c. LED color and light cover color will be specified by HRSD
   d. No IEC or NEMA/IEC Rating (NEMA Only)

M. Voltage Test Points
1. Manufacturer
   a. Safeside- Grace Engineered Products (Load side of Main Breaker)

II. Item No. 2

A. Emergency Generators

1. Manufacturers
   a. Caterpillar
   b. Cummins Onan
   c. Kohler

2. Specific Criteria
   a. Diesel generators
   b. Propane or natural gas powered engine generators are site specific
   c. Engines to be of domestic manufacture whenever possible
   d. Standby rated
   e. 4-stroke
   f. Parts must be available in 48 hours or less
   g. Must meet current U.S. EPA and Virginia DEQ air standards
   h. Low emission units
   i. 48 hours of runtime/Fuel at full load
   j. Remote Emergency stop pushbuttons at doorways (Pilla Model GS120 w/clear, hinged plastic cover)

B. Generator
1. Manufacturers
   a. Stamford Newage
   b. Caterpillar
   c. KATO
   d. LIMA
   e. Marathon
   f. Cummins

2. Specific Criteria
   a. Provide permanent magnet exciters
   b. The rectifier shall be a brushless, full-wave bridge
   c. All stator winding leads are to be brought out to the terminal box
   d. Neutrals shall be sized to full rating
   e. Temperature rise shall not exceed Class B rating with 105°C ambient rise
   f. Alternator shall have a space heater that switches off when running
   g. Provide for 2/3 winding pitch; 5/6 pitch is not acceptable
   h. Minimum Class H insulation (epoxy) with tropicalization (anti-fungus) temperature requirements as specified by NEMA
   i. Provide voltage regulation less than +/- 1%
   j. Provide 150% minimum overspeed capability
   k. Provide amortisseur winding
   l. Provide less than 5% THD (Total Harmonic Distortion)
   m. Provide less than 50 TIF (Telephone influence factor)
   n. Provide Square D/Eaton main breaker of domestic manufacture
   o. Provide elapsed time meter graduated in 1/10 hours (analog or digital), nonresettable
   p. Voltage regulators shall be 3 phase.
   q. Provide 12 leads to switch voltages
   r. Provide flap at the end of exhaust to keep rain, birds, etc. out.
   s. The type of bird screen is site specific.
   t. Sound attenuation is site specific

C. Diesel Engine

1. Manufacturers
   a. Caterpillar
   b. Cummins
   c. John Deere
   d. MTU

2. Specific Criteria
   a. Heavy-duty, direct-injected, 4-stroke diesel engine.
   b. Provide electronically controlled engines with an electronic control system to meet current EPA emissions regulations
   c. State the control system
   d. Provide isochronous frequency regulation (no load to full load)
   e. Provide +/- .25% steady state frequency regulation (minimum)
   f. Size air, fuel and oil filters to provide a minimum of 250 hours of operation before servicing
g. Provide a Racor fuel-water separator
h. The heavy duty air filter is to be a dry type with a restriction indicator
i. Provide a Nelson (or Racor) heavy duty crankcase vapor coalescer
j. Provide a battery charging alternator 12V/65 amp, 24v/35amp minimum – negative ground)
k. Skid-mounted radiator sized to prevent overheating in the most severe conditions (122°F ambient)
l. Provide residential grade super critical type exhaust system (lowest possible DB available: indicator lights for all shutdowns and alarms) and muffler. All insulation must be blanket type (non-asbestos), removable for servicing of exhaust system
m. Provide 12/24 volt DC starting system
n. Provide all diagnostic equipment for complete trouble shooting and training; operational training must be included (software/technical manuals/hardware etc.)
o. Provide speed sensing to protect against accidental starter engagement into a moving flywheel. (Battery charging alternator voltage output will not be accepted for this purpose)
p. Provide an adjustable (0-15 minutes) cool down time
q. Provide a large red emergency stop push button
r. Generator Alarms and shutdowns
   1) Low oil pressure
   2) Not in auto
   3) High coolant temperature
   4) Overspeed
   5) Low fuel (Pre shutdown)
   6) Generator running and over-crank shall shut down the engine and provide indicator lights.
   7) All generator alarms/shut downs provide indicator lights
   8) Separate alarms and shutdowns based on HRSD recommendation and not tie everything to common alarm
s. Provide analog or digital displays for coolant temperature, oil pressure, service hours, engine RPM, system DC volts and system diagnostic code
t. Provide Kim Hot-Start engine block heater (thermostatically controlled); isolation valves must be included.
u. Provide vibration isolators between generator set base and floor
v. Provide lifting eyes bolt
w. Provide break mean effective pressure (BMEP) calculations
x. Provide SCADA interface/data monitoring for HRSD generators

D. Battery Chargers
   1. Manufacturers
      a. LaMarche
      b. Cummins
      c. SENS
   2. Specific Criteria
      a. 12 / 24 volt chargers or equal
      b. Automatic, solid state, provide continuous taper charging
c. UL listed, provide with under/over voltage, current failure and loss of power acknowledgment

d. Evaluate full float charge versus trickle charge

E. Starting Batteries

1. Manufacturers
   a. Exide

2. Specific Criteria
   a. Use 8D series lead acid batteries (4D is not acceptable)
   b. Provide 2 minimum
   c. Each battery shall provide 1200 CCA each
   d. Provide with insulated battery rack
   e. Provide with 2 year full replacement guarantee
   f. Provide as a minimum 2 cranking cycles at a minimum of 30 seconds each
   g. Consult engine manufacturer for sizing

F. Day Tanks

1. Manufacturers
   a. Pryco
   b. Tramont

2. Specific Criteria
   a. UL Listed – double wall
   b. Provide with Oberndorfer bronze gear type pump. All pumps must be mounted on Day Tank. Pumps with rubber or nitrile impellers will not be accepted
   c. Provide with a low level alarm and light
   d. Size for 2 hour minimum running time
   e. Provide a fuel level indicator on the day tank
   f. Provide a 2 pump system. Each pump shall be capable of pumping 100% fuel oil throughout the entire system.
   g. Provide “Not in Auto” lamp or other warning device
   h. Use momentary switch for tank fill/test

G. Transfer Switches

1. Manufacturers
   a. Eaton
   b. ASCO

2. Specific Criteria
   a. Provide with a metering package
   b. Provide with an exercise cycle of 4 hours, field adjustable from 10 minutes to 4 hours
   c. Provide with a utility power available light normal/emergency, phase indicator lights
   d. Zenith transfer switches are not acceptable.
   e. VFD compatible
   f. Time delay normal to emergency
g. Time delay engine start
h. Time delay emergency to normal
i. Time delay engine cool down
j. Three phase over voltage (Source 1 & 2)
k. Phase reversal (normal)
l. Three phase under frequency (Source 2)
m. 4 NO / NC form C contacts for (Source 1 & 2)

n. Manual Push to test button which automatically returns to utility & adjustable run
   timer (0-600 minutes) **(Note: This is not an exercise function)**
o. Time delay neutral position
p. Three phase UV protection (Source 1 & 2)
q. Normal position light
r. Emergency position light
s. Normal source available light
t. Emergency source available light

H. Underground Storage Tanks (UST) Leak Detection

1. Manufacturers
   a. Veeder Root TLS 300/350 (printer option is available)
   b. Xerxes

2. Specific Criteria
   a. Provide with leak detection system
   b. Provide in accordance with EPA and all applicable state and local standards
   c. Provide tank monitoring system
   d. Provide a graduated stick for level measuring
   e. Provide for refueling and stick access
   f. Provide with electronic tank level indicating system
   g. Provide with 48-hour fuel tank capacity
   h. Provide AMI Model 8CH-DAC 8 channel digital/analog converter (4-20ma)

I. Louvers and Dampers

1. Manufacturers
   a. Greenheck
   b. Ruskin

2. Specific Criteria
   a. Provide gravity damper
   b. Provide anodized aluminum louvers and dampers with nylon bushings or ball bearings
   c. Provide with bird screens readily removable without removing louvers or dampers
   d. Designed to limit rainwater in the building
   e. All hardware & components must be the same material and non-corrosive.
   f. Where louvers and dampers are required provide (inside) recessed damper and
      (outside) flange mounted louvers

J. Meter or monitoring package
1. Specific Criteria
   a. Provide standard metering package
   b. Frequency
   c. Provide a voltage adjust rheostat
   d. Provide 3 phase undervoltage and over-current protection
   e. Provide automatic and manual start and stop

K. Start Up and Testing - Diesel Generator Tests
1. Specific Criteria
   a. Provide factory test data
   b. Contractors shall verify and provide fuel prior to start up and testing
   c. Simulate and test all safety equipment. Using a reactive load bank > 500kW or a resistive load bank <500kW (0.8pF) run the generator:
      1) 15 minutes at idle speed
      2) 30 minutes at 25% load
      3) 30 minutes at 50% load
      4) 60 minutes at 75% load
      5) 120 minutes at 100% load
      6) 15 minutes at 25% load
      7) 15 minutes at 0% load
      8) off-Record stator, bearing, oil, ambient, and water temperatures every 15 minutes
   d. Provide load bank receptacle boxes (site specific – Refer to Exhibit B)
   e. Design in such that the station load is not included during load bank test.
   f. Take power factor (pF) into consideration for resistive load bank test to ensure generator is not overloaded.
   g. Demonstrate all warnings and shutdown alarms (simulation with laptop).
   h. Record speed, voltage and amperage at 15 minute intervals as well as just prior to and after the load change
   i. Hook up the generator and cycle through the light loading cycles as well as heavy loading cycles (3 each). Record same parameters every 15 minutes and before and after changing load. Tests to be witnessed by HRSD Automotive Superintendent and HRSD Electrical Engineer/Superintendent or designee
   j. Create and attach to the switchgear detailed instructions. The instructions shall be laminated. The instructions shall be simple enough for anyone to pick them up and operate the diesel generator set.
   k. Group A, B, and C phase cable together to cancel out EMF (Electromagnetic Field)

III. Item No. 3
   A. **Energy Efficient Motors**
      1. Specific Criteria
         a. HRSD Electric Motor Specifications in Exhibit E “HRSD Electric Motor Specifications”.
         b. Emergency stop pushbuttons

IV. Item No. 4
A. **Sump Pumps**

1. Manufacturers
   a. Zoeller Co.

2. Specific Criteria
   a. 120 volt
   b. Plug into receptacle
   c. Float controlled

V. **Item No. 5 - Level Sensing Systems**

A. Bubbler Type, Ultrasonic (Rosemount), and Submersible

1. Specific Criteria
   a. Complete purged air bubbler system for sensing wetwell liquid level which generates and transmits level signals to a separate PLC which controls pump operations
   b. Provide UPS for power failure
   c. Power light – white
   d. Provide with low pressure switch with normally closed dry contacts downstream of the regulator
   e. Provide externally mounted duplex air compressors mounted on 30 gallon horizontal receiving tank (Model 3HBB-10-M300 AX) with lead/lag rotation control
   f. Provide oil-less compressors with 120 volt 60 cycle, single phase motors with integral thermal overload protection
   g. Provide manual purging of bubbler piping
   h. Provide manual alternation of air compressors
   i. Mount air compressors outside of the panel whenever possible
   j. Provide high level alarm in wetwells. Provide with micro (non-mercury) switch backup (float ball)
   k. Provide high wet well light and pressure switch
   l. Provide overflow light and pressure switch
   m. Provide high wet well and overflow push to test lights
   n. All alarm contacts are closed in a normal operating state (Closed loop system)
   o. Provide high level Floatball for alarms

B. Ultrasonic (site specific)

1. Manufacturers
   a. Siemens

2. Specific Criteria
   a. Microprocessor
   b. FM approved (frequency modulation)

C. Level Transducer (site specific)

1. [Refer to Exhibit F - Stilling Well Detail](#)
D. Pressure Sensing Systems

1. Manufacturers
   a. Foxboro
   b. Rosemont

2. Specific Criteria
   a. Provide series 40 Red Valve pressure seals with Viton boot
   b. Provide 0-100psi gauge (Ashcroft)
   c. Provide a Foxboro IDPT 10 absolute pressure electronic transmitter
   d. See Standard Detail “Pressure Reducing Station Pressure Sensor Detail”
   e. Suction and discharge transmitters to be mounted in dry well area

E. Float Balls

1. Manufacturers
   a. Flygt
   b. Opti Float (Intrinsically Safe – Fiber Optic)
   c. CSI Controls

2. Specific Criteria
   a. Locate near sump pump in dry well and wet well
   b. Alarm on high level
   c. Support float ball cable to bottom of well; must be rigid and removable from top

VI. Item No. 6 – Variable Frequency Drives (VFDs)

A. Variable Frequency Drives (VFDs)

1. Manufacturers
   a. YASKAWA (A1000) – P1000 is acceptable for certain applications; must be approved by owner.
   b. Allen Bradley (Powerflex 400/700)

2. Specific Criteria
   a. Provide thermal/mag breakers for the drive input power
   b. Install equipment with the idea of keeping it clean and the temperature regulated
   c. Provide thumbscrews for removable/washable filters or thumb screws replaced by snap in grills that are removable from the front of the cabinet (reusable)
   d. Provide a programmable ramp time
   e. Provide input reactors (MTE Corp) or TCI
   f. Pulse Width Modulated (PWM)
   g. IGBTs
   h. Automatic restart on power disruption
   i. Tune out a minimum of 3 frequencies
   j. Hand/Off/Automatic (HOA) selector switch
   k. Manual speed pot door mounted (in addition to keypad control)
   l. Mount the resets and appropriate indicator lighting on the front of the drive or outside of the box
   m. Tune drive to motor with a harmonics meter
n. Provide an input circuit breaker for short circuit protection (Fuses are not acceptable)
o. The controller electronics shall contain indicators of the following conditions:
   1) Undervoltage
   2) Overvoltage
   3) Over temperature
   4) Memory failure
   5) Emergency Stop
   6) Ground fault
   7) Instantaneous overcurrent
o. Provide auxiliary run contacts wired to run command for ventilation fan
p. Provide a NEMA 12 flanged disconnect free standing enclosure
q. Mount the resets and the appropriate indicator lighting on the front of the drive or the outside of the box
r. Provide four contact outputs for run status, power failure, VFD failure, not in auto status
s. The following are site specific options:
   1) VFD must be able to be isolated and bypassed (auto/manual operation) allowing the motor to operate across the line at full load speed and current
   2) Provide manual isolation and bypass capability
   3) Provide three contactors for bypass operation
   4) 6 Pulse Drive
   5) Bypass contactors are site specific; consult with Interceptor Systems & Electrical Shop

3. Additional Design Considerations
   a. All electrical components must be NEMA only. IEC or NEMS/IEC is not acceptable.
   b. Filters to HVAC units must be maintained and free from dust during construction phase.
   c. VFD parameters must be included on as built prints (i.e. momentary power loss ride thru, energy savings, and fault reset)
   d. Specify coil locks (Power Quality Solutions) on control relays for power dip ride thru capabilities.
   e. Provide Bypass mode for critical VFD’s. Soft start or across the line depending on application.
   f. Specify main circuit breaker cable operators for breaker operation instead of standard door operating mechanisms.
   g. Provide One reset button to reset VFD and control circuit faults.
   h. Provide finger safe barriers for main side line breaker lugs.
   i. Provide enough fans to replace each fan within a VFD (spare parts) where several VFD’s of the same size and model are specified.
   j. Provide paper copies of VFD manuals.
   k. To support large and heavy VFD’s 60 HP and above, provide a pedestal with a flat plate mounted inside the enclosure for VFD to rest for easy removal. Also provide a lift table to remove VFD.
   l. Provide external air filter for easy access on cabinets.
m. Contractor to perform static tuning for optimal performance during startup. Contractor to supply panel shop with motor data sheets including the number of poles per motor. Also, include number of motor poles on motor nameplate.

n. Provide extended warranty by VFD manufacturer where replacement cost is justified.

p. Need all switches to indicate when not in auto

q. Need indication when control power is loss in addition to VFD fault.

r. VFD shall be sized to provide current necessary for motor to produce continuous rated horsepower and service factor horsepower at highest carrier frequency.

Refer to Exhibit C “Variable Frequency Drive” Specs

B. Eddy Current Brake Systems/DC Drives – UNACCEPTABLE

VII. Item No. 7

A. Watt Hour Meter (for MCCs or individual motors) – Meter base and meter

1. Specific Criteria
   a. Provided by utility. Locate outside of pump station.

VIII. Item No. 8

A. PLC/RTU

1. Manufacturers
   a. Emerson / Control Wave
   b. Allen Bradley

2. Specific Criteria
   a. Provide functional descriptions, the application program, the job-specific program data and a copy of the as-built software documentation
   b. Include control & alarms
   c. Controls accommodate automatic purge and latch output to current state during bubbler purge
   d. Program must be provided using Function Block Programming
   e. Control Wave Micro
   f. PLC’s and RTU’s shall be equipped with isolation relays for all digital inputs. Example: (Idec 5-blade – 24 VDC coils- with a form C configuration contactor) relays mounted on DIN rail for the purpose isolating relay inputs. Whether a junction box is used or control panel a 24 VDC power supply with sufficient capacity to energize all of the 24 VDC relay coils simultaneously when necessary for all PLC or RTU inputs.

IX. Item No. 9

A. Exhaust Fans
1. Manufacturers
   a. ILG
   b. Dayton
   c. Greenheck
   d. Airovent
   e. MK Plastics

2. Specific Criteria
   a. Corrosion resistant including hardware
   b. Must be explosion proof in wet wells and metering vaults
   c. Direct drive
   d. Belt drive not acceptable unless approved by Owner

X. Item No. 10

A. Lighting

1. Manufacturers
   a. Holophane
   b. Hubbell
   c. Thomas
   d. Crouse Hinds

2. Specific Criteria
   a. Provide proper levels of lighting over major equipment including switchgear, generators, pump motors, and controls. Lighting levels should conform to the IES lighting handbook as a minimum.
   b. Provide exterior lighting at doorways and yard lighting required by building configuration.
   c. Consider operation by photo electric cell.
   d. ALTO or equivalent lighting shall be used to limit the mercury content of the lighting.
   e. Non-fluorescent fixtures shall be LEDs Remove.f.
   f. Consider LED technology for design and replacement of existing.

   Refer to Exhibit D - Lighting Policy

B. Incandescent

1. Manufacturers
   a. Crouse Hinds
   b. Holophane
   c. Appleton

2. Specific Criteria
   a. Provide explosion proof lighting in pump station wet wells
   b. Provide 10 ft. candles minimum in wet well areas
   c. Provide corrosion resistant or rubber coated lights in wet wells
   d. LEDs
C. Fluorescent Light
   1. Manufacturers
      a. Holophane
   2. Specific Criteria
      a. Provide with low temp ballasts
      b. Provide with lens and gaskets in chemical rooms
      c. Do not provide fluorescent lighting and controls on the same circuit
      d. Provide electronic ballasts with T-8 bulbs
      e. Provide fluorescent lighting in control cabinets (i.e. PLCs, bubbler control panels)
         with door switches

D. Metal Halide
   1. Manufacturers
      a. Holophane
   2. Specific Criteria
      a. Suitable in high bay areas
      b. Provide quick strike fixtures in appropriate areas
      c. Wall-paks are suitable inside or outside
      d. Purchase Type “O” lamps for open fixtures.

E. HPS, LPS, and Mercury Vapor – NOT ACCEPTABLE FOR ANY APPLICATION

F. Emergency Lighting
   1. Specific Criteria
      a. Dual Lite GMM-EL-W2 in admin areas
      b. Emerg Lite PRO-2 in corrosive areas
      c. Wall-paks are provided by HRSD
      Note: Install dual input inverters if applicable

G. Exit Lighting
   1. Specific Criteria
      a. Highly visible 24 hours/day for life of material

H. LED
   1. Specific Criteria
      a. To reduce maintenance
      b. Perform payback analysis

XI. Item No. 11
    A. Concrete Housekeeping Pads
1. Specific Criteria
   a. Provide a minimum of 4 inch thickness under MCCs, generators, transformers, and other general electrical equipment and around conduits at floor penetration.
   b. Chamfer all edges

XII. Item No. 12

A. Conduit and Conduit Systems

1. Specific Criteria
   a. Ream and chamfer all edges
   b. EMT or IMC are not allowed
   c. All flexible conduit shall be metallic liquidtite or equal
   d. Flexible conduit must not be installed to complete one small run between RGS.
   e. Provide ¾ inch minimum size. (Where specifically approved or when the instrumentation restricts this size, ½ inch can be used)
   f. Do not use plastic anchors
   g. Seal conduits with a silicone product as necessary
   h. See Miscellaneous section of these standards for markings and coatings
   i. Seal conduits with OZ Gedney conduit and cable seals or with silicone where seals are not available
   j. Cable trays are not acceptable unless approved by Owner
   k. Label all conduits inside of building (Engineer must provide conduit schedule)
   l. Circuit # must be brought back to the panel/breaker.
   m. Paint RGS conduits red if requested by owner.

B. Spare Conduit Feeder

1. Specific Criteria
   a. Provide with service entrance
   b. Add appropriate spares with pull wire

C. PVC Coated Rigid Steel (inside and out)

1. Manufacturers
   a. Robroy
   b. OCAL
   c. Perma-Cote
   d. Gafco Industries
   e. Plastibond
   f. KorKap

2. Specific Criteria
   a. Provide in wet wells, underground (not encased), chemical areas, outside, and damp areas. Provide with PVC coated fittings, boxes and touch-up material
   b. Provide 8” of PVC coated conduit where stubbed up through concrete (washdown areas)

D. Galvanized Rigid Steel
1. Specific Criteria
   a. Provide with applications other than PVC coated above.

E. PVC
   1. Specific Criteria
      a. Underground/encased reinforced concrete, Schedule 40 can be substituted for galvanized conduit in duct banks where EMI is not a threat.

F. Tools Used
   1. Specific Criteria
      a. Use suitable tools with conduit.

G. Patching/Repair
   1. Specific Criteria
      a. Use appropriate material to patch and repair.

H. Flex – Liquidtite & Fittings
   1. Manufacturers
      a. Crouse Hinds
   2. Specific Criteria
      a. Use fittings to suit installed conduit.

I. Fixtures & Fittings (pull boxes)
   1. Specific Criteria
      a. Use appropriate fittings and materials.

J. Struts and Straps
   1. Specific Criteria
      a. To suit conduit materials
      b. Use matching fasteners
      c. In outside, wet or damp areas use stainless steel fasteners
      d. PVC coated channel or unistrut are not acceptable

K. Pull Boxes (wire pulled through) and Junction Boxes (wires terminated inside)
   1. Specific Criteria
      a. In outside, wet or damp areas, use stainless steel fasteners
      b. Over 6 inch x 6 inch are to be hinged
      c. Gasketed
      d. Use stainless steel or aluminum in outside or damp areas

L. Red Dye (Ductbank)
   1. Specific Criteria
      a. Provide red dye in concrete duct banks
XIII. Item No. 13

A. Wire

1. Specific Criteria
   a. Provide separation of power, signal and telephone services
   b. Use compression type lugs only
   c. Do not splice wire
   d. Telephone
      1) Provide conduit and wiring for telephone
   e. Welding cable (DLO) – Design based on intermittent duty vs. continuous duty
   f. THHN, THWN, XHHW (for ductbanks)
      1) Follow NEC color coding
      2) All wire shall be stranded wire, rated for 600 volts
      3) #12 minimum wire size for typical applications
   g. Instrumentation
      1) All wire (MTW ) or signal wire shall be rated at 600 volts
      2) DC wire shall be color-coded blue #16 AWG minimum
      3) AC wire shall be color-coded red #16 AWG minimum
      4) Analog signals shall be #18-2 with a shield (minimum), tinned

Note: Cabinets with multiple sources must be clearly marked as such

XIV. Item No. 14 - Relays

A. Industrial

1. Manufacturers
   a. Allen Bradley
   b. Eaton

2. Specific Criteria
   a. Fixed base

B. Electronic

1. Manufacturers
   a. IDEC
   b. Potter-Brumfield
   c. Agastat

2. Specific Criteria
   a. Plug in ice cube type with pilot lights
XV. Item No. 15 - Lockout / Tagout (Safety)  Refer to Section 21 – HRSD Safety Program in this manual for specifics.

XVI. Item No. 16

A. Switches / Receptacles / Plugs
   1. Manufacturers
      a. Pass & Seymour
      b. Hubbell
      c. Crouse Hinds
   2. Specific Criteria
      a. Provide compression type screw terminals on receptacles. Wire binding receptacles or switches are not acceptable
      b. Provide for dedicated circuits for sump pumps
      c. Provide one weatherproof (WP)/watertight receptacle with lockable cover on exterior wall of the pump station on a separate circuit; separately switches and should not be hot at all times.
      d. Provide a receptacle on each wall of the PS, upper & lower levels.
      e. Lower levels shall be mounted at 48 inches above finished floor -Provide one weatherproof/water tight receptacle on exterior walls on a single circuit, separately switched (Should be “hot” all the time)
      f. Provide ground fault receptacles and breakers where required
      g. Provide power receptacles in control cabinets
      h. Provide “in use” covers for indoor sump applications

XVII. Item No. 17 - Electric Unit Heaters
   Not used, do not supply unless a condition requires it.

XVIII. Item No. 18

A. Electrical Drawings
   1. Specific Criteria
      a. Process and Instrumentation Diagrams (P&IDs) are to conform to ISA modified standards (Consulting engineer to provide)
      b. Provide functional descriptions with the P&IDs (Consulting engineer to provide)
      c. Provide Point-to-Point connection drawings. Contractor shall develop
      d. Review and approval by the engineer shall be prior to installation
      e. Label all conduits inside building
f. Place metal tags on cables in manholes.
g. Provide final conduit & cable schedule on disk (AutoCAD, PDF or VISIO)

XIX. Item No. 19

A. Safety Switches (fused or unfused)
   1. Manufacturers
      a. Square D
      b. Eaton
      c. Allen Bradley

   2. Specific Criteria
      a. Light duty safety switches are unacceptable
      b. Must be pad lockable

XX. Item No. 20

A. Transformers (Dry)
   1. Manufacturers
      a. Square D
      b. Eaton
      c. GE

   2. Specific Criteria
      a. No aluminum wire
      b. Provide 220° C insulation system for 15 kVA and larger
      c. Provide 180° C insulation system for transformers less than 15 kVA
      d. Transformers shall handle a 15% overload without exceeding the insulation rating

XXI. Item No. 21 – Metering Vaults / Pits

A. Dehumidifiers
   1. Specific Criteria
      a. Provide receptacle and location for HRSD installation

B. Power Requirements
   1. Specific Requirements
      a. Provide two receptacles with weatherproof covers

C. Exhaust Fans
   1. See Exhaust Fans (item#9)

D. Sump Pumps
1. Provide “in use” receptacle with a remote GFCI breaker located in station power panel

E. Lighting

XXII. Item No. 22

A. Pressure Sustaining/Regulating Valves

1. Manufacturers
   a. KTM
   b. Foxboro
   c. Clow

2. Specific Criteria
   a. No butterfly valves or pinch valves with controls
   b. Provide 4-20 mA operated valves. Do not use pulsed control valves
   c. Automatic Controls of Virginia or Valve Automation for actuator applications

B. Valve Actuators

1. Manufacturers
   a. EIM/Bettis

2. Specific Criteria
   a. Auma and Rototorque are not acceptable

XXIII. Item No. 23

A. Alarm Systems

1. Specific Criteria
   a. HRSD will provide and install the alarm system. Contractor shall provide sensors and wiring to a junction box and terminate on a terminal strip adjacent to the alarm panel location
   b. HRSD will provide alarm points

B. Station Bypass Alarm Systems *(Refer to Exhibit G)*

1. Specific Criteria
   a. A minimum of two (2) weeks notice is required to set up temporary alarms for a scheduled station bypass operation
   b. HRSD will provide and install the temporary alarm system. Contractor shall provide sensors and wiring to a junction box and terminate on a terminal strip adjacent to the alarm panel location.
   c. HRSD will provide alarm points
   d. Contractors to provide contact names and numbers for alarming purposes

XXIV. Item No. 24 – Flow Meters *(Size for average flows)*
A. Magnetic

1. Manufacturers
   a. Rosemount
   b. Foxboro

2. Specific Criteria
   a. Use for control or billing applications
   b. Ensure vendor is clear on application
   c. Provide with remote head, display and keyboard

B. Insertable Doppler

1. Manufacturers
   a. ISCO

C. Ultrasonics (strap on)

1. Manufacturers
   a. FUJI

2. Specific Criteria
   a. Do not use for control
   b. Locate inside station

D. Venturi

1. Specific Criteria
   a. Generally, not used in most applications

XXV. Item No. 25 – RTUs

A. Antenna
B. Junction box

XXVI. Item No. 26

A. Louvers/Dampers

1. Specific Criteria
   a. See Emergency Diesel Generator Louvers and Dampers (Item #2)

XXVII. Item No. 27

A. Cathodic Protection (Test Stations)

1. Specific Criteria
   a. Use Flush Fink Test Stations
XXVIII. Item No. 28

A. Junction Boxes and Misc. Enclosures

1. Manufacturers
   a. Hoffman
   b. Saginaw
   c. Hammond

2. Specific Criteria
   a. Provide PVC coated boxes and/or fittings when using with PVC coated conduit. Use “like” materials.

3. Inside
   a. Specific Criteria
      1) Stainless steel, fiberglass reinforced plastic (FRP), NEMA 4x

4. Outside
   b. Specific Criteria
      1) Stainless steel, NEMA 4x with Myers hubs

5. Wet
   a. Use with PVC coated conduit and PVC coated hubs
      1) Stainless steel, fiberglass reinforced plastic, NEMA 4x with watertight fittings (Myers)

XXIX. Item No. 29

A. Panel Boards/Control Panels

1. Manufacturers
   a. Eaton
   b. Square D
   c. GE

2. Specific Criteria
   a. Provide with tin-plated copper bus
   b. Provide 25% spares (minimum)
   c. Provide bolt-in breakers
   d. Do not provide cans with pre-stamped knockouts
   e. Provide with hinged panel cover with a latching door
   f. Provide heavy duty industrial grade panel boards
   g. Breaker operator should be outside of panel
   h. Breaker should be located inside of panel
i. HOA switches should be on the outside of panel
j. Dead front Hinge panel cover if available.
k. Provide LED work light, if warranted
l. Provide phenolic labels with black backgrounds and white lettering

XXX. Item No. 30 – Miscellaneous Electrical

A. Electrical Equipment Testing
   1. Specific Criteria
      a. Provide testing in off-peak hours or switch off an equivalent amount of load prior to testing.

B. One Line Diagram
   1. Specific Criteria
      a. Provide an update to the one line diagram with significant changes in the electrical system.

C. Thermographic Inspection
   1. Specific Criteria
      a. Provide a thermographic inspection of the new systems upon completion.

D. Short Circuit / Coordination Study / Arc Flash
   1. Specific Criteria
      a. Provide a coordination study short circuit, coordination, and arc flash analysis for new systems or systems with significant changes.
      b. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable. Include Arc flash analysis results for generator protective device.
      c. Contractor must adhere to NFPA 70E Electrical Safety requirements when working on electrical equipment in HRSD facilities.
      d. Engineer must design electrical systems in accordance with NFPA 70E.

Refer to Exhibit A
XXXI. **Item No. 31 - Lightning Protection** Refer to NFPA 820 and NFPA 780. - Lightning Protection applications will be site specific (Discuss with HRSD Electrical Staff).

XXXII. **Item No 32 - SCADA Site Drawing (Refer to Exhibit H)**
I. Item No. 1

A. **Switchgear**

1. Manufacturers
   a. Eaton
   b. Square D

2. Specific Criteria
   a. Design to meet arc flash standard; Reduce hazard category rating to 2 or lower (MCC and VFD’s should be designed to meet incident energy of 1.2 Cal/Cm2 or below if attainable); Reference HRSD Arc Flash Mitigation Document Dated July 9-10, 2013
   b. Provide two 48 VDC control voltage. 48 VDC redundant battery systems for control voltage per incoming primary voltage source. Use 1 Best Battery Selector to switch between each set of batteries (per primary source side) for control voltage
   c. Stored charge breaker systems are unacceptable
   d. Sealed Lead acid (VRLA)
   e. NiCAD are not acceptable unless approved by Owner
   f. Provide tin-plated copper bus
   g. Provide switchgear indoors in a NEMA 1A (gasketed) enclosure
   h. Switchgear to be located indoors
   i. Provide with push to test lights
   j. Bottom entry versus top entry must be evaluated for application
   k. Provide in a room strictly for switchgear
   l. Install 3 or 4 inch windows on switchgear for IR testing for new installations (consult with Electrical Manager)
   m. Equipment should be designed to be double end fed with tie breakers
   n. Rack out breakers must be racked in and out remotely without opening doors
   o. Provide remote open/close operator to protect personnel from Arc Flash Incident; operator should be outside of arc flash boundary where possible.
   p. Provide ARMS “Arc Reduction Maintenance Switch” or equal; when activating downstream breakers incident energy levels will be reduced. Also, add separate pilot light to indicate when maintenance mode is enabled or disabled.
   q. Provide hinged doors if available
   r. Design electrical gear/equipment to achieve an arc flash rating of Cat 2 or less
   s. Provide trip units with fault indication to determine status (i.e. overloads or fault conditions)
   t. Provide LSIG digital trip unit if =/> 1000 amps and LSI if < 1000 amps
   u. Provide extra fasteners for door cover
   v. Provide phenolic labels with black backgrounds and white lettering

**Note:** 1. *For reliability and the ability to safely troubleshoot and perform maintenance on switchgear and MCC’s, the main switchgear should be double ended with a Bus tie. The main gear shall provide each piece of major electrical equipment with an A and B feeder (from each*
Each MCC shall have a double ended configuration with Bus ties and Kirk Key interlocks to allow isolation of ½ the electrical gear at the MCC level.

2. When this is not possible, alternatives shall be investigated for critical electrical equipment for critical processes. (Return to MCCs)

Refer to Exhibit A

B. Breakers/Solid State Breakers

1. Manufacturers
   a. Eaton
   b. Square D

2. Specific Criteria
   a. Provide appropriate spares and spaces

C. Metering or Monitoring Package (Utility Grade Metering)

1. Manufacturers
   a. Schweitzer Eneigneering Laboratories (SEL)
   b. Eaton
   c. Schneider Electric (Square D)
   d. GE
   e. Basler

2. Specific Criteria
   a. Provide utility grade metering
   b. Volt Meter 3 phase & off
   c. Ammeter 3 phase & off
   d. kW
   e. PF
   f. kVA
   g. kVAR
   h. Utility grade CTs & PTs
   i. Metering packages (See Item No. 8)
   j. Provide 3 phase undervoltage & overcurrent protection (open Delta PTs are unacceptable)
   k. Provide testing that trips the main with a loss of any of the three legs.
   l. Generator must be designed to be manually initiated to return to utility.

D. Selector Switches, Push Buttons, Lighted Push Buttons

1. Manufacturers
   a. Square D
   b. Eaton
   c. Allen Bradley
2. Specific Criteria
   a. Expandable contact blocks on operators
   b. NEMA/IEC rated switches are not acceptable.

E. Contactors
   1. Manufacturers
      a. Eaton
      b. Square D
      c. Allen Bradley
   2. Specific Criteria
      a. Provide with expandable auxiliary contacts for 120 volt control circuits
      b. NEMA/IEC rated contactors are not acceptable

F. Fuses & Fuse Holders
   1. Specific Criteria
      a. Must be locally available

G. Switchgear Control Transformers
   1. Specific Criteria
      a. Provide copper coils
      b. Aluminum coils are unacceptable

H. Terminal Strips / DIN Rail (Space Saver)
   1. Manufacturers
      a. Phoenix
      b. Contact
      c. ILSCO
      d. Square D
      e. Weidmuller
      f. Panduit Panduct
   2. Specific Criteria
      a. Rail mount if possible
      b. Industrial rated
      c. Finger safe

I. Rubber Mats
   1. Specific Criteria
      a. Contractor will provide and install at substantial completion (OSHA Approved: Type II ASTM D178)
      b. Add matting in front of gear

J. Pilot Lighting
   1. Specific Criteria
      a. Provide LED type pilot lights
K. Protective Relays
   1. Manufacturers
      a. Schweitzer Engineering Laboratories
      b. GE
      c. Basler
   2. Specific Criteria
      a. Provide 10 year warranty
      b. Solid State

II. Item No. 2

A. MCCs
   1. Manufacturers
      a. Eaton
      b. Square D
      c. Allen Bradley
   2. Specific Criteria
      a. Provide with tin-plated copper bus
      b. MCCs to be placed indoors in a NEMA 12 (gasketed) enclosure.
      c. Provide redundant feeders to either end of the MCCs with a bus tie in the middle whenever possible.
      d. Provide with Kirk key interlocks door (mounted)
      e. Do not provide in the same room with chemical tanks or pumps
      f. Provide with “push to test” lights
      g. Bottom entry vs. top entry must be evaluated based on application
      h. Provide with face mounted operators and resets
      i. Design to meet arc flash standard
      j. Provide extra fasteners for door cover.
      k. Provide phenolic labels with black backgrounds and white lettering
      l. Provide spare terminals for intermediate terminal blocks for controls.
         
         Notes: See General Notes, Item 1 – Switchgear

A. Breakers/Solid State Breakers
   1. Manufacturers
      a. Eaton
      b. Square D

B. Metering/Monitoring Package (For applications other than utility grade metering)
   1. Manufacturers
      a. Eaton IQ SEL
      b. Square D
      c. Power Logic
      d. Schweitzer Engineering Laboratories (SEL)
2. Specific Criteria
   a. Volt Meter 3 phase & off
   b. Ammeter 3 phase & off
   c. kW
   d. PF
   e. kVA
   f. kVAR
   g. CTs & PTs
   h. Metering packages (See Item No. 8)

C. Selector Switches, Push Buttons, Lighted Push Buttons
   1. Manufacturers
      a. Square D
      b. Eaton
      c. Allen Bradley
   2. Specific Criteria
      a. Expandable contact blocks on operators

D. Contactors
   1. Manufacturers
      a. Eaton
      b. Square D (Contactor must be able to reclose after short power blips)
      c. Allen Bradley
   2. Specific Criteria
      a. Provide with expandable auxiliary contacts for 120 volt control circuits

E. Fuses & Fuse Holders
   1. Manufacturers
      a. Bussmann
      b. Shawmut
   2. Specific Criteria
      a. Must be locally available

F. MCC CTs and PTs
   1. Manufacturers
      a. Square D
      b. Eaton
      c. Allen Bradley
   2. Specific Criteria
      a. Metering
      b. Provide copper coils
      c. Aluminum coils are unacceptable

G. Terminal Strips
1. Manufacturers
   a. Pheonix
   b. Contract
   c. ILSCO
   d. Square D
   e. Weidmuller

2. Specific Criteria
   a. Rail mount instrumentation if possible
   b. Industrial rated

H. Combination Starters (Buckets)

1. Manufacturers
   a. Square D
   b. Eaton
   c. Allen Bradley

2. Specific Criteria
   a. 120 volt control voltage
   b. Run light – red
   c. Stop light – green
   d. Fault light – amber
   e. Power available light – white
   f. Provide push to test indicator lights
   g. Elapsed time meters–graduated in 1/10 hours Resetable or Non-resetable (plant/site specific; incorporate time meters on DCS if available)
   h. Provide over load resets operational from the front (external)
   i. Provide with adjustable thermo-mag breakers
   j. Fused control transformer
   k. 25% spares and/or spaces for all sizes of buckets or expandable option
   l. MCC mounted lighting panels shall be provided with 25% spare breakers
   m. Provide connections for motor leads directly from the motors to the starter. Do not use intermediate terminal blocks (50 HP and smaller)
   n. Provide standalone combination starters in the proper enclosures (See Junction/Pull Boxes and Miscellaneous Enclosures)

I. Rubber Mats (to be placed in front of gear)

1. Manufacturers
   a. Grainger
   b. Chesapeake Bay Rubber

2. Specific Criteria
   a. Contractor will provide and install at substantial completion (OSHA approved: Type II ASTM D178)
a. Safeside-Grace Engineered Products (Load side of Main Breaker)

III. Item No. 3

A. Emergency Generators

1. Manufacturers
   a. Caterpillar
   b. Cummins

2. Specific Criteria
   a. Diesel generators
   b. Turbine generators are not acceptable unless approved by Owner.
   c. Engines to be of domestic manufacture whenever possible
   d. 4-stroke diesels **ONLY**
   e. Parts must be available in 48 hours or less
   f. Must meet current U.S. EPA and Virginia DEQ air standards
   g. Low emission units
   h. All units shall be Standby Rated
   i. Remote Emergency stop pushbuttons at doorways (Pilla Model GS120 w/clear, hinged, plastic cover)

B. Generator

1. Manufacturers
   a. Stamford
   b. Newage
   c. Caterpillar
   d. KATO
   e. LIMA
   f. Marathon
   g. Cummins

2. Specific Criteria
   a. Generators 1 MWatt and larger require a two bearing generator unless the manufacturer has engineered the engine main bearing to reliably withstand the dynamic rotor loads and weights
   b. The rectifier shall be a brushless, full-wave bridge
   c. <400 kW and below at 480 volts bring all leads out to the terminal box
   d. 400 kW and above – bring out 3 leads and a neutral (minimum) to the terminal box
   e. Neutrals shall be sized to full rating (brought out to the terminal box)
   f. Temperature rise on generator voltages 4160 & higher shall not exceed Class B rating with 80°C ambient rise. All others shall not exceed 105°C rating
   g. Alternator shall have a space heater that switches off when running
   h. Provide for 2/3 winding pitch
   i. Minimum Class H insulation (operating temperature class 180°C) with topicalization (anti-fungus)
   j. Provide voltage regulation less than +/- 1%
k. Provide 150% minimum overspeed capability  
l. Provide amortisseur winding  
m. Provide less than 5% THD (Total Harmonic Distortion)  
n. Provide less than 50 TIF (Telephone influence factor)  
o. Voltage regulator shall be 3 phase  

C. Diesel Engine  

1. Manufacturers  
   a. Caterpillar  
   b. Cummins  

2. Specific Criteria  
   a. Heavy-duty, direct-injected, 4-stroke diesel engine  
   b. Provide electronically controlled engines  
   c. Provide electronically controlled engines with an electronic control system  
   d. Require vendor to identify the control system to be provided  
   e. Provide system software and training to fully troubleshoot and operate the engine  
   f. Provide isochronous frequency regulation (no load to full load)  
   g. Provide +/- 0.25% steady state frequency regulation (minimum)  
   h. Air, fuel and oil filters shall be sized to provide a minimum of 250 hours of operation before servicing  
   i. Provide a Racor fuel-water separator  
   j. The air filter is to be a dry type with a restriction indicator  
   k. Provide RTD’s for monitoring bearing and winding temperatures  
   l. Add vibration monitoring if > 1000 KW  
   m. Provide a Nelson (or Racor) heavy duty crankcase vapor coalesce  
   n. All radiators and supporting appurtenances are to be galvanized steel  
   o. The radiator core shall have solder coated fins to prevent corrosion by hydrogen sulfide gas  
   p. Size radiator to prevent overheating in the most severe conditions (122°F ambient)  
   q. Exhaust system and muffler shall be lowest DB appropriate for the surrounding area.  
   r. The starting system shall be 24 volt DC  
   s. Provide all diagnostic equipment for complete trouble shooting (software/technical manuals/hardware etc.)  
   t. Speed sensing shall be provided to protect against accidental starter engagement into a moving flywheel.  
   u. Battery charging alternation output voltage will not be acceptable for this purpose  
   v. Provide an adjustable (0-15 minutes) cool down time  
   w. Provide a large red emergency stop push button  
   x. Low oil pressure, high coolant temperature, overspeed, and over-crank shall shut down the engine and provide indicator lights  
   y. Analog or digital displays shall be provided for coolant temperature, oil pressure, service hours, engine RPM, system DC volts and system diagnostic code  
   z. Provide Kim Hot-Start engine block heater (thermostatically controlled) set in accordance with manufacturer’s recommendation (120°F – 140°F)  
   aa. Provide vibration isolators between generator set base and floor  
   bb. Provide lifting eyes  
   cc. Provide brake mean effective pressure (BMEP) calculations
dd. Provide means of quantifying flows from the day tank to the diesel and from the diesel back to the main tank.

D. Battery Chargers

1. Manufacturers
   a. LaMarche
   b. Cummins
   c. SENS

2. Specific Criteria
   a. 24 volt chargers or LaMarche equal
   b. Automatic, solid state, provide continuous taper charging
   c. UL listed, provide with under/over voltage, current failure and loss of power acknowledgment
   d. Full Float Charge versus trickle charge must be evaluated for application.

E. Starting Batteries

1. Manufacturers
   a. Delco-DEKA
   b. Exide Switch locations

2. Specific Criteria
   a. Use 8D lead-acid batteries (4D is not acceptable)
   b. Provide a minimum of 2. The batteries shall provide 1200 CCA each
   c. Provide with insulated battery rack
   d. Provide a 2 year full replacement guarantee
   e. Provide as a minimum 2 cranking cycles at a minimum of 30 seconds each

F. Air Starter

1. Manufacturers
   a. Ingersoll Rand

2. Specific Criteria
   a. Site Specific

G. Day Tanks

1. Manufacturers
   a. Pryco
   b. Simplex
   c. Tramont

2. Specific Criteria
   a. UL Listed – double wall
   b. Provide with Oberndorfer bronze gear type pump. Pumps with rubber or nitrile impellers will not be accepted
   c. Provide with a low level alarm
   d. Size for 2 hour minimum running time
e. Provide a fuel level indicator on the day tank
f. Provide a two pump system. Each pump shall be capable of pumping 100% of the fuel oil for all generators
g. Fuel shall be returned to the day tank
h. Provide Not in Auto lamp or other warning device.
i. Meet all VDEQ requirements

H. Underground Storage Tanks (UST)

1. Manufacturers
   a. Controls by Veeder-Root TLS 300/350 (printer available as option)
   b. Xerxes

2. Specific Criteria
   a. Provide in accordance with EPA and all applicable state and local standards
   b. Provide with leak detection system
   c. Provide a graduated stick for level measuring
   d. Provide for stick access and refueling
   e. Provide with 7 days of fuel tank capacity
   f. Provide an electronic tank level indicating system with a 4-20 mA output calibrated to the tank or Ethernet connection (TCP/IP)
   g. Provide AMI Model 8CH-DAC 8 channel digital/analog converter (4-20ma)

I. Louvers and Dampers

1. Manufacturers
   a. Greenheck
   b. Ruskin

2. Specific Criteria
   a. Aluminum or PVC with hardware
   b. Provide for gravity dampers on emergency generator systems (For motor operated applications, must fail to open position if power loss)
   c. Provide anodized aluminum dampers with nylon bushings or ball bearings
   d. Steel and/or steel shafts are not acceptable
   e. Provide with bird screens readily removable without removing louvers or dampers
   f. Designed to limit rainwater in building
   g. Where louvers and dampers are required, provide recessed dampers (inside) and flange mounted louvers (outside)
   h. Manufacturer shall set and balance the system

J. Metering/Monitoring Package

1. Specific Criteria
   a. Volt meter 3 phase & off
   b. Ammeter 3 phase & off
   c. Frequency
   d. kW
   e. PF
   f. kVA
   g. kVAR
h. kWh
i. Utility grade CTs & PTs
j. Metering packages (See Item No. 8)
k. Provide 3 phase undervoltage & overcurrent protection
l. Synchroscope
m. Sync lights
n. Supply a TCP/IP modbus link with an HRSD supplied IP address, subnet mask, and gateway to allow the Emerson DCS (or other monitoring system) to read the all data registers from the generators and the associated MCC hardware. This includes run statuses, breaker statuses, voltage, current, diesel generator engine data, etc.

K. System Operation

1. Specific Criteria
   a. Provide protection such that the two sources (utility & emergency generator) can never be closed out of phase
   b. Provide approvals by Dominion Virginia Power on the paralleling protection scheme
   c. Provide a selector switch to allow the operator to choose “curtailment” or “loss of power” (typically set to “loss of power”)
   d. In the loss of power setting, the system shall have automatic and manual operation. The manual operation would be provided in the event the automatic functions failed
   e. If the operator switches to curtailment:
      1) Depressing a single push button in the automatic mode will start the engine, parallel with the utility, ramp the plant load onto the generator and open the utility breaker
      2) Depressing a second push button will ramp the load back to the utility and shut down the generators
   f. Provide a detailed sequence of operation for generator and switchgear operation

L. Start Up and Testing

1. Specific Criteria
   a. Provide factory test data.
   b. Simulate and test all safety equipment. Using a reactive load bank (0.8PF) run the generator:
      1) 15 minutes at idle speed
      2) 30 minutes at 25% load
      3) 30 minutes at 50% load
      4) 60 minutes at 75% load
      5) 120 minutes at 100% load
      6) 15 minutes at 25% load
      7) 15 minutes at 0% load (cool down) off
         Record stator, bearing, oil, ambient, and water temperatures every 15 minutes.
   c. Record speed, voltage and amperage at 15 minute intervals as well as just prior to and after a load change.
d. Demonstrate all warnings and shutdowns with laptop.

e. Hook up the generator to the main switchgear. Perform all automatic and manual functions a minimum of three times each. The plant will load the generators as much as possible. Particular attention should be observed to the larger starting loads. Record same parameters every 15 minutes and before and after changing load. Tests to be witnessed by HRSD Automotive Superintendent and HRSD Electrical Engineer or designee.

f. Create and attach to the switchgear detailed instructions. The instructions shall be laminated. The instructions shall be simple enough for anybody to pick them up and operate the diesel generator set.

g. Group A, B, and C phase cable together to cancel out EMF (Electromagnetic Field)

IV. Item No. 4

A. Energy Efficient Motors

1. Specific Criteria
   a. See HRSD Electric Motor Specifications in Exhibit E “HRSD Electric Motor Specifications”.
   b. Provide ammeters on motors 50 HP & larger.
   c. Local stop pushbuttons for VFDs, Use HOA for constant speed applications.
   d. Add momentary push button at Motor

V. Item No. 5

A. Sump Pumps

1. Specific Criteria
   1) Provide with 120 volt plug and receptacle. See Treatment Plant/Miscellaneous Items.

VI. Item No. 6

A. Level Sensing Systems

1. Specific Criteria
   a. Provide 4-20 mA signal
   2) See Treatment Plant No. 24
   3) See Chemical Systems Plants

B. Bubbler Type – Level Sensing Systems

1. Specific Criteria
a. Complete purged air bubbler system with time delay for sensing wet well liquid level which generates and transmits level signals to control pump operations
b. Provide UPS backup for controls
c. Provide power light – white
d. Provide a pressure sensing device (Foxboro or equal)
e. Provide externally mounted duplex air compressors mounted on 30 gallon horizontal receiving tank
f. Provide push button for manual purging of bubbler piping
g. Provide manual alternation of air compressors
h. Provide lead/lag switch – no off
i. Provide panel mounted 4 ½ inch 0 level gauge/Analog gauge
j. Mount air compressors outside of panel whenever possible
k. Provide pressure activated switches for point applications (Barksdale)

C. Ultrasonic – Level Sensing Systems
   1. Manufacturers
      a. Rosemont
      b. Siemens
   2. Specific Criteria
      a. Microprocessor
      b. FM approved (frequency modulation)

D. Capacitance – Level Sensing Systems (Not Acceptable)
   1. Manufacturers
      a. Warrick
      b. Drexelbrook
   2. Specific Criteria
      a. Provide with point applications only
      b. Not for 4-20 ma applications

E. Pressure Transmitters – Level Sensing Systems
   1. Manufacturers
      a. Foxboro
      b. Rosemount
      c. Air Monitor – Incinerator draft
   2. Specific Criteria
      a. All other locations

F. FloatBalls
   1. Manufacturers
      a. Flygt
      b. Optifloat
   2. Specific Criteria
      a. Non mercury
b. Fiber Optic

G. Pressure Sensing System – Level Sensing Systems

1. Specific Criteria
   a. Provide series 40 Red Valve Pressure seal with Viton boot
   b. Provide Ashcroft Gauges 100 psi
   c. Provide Foxboro IDPT 10 absolute pressure electronic transmitter
   d. See Standard Detail “Pressure Reducing Station Pressure Sensor Detail”

H. Diaphragm – Level Sensing Systems

1. Manufacturers
   a. Foxboro
   b. Rosemont

2. Specific Criteria
   a. Pressure Transmitter (Diaphragm Type)

I. Radar – Level Sensing Systems

1. Manufacturers
   a. Rosemont

2. Specific Criteria
   a. Non-Contacting and Guided Wave types will be application dependent

VII. Item No. 7

A. Variable Frequency Drives (VFDs)

1. Manufacturers
   a. Yaskawa (A1000)
   b. Allen Bradley (Powerflex 400/700)

2. Specific Criteria
   a. Install the equipment with the idea of keeping it clean and temperature regulated
   b. Provide thumbscrews for removable/washable filters or thumb screws replaced by snap in grills that are removable from the front of the cabinet (reusable)
   c. Provide a programmable ramp time
   d. Provide input reactors (MTE Corp) or TCI
   e. Pulse Width Modulated (PWM)
   f. Use IGBTs
   g. Automatic restart on power disruption
   h. Tune out a minimum of 3 frequencies
   i. Hand/Off/Automatic (HOA) selector switch
   j. Manual speed control by potentiometer (door mounted) in addition to keypad control.
   k. Tune drive to motor with a harmonics meter
   l. Provide an input circuit breaker for short circuit protection (Fuses are not acceptable)
   m. The controller electronics shall contain indicators of the following conditions:
      1) Undervoltage
2) Overvoltage
3) Over temperature
4) Memory failure
5) Emergency Stop
6) Ground fault
7) Instantaneous overcurrent

n. Provide a NEMA 12 flanged disconnect free standing enclosure

O. Provide auxiliary run contactor wired to run command for ventilation fan

P. Mount the resets & appropriate indicator lighting on the front of the drive or the outside of the box

Q. Provide four contact outputs for run status, power failure, VFD failure, not in auto status

R. The following are site specific options:
   1) VFD must be able to be isolated and bypassed (auto/manual operation) allowing the motor to operate across the line at full-load speed and current. Site specific
   2) Provide manual isolation and bypass capability
   3) Provide three contactors for bypass operation

S. VFD “T” leads in free air shall be run in RGS or PVC coated RGS

T. “T” leads can be run in PVC if in a duct bank

U. Do not run “T” leads in conduit with any other conductors

V. “T” leads shall be run in a separate conduit per each drive

W. 6 pulse drive or Matrix drive or AB 755T

3. Additional Design Considerations

a. All electrical components must be NEMA only. IEC or NEMS/IEC is not acceptable.
b. Filters to HVAC units must be maintained and free from dust during construction phase.
c. VFD parameters must be included on as built prints (i.e. momentary power loss ride thru, energy savings, and fault reset)
d. Specify coil locks (Power Quality Solutions) on control relays for power dip ride thru capabilities.
e. Specify Baker SKF EP 1000 Dynamic motor link on all motor/VFD system 100HP and above or designated as critical equipment.
f. Provide Bypass mode for critical VFD’s. Soft start or across the line depending on application.
g. Specify main circuit breaker cable operators for breaker operation instead of standard door operating mechanisms.
h. Provide One reset button to reset VFD and control circuit faults.
i. Provide finger safe barriers for main side line breaker lugs.
j. Provide enough fans to replace each fan within a VFD (spare parts) where several VFD’s of the same size and model are specified.
k. Provide paper copies of VFD manuals.
l. To support large and heavy VFD’s 60 HP and above, provide a pedestal with a flat plate mounted inside the enclosure for VFD to rest for easy removal. Also provide a lift table to remove VFD.
m. Provide external air filter for easy access on cabinets.
n. VFD shall be sized to provide current necessary for motor to produce continuous rated horsepower and service factor horsepower at highest carrier frequency.
o. Contractor to perform static tuning for optimal performance during startup. Contractor to supply panel shop with motor data sheets including the number of poles per motor. Also, include number of motor poles on motor nameplate.
p. Provide extended warranty by VFD manufacturer where replacement cost is justified.
q. Need all switches to indicate when not in auto
r. Need indication when control power is loss in addition to VFD fault.
s. Evaluate best routing method for bottom versus top entry of wire.

B. DC Drives

1. Specific Criteria
   a. Unacceptable

C. Eddy Current Brake Systems

1. Specific Criteria
   a. Unacceptable

VIII. Item No. 8

A. Metering Packages for Switchgear

1. Manufacturers
   a. Schweitzer Engineering Lab (SEL)
   b. Xpert (Eaton)
   c. Power Logic (Square D)
   d. Multilin (GE)

2. Specific Criteria
   a. Provide cumulative watt-hour meters on each MCC, or specific motor
   b. Provide a meter on each MCC to indicate 3 phase parameters on the MCC; i.e., volts, amps, kW, PF, kVA, kWh, etc.
   c. Provide with motors 200 HP and above

IX. Item No. 9

A. PLCs

1. Manufacturers
   a. Allen Bradley (i.e. – SLC 500, Compact Logix 5000, Micro Logix 5000)

2. Specific Criteria
   a. Provide functional descriptions, the application program, the job-specific program data and a copy of the as-built software documentation
   b. Include PLC fail indicator
   c. Provide license, software, programmed files with labels (as Built)
   d. PLC’s and RTU’s shall be equipped with isolation relays for all digital inputs. Example: (Idec 5-blade – 24 VDC coils- with a form C configuration contactor) relays mounted on DIN rail for the purpose isolating relay inputs. Whether a junction box is
used or control panel a 24 VDC power supply with sufficient capacity to energize all of the 24 VDC relay coils simultaneously when necessary for all PLC or RTU inputs.

**Item No. 10**

A. **Exhaust Fans**

1. Manufacturers
   a. ILG
   b. Dayton
   c. Greenheck
   d. Airovent
   e. Mk Plastics

2. Specific Criteria
   a. Corrosion resistant including hardware
   b. Must be explosion proof in hazardous areas

**XI. Item No. 11**

A. **Lighting**

1. Manufacturers
   a. Holophane
   b. Hubbell
   c. Thomas
   d. Crouse-Hinds

2. Specific Criteria
   a. LEDs
   b. Provide proper levels of lighting over major equipment including switchgear, generators, pump motors, and controls. Minimum lighting levels should conform to the IES lighting handbook.
   c. ALTO or equivalent lighting shall be used to limit the mercury content of the lighting.
   d. Non fluorescent fixtures shall be metal halide
   e. Exterior lights shall be placed on a single photo cell (within reason)

   *Refer to Exhibit D - Lighting Policy*

B. Incandescent – Light Bulbs

1. Manufacturers
   a. Crouse Hinds
   b. Holophane
   c. Appleton

2. Specific Criteria
   a. Explosion proof in hazardous areas
   b. Industrial areas
C. Florescent – Light Bulbs

1. Manufacturers
   a. Holophane

2. Specific Criteria
   a. Provide with low temp ballasts
   b. Provide with lens and gaskets in chemical rooms
   c. Do not provide florescent lighting and controls on the same circuit
   d. Provide electronic ballasts with
   e. T-8 bulbs

D. Metal Halide – Light Bulbs

1. Manufacturers
   a. Holophane

2. Specific Criteria
   a. Suitable in high bay areas
   b. Provide quick strike fixtures in appropriate areas
   c. Wall-paks are suitable inside or outside

3. Other
   a. HPS
      1) Specific Criteria
         i. Not acceptable for any application
   b. LPS
      1) Specific Criteria
         i. Not acceptable for any application
   c. Mercury Vapor
      1) Specific Criteria
         i. Not acceptable for any application
   d. Emergency Lighting
      1) Manufacturers
         i. Dual Lite
         ii. Emergency Lite
         
         Note: Install dual input inverters if applicable

      2) Specific Criteria
         i. Dual Lite GMM-EL-W2 in admin areas
         ii. Emerg Lite PRO-2 in corrosive areas
   e. Exit Lighting
      1) Manufacturers
         i. Dual Lite
         ii. Lithonia
2) Specific Criteria
   i. Highly visible 24 hours/day for life (self-illuminating)
   ii. Provide lighted only if required

f. High-Mast Lighting
   1) Manufacturers
      i. Holophane

2) Specific Criteria
   i. Site specific

g. LED
   1) Specific Criteria
      i. To reduce maintenance
      ii. Perform payback analysis

XII. Item No. 12

A. Concrete Housekeeping Pads

1. Specific Criteria
   a. Provide a minimum of 4 inch thickness under Switchgear, MCCs, transformers, general electrical equipment, and around conduits at floor penetrations
   b. Chamfer all edges

XIII. Item No. 13

A. Conduit and Conduit Systems

1. Specific Criteria
   a. Provide three separate conduit systems. One for power circuits >600 volts, one for power circuits less than 600 volts, and one for communication circuits
   b. Instrumentation (<25v) can be placed in the communication duct bank
   c. Use compression type lugs only; when splicing is specifically approved
   d. Ream and chamfer all edges
   e. EMT or IMC are not acceptable unless approved by Owner
   f. All flexible conduit shall be heavy duty metallic liquidtite or equal
   g. Provide ¾ inch minimum size (when specifically approved or when instrumentation restricts this size, ½ inch can be used)
   h. Do not use plastic anchors
   i. Seal conduits with a silicone product as necessary (in the manholes to the buildings)
   j. Administrative areas (plenum) can use EMT down to ½ inch (lighting only)
   k. Label all conduits inside of building (Engineer must provide conduit schedule)
   l. Circuit # must be brought back to the panel/breaker.
   m. Place metal tags on cables in manholes
   n. See the Miscellaneous section of these standards for markings and coatings
   o. Provide Oz Gedney conduit and cable seals or silicone where seals are not available
p. Cable trays are not acceptable unless approved by Owner
q. Evaluate cost of stainless steel or aluminum conduit vs. PVC coated rigid steel conduit (where applicable)

B. Spare Conduits
1. Specific Criteria
   a. Provide with service entrance
   b. Add appropriate spares with pull wires

C. Future Conduits
1. Specific Criteria
   a. Some future conduits may become trip hazards, they must be cut flush and grouted at the finish floor in some cases.

D. PVC Coated Rigid Steel (inside and out)
1. Manufacturers
   a. Robroy
   b. Plasti-Bond
   c. Perma-cote
   d. Korkap
   e. Ocal
   f. Gafco Industries
2. Specific Criteria
   a. Provide in corrosive areas, underground (not encased), chemical areas, chemical containment areas, outside and damp areas
   b. Provide with PVC coated fittings, boxes and touch-up material
   c. Provide 8” of PVC coated conduit where stubbed up through concrete (wash-down areas)

E. PVC
1. Specific Criteria
   a. Underground/encased reinforced concrete
   b. Can replace RGS in duct banks where EMI is not a threat

F. Rigid Galvanized Steel
1. Specific Criteria
   a. Provide in all other areas not covered by PVC and PVC coated

G. Tools Used
1. Specific Criteria
   a. Use suitable tools with conduit

H. Patching/Repair
1. Specific Criteria
   a. Use appropriate material to patch and repair
I. Flex – Liquidtite & Fittings
   1. Specific Criteria
      a. Use Myers hubs where suitable
      b. Use coated fittings where appropriate
      c. Heavy duty metallic fittings require

J. Explosion Proof Fittings
   1. Manufacturers
      a. Crouse Hinds
      b. Appleton
   2. Specific Criteria
      a. Use fittings to match installed conduit

K. Fixtures & Fittings
   1. Specific Criteria
      a. Use appropriate fittings and materials

L. Struts and Straps
   1. Specific Criteria
      a. To suit conduit materials
      b. Use matching fasteners
      c. In outside, wet or damp areas use stainless steel fasteners

M. Pull Boxes (wire pulled through) and Junction Boxes (wires terminated inside)
   1. Specific Criteria
      a. Over 6 inch x 6 inch are to be hinged
      b. Gasketed
      c. Use stainless steel/aluminum in outside/wet areas
      d. Use PVC coated reinforced fiberglass in hazardous and chemical areas

N. Wire Hangers
   1. Specific Criteria
      a. Appropriately locate above dropped ceilings

O. Red Dye
   1. Specific Criteria
      a. Provide red dye in concrete duct bank
      b. 4000 psi

XIV. Item No. 14
A. **Wire**

1. Specific Criteria
   a. Provide for separation of power, signal and telephone services
   b. Do not splice wire
   c. Use compression type lugs only
   d. Place metal tags on cables in manholes
   e. Welding cable (DLO) – Design based on intermittent duty vs. continuous duty

B. Telephone – Wire

1. Specific Criteria
   a. Minimum wire gauge #22-24 AWG
   b. Provide plenum rated cable in return air plenums

C. THHN, THWN, XHHW – Wire

1. Specific Criteria
   a. Follow NEC color coding
   b. All shall be stranded wire, rated for 600 volt
   c. #12 minimum wire size for typical applications

D. Instrumentation – Wire

1. Specific Criteria
   a. All wire MTW or signal wire shall be rated at 600 volt
   b. Do not combine analog circuits (twisted shielded pair-TSP) with other circuits in the same conduit
   c. Instrumentation control wires should be sized accordingly (#16 stranded wire recommended)
   d. DC wire shall be color-coded blue #16 AWG minimum
   e. AC wire shall be color-coded red #16 AWG minimum
   f. Unless otherwise specified by the manufacturer, provide analog signals with #18-2 AWG with a shield, tinned

   **Note:** Cabinets with multiple sources must be clearly marked as such

E. High Voltage Cable – Wire

1. Specific Criteria
   a. Follow appropriate code

F. Heat Tracing – Wire

1. Manufacturers
   a. Letco-Dual Controls
   b. Chromolox

2. Specific Criteria
   a. Provide terminations and splices above the insulation
   b. Provide thermostatically controlled constant watt tracing
c. Provide with insulation
d. Provide with protective outer coating
e. Provide a metal strip on PVC pipe to distribute heat
f. Provide with indicator light
g. Provide with stainless steel leads in corrosive areas
h. Provide coating for chemically corrosive areas

XV. Item No. 15 - Relays

A. Industrial
   1. Manufacturers
      a. Allen Bradley
      b. Eaton
   2. Specific Criteria
      a. Fixed base

B. Electronic
   1. Manufacturers
      a. IDEC
      b. Potter-Brumfield
      c. Agastat
   2. Specific Criteria
      a. Plug-in/ice cube type with pilot lights

XVI. Item No. 16

A. Lockout / Tagout → Safety
   1. Specific Criteria

XVII. Item No. 17

A. Switches / Receptacles / Plugs
   1. Manufacturers
      a. Pass & Seymour
      b. Hubbell
      c. Crouse Hinds
   2. Specific Criteria
      a. Provide compression type screw terminals on receptacles. Wire binding receptacles or switches are not acceptable.
      b. Provide for dedicated circuits for sump pumps
      c. Provide power receptacle in control cabinets
d. Provide a neutral for each circuit, multi wire circuits are not allowed without special approval and then with a two-pole breaker  
e. Provide “in use” covers for indoor sump area applications

XVIII. Item No. 18 – Unit Heaters

A. Unit Heaters - Electric

1. Manufacturers  
   a. QMark  
   b. Dayton

2. Unit Heaters – Gas  
   a. Space Ray  
   b. Dayton

XIX. Item No. 19

A. Electrical Drawings

1. Specific Criteria  
   a. Process and Instrumentation Diagrams (P&IDs) are to conform to ISA modified standards (Consulting engineer to provide)  
   b. Provide functional descriptions with the P&IDs (Consulting engineer to provide)  
   c. Provide Point-to-Point connection drawings. Contractor shall develop.  
   d. Review and approval by the engineer shall be prior to installation  
   e. Label all conduits inside building  
   f. Place metal tags on cables in manholes  
   g. Provide final conduit & cable schedule on disk (AutoCAD, PDF & VISIO)

XX. Item No. 20

A. Safety Switches (fused or unfused)

1. Manufacturers  
   a. Square D  
   b. Eaton  
   c. Westinghouse  
   d. Allen Bradley

2. Specific Criteria  
   a. Light duty safety switches are unacceptable  
   b. Must be pad lockable

XXI. Item No. 21 - Transformers
A. Dry Transformers
   1. Manufacturers
      a. Square D
      b. Eaton
      c. GE
      d. ACME
   2. Specific Criteria
      a. No Aluminum Wire
      b. Provide 220° C insulation system for 15kVA and larger
      c. Provide 180° C insulation system for transformers less than 15kVA
      d. Transformers shall handle a 15% overload without exceeding the insulation rating
      e. Place on 4” housekeeping pads

B. Oil Filled Transformers
   1. Manufacturers
      a. Square D
      b. Eaton
      c. GE
   2. Specific Criteria
      a. No PCBs allowed
      b. Provide with FR3 oil
      c. Provide housekeeping pad – elevate pad in places prone for flooding.
      d. Require external sample ports

XXII. Item No. 22

A. Metering Vaults/Pits
   1. Specific Criteria
      a. Provide receptacle and receptacle location per HRSD direction
      b. Provide sump pumps as needed with remote GFCI circuit breaker protection

B. Other Metering Vaults/Pits
   1. Power Requirements
      a. Specific Criteria
         1) Provide two receptacles with weatherproof covers with remote GFCI circuit breaker protection
   2. Exhaust Fans
      a. See Exhaust Fans
      b. Size for 12 air changes per hour (minimum)
      c. Bring exhaust duct to within 6 inches above finished floor
   3. Lighting
      a. Provide incandescent lighting with a vapor tight glove and guard
b. Provide light switch at access

XXIII. Item No. 23

A. Pressure Sustaining/Regulating Valves

1. Manufacturers
   a. KTM
   b. Foxboro
   c. Clow

2. Specific Criteria
   a. Provide 4-20 mA operated valves. Do not use pulsed control valves
   b. Automatic Controls of Virginia or Valve Automation for actuator applications
   c. Use EIM/Bettis actuators

B. Other

1. Butterfly Valves
2. V Notch Plug Valves
3. V Notch Ball Valves

XXIV. Item No. 24

A. Flow Meters – Size for average flows

1. Parshall flume
   a. Specific Criteria
      1) Use ultrasonic level indicator (Siemens)

2. Magnetic
   a. Manufacturers
      1) Rosemont
      2) Foxboro

   b. Specific Criteria
      1) Use for control or billing applications
      2) Ensure vendor is clear on application
      3) Provide with remote head, display and keyboard

3. Ultrasonics (strap on)
   a. Manufacturers
      1) Fuji

   b. Specific Criteria
2) Do not use for control

4. Ultrasonics level
   a. Manufacturers
      1) Siemens
      2) Rosemount

5. Insertion (mass flow)
   a. Manufacturers
      1) Magnetrol
      2) Sierra
      3) Kurz
   b. Specific Criteria
      1) Air

6. Venturi
   a. Specific Criteria
      1) Generally, not used in most applications

XXV. Item No. 25

   A. RTUs (Remote Terminal Unit)
      1. Manufacturers
         a. Allen Bradley

      2. Specific Criteria
         a. HRSD shall provide
         b. Physical size 24”x24”x8” in a NEMA 4x enclosure
         c. Physical size 12”x12”x8” in a NEMA 4x enclosure

XXVI. Item No. 26

   A. Louvers/Dampers
      1. Manufacturers
         a. Greenheck
         b. Ruskin

      2. Specific Criteria
         a. Provide gravity dampers for all applications
         b. See Emergency Generators

XXVII. Item No. 27
A. **Transfer Switches**

1. Manufacturers
   a. Eaton
   b. Square D
   c. ASCO

2. Specific Criteria
   a. Nema 12 Enclosure unless required otherwise
   b. IQ Plus Monitoring Device
   c. Provide BUS status (A or B) to the DCS
   d. *Zenith transfer switches are not acceptable*

XXVIII  **Item No. 28**

A. **On-Line Vibration Monitors**

1. Manufacturers
   a. Bentley-Nevada

2. Specific Criteria
   a. Application specific

XXIX.  **Item No. 29**

A. **Panel Meters**

1. Analog
   a. Manufacturers
      1) GE/Yokogawa
      2) Simpson

2. Digital
   a. Manufacturers
      1) Yokogawa
      2) Red Lion
      3) Simpson

3. Elapsed Time
   a. Manufacturers
      1) Crompton
      2) ENB
      3) Yokogawa
   b. Specific Criteria
      1) Non resettable / resettable (plant site specific)

4. Pulse Counters
   a. Manufacturers
      1) Acromag
      2) Omron
5. Isolators
   a. Manufacturers
      1) Action Pack
      2) AGM
      3) Yokogawa
   b. Specific Criteria
      1) Isolate 4-20 MA and 1-5 volt signals

6. Signal Converters
   a. Manufacturers
      1) AGM
      2) RIS
      3) Acromag
   b. Specific Criteria
      1) Isolate 4-20 MA and digital

7. Surge Protectors
   a. Manufacturers
      1) Phoenix
      2) MTL-Crouse Hinds
   b. Specific Criteria
      1) Provide 4-20mA DC signal surge protectors
      2) Surge protectors are to be Din Rail mounted
      3) Provide 120v AC power supply surge protectors

XXX. Item No. 30

A. Analyzers/ Monitors: Safety / Gas
   1. Combustible LEL
      a. Manufacturers
         1) Detronics
         2) MSA

   2. O₂
      a. Manufacturers
         1) Detronics
         2) MSA

   3. SO₂
      a. Manufacturers
         1) Detronics

   4. Bisulfite

   5. H₂S
      a. Manufacturers
         1) Detronics
b. Specific Criteria
   1) ATI is not used for Safety

B. Analyzers/Monitors: Process

1. pH
   a. Manufacturers
      1) Foxboro
      2) E&H Memosens CPS16D pH probe (Incinerator scrubber water process)
         (Site Specific/Specific applications)

2. ORP
   a. Manufacturers
      1) Foxboro
      a. Specific Criteria
         1) Provide only
         2) Stanco not acceptable

3. O₂ (Incinerator)
   a. Manufacturers
      1) COSA
      b. Specific Criteria
         1) Provide only
         2) Operating temperature >1500°F

4. DO
   a. Manufacturers
      1) Hach
      2) Insite
      b. Specific Criteria
         1) Optica

5. CL₂
   a. Manufacturers
      1) Rosemount
      2) Prominent
      3) Chemtrac

6. H₂S
   a. Manufacturers
      1) ATI

XXXI. Item No. 31

A. Miscellaneous Instrumentation

1. PID Controllers
   a. Manufacturers
      1) Emerson Ovation
2. Electric Actuators
   a. Manufacturers
      1) EIM/Bettis
         Note: Verify hazardous classification for small 120V actuators.
   b. Specific Criteria
      1) 120 volts and 480 volts AC

3. Burner Actuators
   a. Manufacturers
      1) Honeywell
      2) Barber Coleman

4. Alarm Panel
   a. Manufacturers
      1) Ronan

5. Temperature Controllers
   a. Manufacturers
      1) Yokogawa

XXXII. Item No. 32

A. Miscellaneous Electrical

1. Electrical Equipment Testing
   a. Specific Criteria
      1) Provide testing in off-peak hours or switch off an equivalent amount of load prior to testing.

2. One Line Diagram
   a. Specific Criteria
      1) Provide an update to the one line diagram with significant changes in the electrical system.

3. Thermographic Inspection
   a. Specific Criteria
      1) Provide a thermographic inspection of the new systems upon completion.

4. Coordination Study/Short Circuit/Arc Flash
   a. Specific Criteria
      1) Provide a coordination study short circuit, coordination, and arc flash analysis for new systems or systems with significant changes.
      2) The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum...
amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable. Include Arc flash analysis results for generator protective device. Contractor must adhere to NFPA 70E Electrical Safety requirements when working on electrical equipment in HRSD facilities.

3) Engineer must design electrical systems in accordance with NFPA 70E

Refer to Exhibit A

XXXIII. Item No. 33

A. Heating and Cooling

1. Manufacturers
   a. Honeywell
   b. Barber Coleman

2. Specific Criteria
   a. Louver actuators to be used with building heating/ventilation systems.

XXXIV. Item No. 34 – Junction/Pull Boxes and Miscellaneous Enclosures

A. Junction/Pull Boxes and Miscellaneous Enclosures

1. Manufacturers
   a. Hoffman
   b. Saginaw
   c. Hammond

2. Specific Criteria
   a. Provide PVC coated boxes and/or fittings when using with PVC coated conduit.

B. Administrative Areas

1. Manufacturers
   a. Hoffman
   b. Saginaw
   c. Hammond

2. Specific Criteria
   a. NEMA 4

C. Inside

1. Specific Criteria
   a. Stainless steel, fiberglass reinforced plastic (FRP), steel, NEMA 4

D. Outside
1. Specific Criteria
   a. Stainless steel, NEMA 4x with Myers hubs

E. Wet
1. Specific Criteria
   a. Use with PVC coated conduit and PVC coated hubs.
   b. Stainless steel, fiberglass reinforced plastic, NEMA 4x with watertight fittings (Myers).

XXXV. Item No. 35

A. Panel Boards/Control Panels
1. Manufacturers
   a. Eaton
   b. Square D
   c. Siemens
   d. GE

2. Specific Criteria
   a. Provide PVC coated boxes and/or fittings when using with PVC coated conduit.
   b. Provide with tin-plated copper bus
   c. Provide 25% spares minimum
   d. Provide bolt in breakers
   e. Do not provide cans with pre-stamped knockouts
   f. Provide with hinged panel cover with a latching door
   g. Provide heavy duty, industrial grade panel boards
   h. Breaker operator should be outside of panel
   i. Breaker should be located inside of panel
   j. HOA switches should be on the outside of panel
   k. Provide dead front hinged panel.
   l. Provide LED work light, if warranted

XXXVI. Item No. 36

A. Distributed Control System (DCS)
1. Manufacturers
   a. Emerson

2. Specific Criteria
   a. Provide fail safe condition within the DCS located in the marshalling cabinet terminal strips

       1) Contact in the field must be wired to a normally closed contact in the energized position. When fault occurs, the contact will open and be displayed as a system failure. This prevents contacts which do not close properly to indicate a fault to
the system. A digital status that equals 1 (one) indicates a closed contact and a 0 (zero) indicates an open contact. An open contact occurs when a fault occurs (fail open).

2) DCS DCU’s and RIO’s shall be equipped with isolation relay junction box(s) (interposing relays) adjacent to all of the DCU’s and RIO’s. The junction box shall contain ample room to house relays; Example: (Idec 5-blade – 24 VDC coils-with a form C configuration contactor) relays mounted on DIN rail for the purpose isolating relay junction box. This junction shall be equipped with a 24 VDC power supply with sufficient capacity to energize all of the 24 VDC relay coils simultaneously when necessary for all DCS inputs.

Note: The following HRSD design standards shall be adhered to: colors for graphical screens, graphics design, and control functionality. The current HRSD DCS standards are maintained by Industrial Automation within the E&I division. These standards are available upon request.

XXXVII. Item No. 37- Lightning Protection Refer to NFPA 820 and NFPA 780. - Lightning Protection applications will be site specific (Discuss with HRSD Electrical Staff).

XXXVIII. Item No. 38 - SWIFT (Refer to Exhibit I)
Meeting Notes

Subject: Arc Flash Mitigation Planning Workshop
Client: HRSD
Project: Arc Flash Mitigation Workshops
Project No: 214032
Meeting Date: July 9-10, 2013
Meeting Location: HRSD South Shore Operations Center, Atlantic Conference Room

Notes by: B. M'Coy

Attendees:
HRSD
Sherman Pressey
Carolyn Cagle
John Haymore
Jennifer See
Tim Marsh
Stephanie Laughinghouse
Ryan Duke
Mardane McLemore
Stan Saunders
Lee Inman
Kelly Lamp
Rick Raike

HDR
Gary Useldinger
Bill M'Coy
Natalie Wieszek
Kevin Thermes

Notes:
Primary HRSD Arc Flash Hazards:
1. Mechanical lock out/tag out by non-qualified personnel – treatment plants and pump stations (unattended).
2. Work on Greater Than Category 4 equipment by qualified electrical personnel.
3. Energized work in emergencies.
4. Hand-Off-Auto (HOA) selector switches located on motor control centers (MCCs) and variable frequency drive (VFD) panels – treatment plants and pump stations.

HRSD Arc Flash Program Goals:
1. Reduce arc flash hazard/risk category to Category 2 or lower (MCC and VFD panels should be reduced to Category 0).
2. Resolve issues with lock out/tag out by non-qualified personnel.
3. Determine method to manage changes to equipment and standard procedures:
   a. Standards & Preferences.
   b. Software (SKM model updates) and hardcopy documentation.
      i. Who will manage; where stored.
      ii. How will changes be tracked.
   c. Manage through construction.
4. Electrical Safety Program in compliance with standards.
   a. Training and qualifying personnel.

HRSD Mitigation Actions to Date:
1. Prepared Draft Electrical Safety Program (held up on lock out/tag out issue).
2. Initiated pilot program at Virginia Initiative Plant (VIP) - mechanical lock out/tag out:
   a. Local shared PPE at equipment (Category 2) - Grit MCC.
   b. Remote Switching Operator (RSO) device - RAS MCC.
3. Purchased Eaton remote racking device for switchgear breakers (located at VIP Blower Building).
4. Developed form for tracking equipment changes.
5. Conducted re-training for all qualified electrical personnel on NFPA 70E.
6. Installed permanent remote operating panel for opening/closing existing 2SB1 main circuit breakers at VIP.
7. Retrofitted circuit breakers with AC-PRO with QUICK-TRIP trip units to provide adjustable long time, short time, and instantaneous settings (LSI) at VIP.
8. Installing Arc Reduction Maintenance Switch (ARMS) and maintenance bypass transfer switches at Army Base Treatment Plant (ABTP).
9. VIP NRI design will include separate enclosures for the Main Switchgear main circuit breakers at VIP.
10. Compiled spreadsheet of electrical equipment with respective arc flash hazard/risk categories.

**Potential Arc Flash Mitigation Alternatives for Medium Voltage Switchgear:**

<table>
<thead>
<tr>
<th>New</th>
<th>Retrofit Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus differential relays installed in switchgear</td>
<td></td>
</tr>
<tr>
<td>- Approximately $5k</td>
<td>Bus differential relays installed in switchgear</td>
</tr>
<tr>
<td>- There is a concern with nuisance tripping</td>
<td>- Approximately $5k</td>
</tr>
<tr>
<td>Maintenance bypass switch on main and feeder circuit breakers</td>
<td>Maintenance bypass switch on main and feeder circuit breakers</td>
</tr>
<tr>
<td>Separate main circuit breaker</td>
<td>Clean air/filtration/climate control (applies to all equipment)</td>
</tr>
<tr>
<td>- Partitions in switchgear</td>
<td></td>
</tr>
<tr>
<td>- Separate rooms</td>
<td></td>
</tr>
<tr>
<td>- Separate space in room</td>
<td></td>
</tr>
<tr>
<td>Permanent remote operator</td>
<td>Permanent remote operator</td>
</tr>
<tr>
<td>Arc flash sensing relay</td>
<td>Arc flash sensing relay</td>
</tr>
<tr>
<td>Main-tie-tie-main configuration (doubled ended switchgear)</td>
<td>Upgrade induction disc relays to microprocessor relays</td>
</tr>
<tr>
<td>5-cycle breakers</td>
<td></td>
</tr>
</tbody>
</table>

**Potential Arc Flash Mitigation Alternatives for Medium Voltage MCC:**

<table>
<thead>
<tr>
<th>New</th>
<th>Retrofit Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove HOA from MCC</td>
<td>Remove HOA from MCC</td>
</tr>
<tr>
<td>Bus differential relays installed in switchgear</td>
<td></td>
</tr>
<tr>
<td>- Approximately $5k</td>
<td>Bus differential relays installed in switchgear</td>
</tr>
<tr>
<td>- There is a concern with nuisance tripping</td>
<td>- Approximately $5k</td>
</tr>
<tr>
<td>Maintenance bypass switch</td>
<td>Maintenance bypass switch</td>
</tr>
<tr>
<td>Separate main circuit breaker</td>
<td>Clean air/filtration/climate control (applies to all equipment)</td>
</tr>
<tr>
<td>- Partitions in switchgear</td>
<td></td>
</tr>
<tr>
<td>- Separate rooms</td>
<td></td>
</tr>
<tr>
<td>- Separate space in room</td>
<td></td>
</tr>
<tr>
<td>Permanent remote operator</td>
<td>Permanent remote operator</td>
</tr>
<tr>
<td>Arc flash sensing relay</td>
<td>Arc flash sensing relay</td>
</tr>
<tr>
<td>Main-tie-tie-main configuration (double ended switchgear)</td>
<td>Upgrade induction disc relays to microprocessor relays</td>
</tr>
<tr>
<td>5-cycle breakers</td>
<td></td>
</tr>
</tbody>
</table>
### Potential Arc Flash Mitigation Alternatives for Low Voltage Switchgear:

<table>
<thead>
<tr>
<th>New</th>
<th>Retrofit Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance bypass at upstream medium voltage feeder and/or at main circuit breaker</td>
<td>Retrofit unit substations (3.F. in Attachment A)</td>
</tr>
<tr>
<td>Remote open/close and remote racking</td>
<td>Remote open/close and remote racking</td>
</tr>
<tr>
<td>Separate main circuit breaker from switchgear</td>
<td>Remove main circuit breaker and install in separate location (if possible)</td>
</tr>
<tr>
<td>Arc flash sensing relay</td>
<td>Arc flash sensing relay</td>
</tr>
<tr>
<td>Arc Vault</td>
<td>Arc Vault</td>
</tr>
<tr>
<td>Zone selective interlocking (ZSI)</td>
<td>ZSI</td>
</tr>
</tbody>
</table>

### Potential Arc Flash Mitigation Alternatives for Low Voltage Switchboards:

<table>
<thead>
<tr>
<th>New</th>
<th>Retrofit Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not preferred for new equipment</td>
<td>Replace with switchgear</td>
</tr>
<tr>
<td>Separate main circuit breaker from switchboard</td>
<td>Remove main circuit breaker and install in separate location</td>
</tr>
<tr>
<td>Arc Vault</td>
<td>Arc vault</td>
</tr>
<tr>
<td>Maintenance bypass switch at upstream feeder circuit breaker and/or at main circuit breaker</td>
<td>Maintenance bypass switch at upstream feeder circuit breaker and/or at main circuit breaker</td>
</tr>
<tr>
<td></td>
<td>Remote open/close of insulated case circuit breakers</td>
</tr>
</tbody>
</table>

### Potential Arc Flash Mitigation Alternatives for Low Voltage MCC:

<table>
<thead>
<tr>
<th>New</th>
<th>Retrofit Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separate main circuit breaker from MCC</td>
<td>Remove main circuit breaker and install in separate location (if possible)</td>
</tr>
<tr>
<td>Solid state trip unit on upstream feeder circuit breaker and/or main circuit breaker</td>
<td>Solid state trip unit on upstream feeder circuit breaker and/or main circuit breaker</td>
</tr>
<tr>
<td>Remote racking</td>
<td>Remote switch operator (RSO)</td>
</tr>
<tr>
<td>Arc Vault</td>
<td>Arc Vault</td>
</tr>
</tbody>
</table>

### Potential Arc Flash Mitigation Alternatives for Low Voltage VFD and Control Panels:

<table>
<thead>
<tr>
<th>New</th>
<th>Retrofit Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote mount HOAs (Category 1 or higher)</td>
<td>Remote mount HOAs (Category 1 or higher)</td>
</tr>
<tr>
<td>Solid state trip unit (LSI) on upstream feeder circuit breakers to VFDs and main circuit breakers</td>
<td></td>
</tr>
</tbody>
</table>

### Potential Arc Flash Mitigation Alternatives for Low Voltage Power Panels and Transfer Switches:

<table>
<thead>
<tr>
<th>New</th>
<th>Retrofit Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addressed by upstream protective device</td>
<td>Addressed by upstream protective device</td>
</tr>
<tr>
<td>Address construction quality in Standards &amp; Preferences</td>
<td>Address construction quality in Standards &amp; Preferences</td>
</tr>
</tbody>
</table>

### Alternatives to be Evaluated for Lowering Arc Flash Hazard Category in Pump Stations:

<table>
<thead>
<tr>
<th>New</th>
<th>Retrofit Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main circuit breaker mounted outside</td>
<td>Main circuit breaker mounted outside</td>
</tr>
<tr>
<td>Install upstream separately-mounted circuit breaker</td>
<td>Install upstream separately-mounted circuit breaker</td>
</tr>
<tr>
<td>Smart MCC with networking</td>
<td>Remote switching</td>
</tr>
</tbody>
</table>
Alternatives to be Evaluated to Address Pump Station Equipment Lock Out/Tag Out:

<table>
<thead>
<tr>
<th>New</th>
<th>Retrofit Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local disconnect with remote start/stop</td>
<td>Local disconnect with remote start/stop</td>
</tr>
<tr>
<td>Remote switching</td>
<td>Remote switching</td>
</tr>
<tr>
<td>Personal protective equipment (PPE)</td>
<td>PPE</td>
</tr>
<tr>
<td>Achieve Category 0 at pump station</td>
<td>Achieve Category 0 at pump station</td>
</tr>
</tbody>
</table>

Alternatives to be Evaluated to Address Plant HOAS:

<table>
<thead>
<tr>
<th>New</th>
<th>Retrofit Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOA located at process equipment without VFD</td>
<td>Achieve Category 0 at MCC/VFD panel</td>
</tr>
<tr>
<td>HOA on VFD with DCS shutdown</td>
<td>Relocate HOA to motor/equipment</td>
</tr>
<tr>
<td>Local disconnect at all equipment with DCS shutdown</td>
<td>Connect to DCS</td>
</tr>
<tr>
<td>HOA located at HVAC equipment</td>
<td></td>
</tr>
</tbody>
</table>

Alternatives to be Evaluated to Address Plant Equipment Lock out/Tag out:

<table>
<thead>
<tr>
<th>New and Retrofit</th>
<th>Retrofit Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local disconnect switch at all equipment with DCS shutdown</td>
<td>RSO devices (all categories)</td>
</tr>
<tr>
<td>Design for Category 0 at applicable panels (MCCs, VFD panels, control panels, etc.)</td>
<td>PPE (Category 2 or lower)</td>
</tr>
<tr>
<td></td>
<td>Modify circuit breakers</td>
</tr>
<tr>
<td></td>
<td>Change protective schemes</td>
</tr>
</tbody>
</table>

Criteria that will be used to evaluate alternatives:

- Initial cost
- Safety – achieve low arc flash hazard/risk
- Risk – loss of operation
- Ease of operation
- Reliability – of implemented equipment
- Versatility - addresses lock out/tag out and electrical work
- Annual cost
- Feasibility/Maintaining operation

Preliminary Decisions:

1. Existing pump stations and new pump stations (< 400A service):
   a. Use portable remote switching operator (RSO) devices.
   b. Relocate HOAs off of MCC.
   c. For new pump stations, separately-mount main circuit breaker inside the pump station.
2. New pump stations (≥ 400A service):
   a. Install main circuit breaker with adjustable LSI trip unit and remote switching.
   b. Separately-mount main circuit breaker inside the pump station.
   c. For Greater Than Category 4 areas, workers need to have utility shut down power at their end to work on main circuit breaker.
   d. HOAs mounted off of MCC.
   e. Consider using SCADA to shutdown equipment and install local disconnect switches.

Miscellaneous Notes:

1. 5 year audit - does it require upgrade to current code?
2. Arc flash labels - equipment based or task based?
3. Who tracks/maintains software?
4. Testing should include circuit breaker trip time.
5. Work on electrical equipment with a Greater Than Category 4 rating at plants by qualified electrical personnel requires equipment to be de-energized prior to work.
**Action Items:**

1. HDR to draft Standard & Preferences language for new pump station electrical service configuration.
2. HRSD to procure RSO devices for existing pump stations.
3. HRSD to contract relocation of HOAs in existing pump stations.
4. HDR to evaluate actions to achieve Category 0 at MCCs, VFD panels, and other applicable panels requiring lock out/tag out at VIP, one larger pump station, and one smaller pump station. Also, evaluate relocation of HOAs to motors at VIP. Consider risk reduction (Category 2 or lower) for electrical work at distribution equipment.
5. HRSD complete pilot testing of RSO devices and PPE at VIP.
6. HDR draft Standard & Preferences language for MCCs, VFD panels, and other applicable panels in new plant designs to address lock out/tag out (goal to achieve Category 0, with adding local disconnects as alternative). Also, installing motorized circuit breakers that feed large VFD panels.
7. HRSD to develop cost for installation of local disconnect switches at two pump stations.
8. HDR draft Standard & Preferences language to address HOAs on new plant designs.
9. HDR draft Standard & Preferences language on managing construction process relative to arc flash (equipment shop drawings, etc.).
10. HRSD and HDR will schedule a follow-up one-day workshop upon completion of the evaluations listed in Actions Items 4 and 7.
Attachment A

Typical Approaches to Limiting Arc Flash Exposure

Limiting Arc Exposure
1. Avoiding arc flash accidents
2. Reducing the level of arc energy released
3. Proper use of personal protective equipment (PPE)

Avoiding Arc Flash Accidents
1. Preventive maintenance
   a. Keep equipment clean.
   b. Keep rodents and birds out of equipment.
   c. Control and repair corrosion of enclosure and electric components.
   d. Check for loose connections.
   e. Test insulation integrity.
   f. Test and repair relays/trip units and breakers.
   g. Test and repair moving parts (breaker racking, switch operation, etc.)
2. Working on Live Equipment
   a. If possible, always work on de-energized equipment.
   b. Use insulated tools.
   c. When excessive force is needed (loosening bolts), it is not uncommon to lose control.
   d. Do not use paint, cleaning chemicals, spray lubrication, etc. on live parts.

Reducing Incident Energy on Worker
1. Reduce the level of fault
   a. Use smaller kVA transformers.
   b. Double ended switchgear:
      i. Keep tie breaker open in Main-Tie-Main configurations.
      ii. Use only one source of a Main-Main configuration.
      iii. Utilize two line-ups in a Main-Tie-Main configuration instead of one line-up in a Main-Tie-Main.
   c. Current limiting fuses or breakers.
   d. Current limiting reactors.
2. Reduce arcing time
   a. Reduce breaker response time safety margin.
      i. Replace electro-mechanical relays with microprocessor relays allows time margin between relays to be reduced from 0.4 second to 0.2 – 0.25 seconds.
      ii. Utilized 5 cycle breakers rather than 8 cycle breakers.
   b. Bus differential protection.
   c. Zone selective interlocking (ZSI).
   d. Temporary instantaneous settings:
      i. Arc maintenance settings on trip units.
      ii. Maintenance group setting on microprocessor relays.
      iii. Add instantaneous trip devices to breakers with no instantaneous that can be turned on and off.
   e. Arc flash sensing relays via fiber optical cable.
   f. Adjust fuse size and speed.
   g. General Electric Arc Vault.
   h. High/Low resistance grounding.
3. Equipment features
   a. Remote breaker operation (open/close).
   b. Remote breaker racking.
   c. Arc flash resistant MCC and switchgear. (not effective with doors open)
   d. MCC that can rack bucket out with door closed.
   e. Locate main breaker section remote (separate room) from distribution section.
   f. Retrofit unit substations (primary fuse switch with secondary feeder breakers) with secondary CT and relay and primary switch over breaker with trip unit to provide both primary and secondary protection.
   g. Remote switching operator (RSO) device.
Exhibit B

North and South Shore Pump Stations
Load Bank Connection's
5560 C/S FY12 Rev 04

PART I – GENERAL

1.01 Scope of Work – Rolling Hills and Colonial Williamsburg Pump Stations

The work to be performed under this Section shall include furnishing all labor, materials, tools and equipment necessary to install and test all load bank connections.

A. Work includes providing labor and materials to build and install a Deep Hinged Window Kit with locking wing knobs and an aluminum inner plate for mounting the necessary panel receptacles.

The Deep Hinged Window Kit shall be sized and configured to ensure proper safe distances between all energized components to grounding surfaces with the hinged cover closed and locked while the panel receptacles are energized.

- Special Notation
  - The amount of panel receptacles and Deep Hinged Window Kit shall be sized to meet the minimum of 100% rating of the generator load with additional room to add 50% more panel receptacles.

B. Work includes installing properly sized aluminum plate and Deep Hinged Window Kit to meet 150% of the capacity of the generator.

C. Work includes providing and installing all necessary lugs in transfer switch to accept cable for panel receptacles.

- Special Notation
  - Lugs shall be sized to accept conductors being used for panel receptacles and conductors from generator.

D. Work includes making all necessary terminations in a workmanship like manner.

E. Work includes removing a portion of the steel side door of the transfer switch and mounting an aluminum plate of adequate size to cover area removed and to accept panel receptacles to meet 150% of the capacity of the generator.

F. Work includes mounting Aluminum Plate, Panel Receptacles, and Deep Hinged Window Kit with machine screws and nuts of adequate size.

G. Work includes coordination with HRSD to perform an operational test to validate product quality and installation.

H. Work must be performed onsite between hours of 7am-3pm Mon-Fri. The time schedule may be altered if approved by owner.
1.02 Scope of Work – Rodman, Quail, and Suffolk Pump Stations

The work to be performed under this Section shall include furnishing all labor, materials, tools and equipment necessary to install and test all load bank connections.

A. Work includes providing labor and materials to install conduit, wire, and deep hinged NEMA 4X junction box with an aluminum dead front panel for mounting the necessary panel receptacles.

   The junction box shall be sized and configured to insure proper safe distances between all energized components to grounding surfaces with the hinged cover closed and locked while the panel receptacles are energized.

   • Special Notation
     - The amount of panel receptacles and junction box shall be sized to meet the minimum of 100% rating of the generator load with additional room to add 50% more panel receptacles.

B. Work includes installing properly sized aluminum plate and junction box to meet 150% of the capacity of the generator.

C. Work includes providing and installing all necessary lugs in transfer switch to accept cable for panel receptacles.

   • Special Notation
     - Lugs shall be sized to accept conductors being used for panel receptacles and conductors from generator.

D. Work includes making all necessary terminations in a workmanship like manner.

E. Work includes installing properly sized conduit and fittings necessary from the existing transfer switch to the receptacle junction box.

F. Work includes mounting aluminum dead front plate and Panel Receptacles in junction box.

G. Work includes coordination with HRSD to perform an operational test to validate product quality and installation.

H. Work must be performed onsite between hours of 7am-3pm Mon-Fri. The time schedule may be altered if approved by owner.
1.03 Submittals
   B. The contractor shall submit a minimum of four copies of all submittals in a three-
      ring binder. Any CAD drawings or other relevant information must be submitted
      in electronic format on a CD (Compact Disc). The Owner will review and
      approve before any material is purchased or any work has commenced. The
      submittals shall be delivered or mailed to the North Shore Electrical Shop, 2391
      G Avenue Newport News, VA 23602 Attn: Dean Lowery or the South Shore
      Electrical Shop, 1424 Air rail Ave, VA Beach VA 23455 Attn: Donnie Ward.
   C. The following submittals will be provided:
      a. Manufacture Product Specification's of cables, connectors, enclosure,
      and associated hardware.

Part 2 Products

2.01 Panel Receptacles shall be Leviton 18 series female panel receptacle, Cam type 400
amp 600v 1/0 – 4/0 AWG. (18R24-(B,O,Y,G))
   A. Panel Receptacles shall be Leviton® 18series female receptacle Cam type
   400amp 600v, 1/0 – 4/0 AWG (part No.18R24).
   B. Panel Receptacles shall be colored to match corresponding phase and
      grounding conductor (grounded conductor Not Applicable)
      i.e.: 480V or 240V
          A phase – Brown/Black
          B phase – Orange/Red
          C phase – Yellow/Blue
          Ground - Green
          Neutral – NA

2.02 Deep Hinged Window Kit with locking wing knobs (Rolling Hills, Colonial Williamsburg)
   A. Deep Hinged Window Kit with locking wing knobs may be Hoffman® (i.e. CAT
      No. AWDH2420N4) or equivalent quality.
   B. Window Kit shall be capable of being locked.
   C. Shall be mounted with machine screws and nuts.

2.03 Deep Junction Box with Aluminum dead front panel (Rodman, Quail,
Suffolk)
   A. Shall be lockable, hinged, and NEMA 4X
   B. Shall have an aluminum dead front panel

2.04 Lugs
   A. Shall be that of a manufacture with conductor size and temperature rating
      stamped into side of lug.
   B. Shall be capable of accepting the correct number of conductors coming from the
      generator and panel receptacles (a minimum of 100% rating of the generator).

2.05 Aluminum Plate
   A. Shall be a minimum of 1/4" thick.
   B. Shall be adequate size to accept the panel receptacles capable of 150% of the
      generator rating.
   C. Shall be mounted with machine screws and nuts.

2.06 Conductor
   A. Shall be that of DLO type (Diesel Locomotive Cable)
   B. Shall be a minimum of 4/0 and 600v rated.
   C. Shall be supported so as not to cause stress on the insulation of the conductor or
      the lugs where being terminated.
   D. Stranded, Copper

2.07 Conduit and Fittings
A. Shall be sized appropriately for conductors.
B. Conduit shall be galvanized ridged steel.
C. Conduit fittings shall be malleable iron.

**Part 3 Execution**

3.01 General and Schedule of work

A. A schedule of work shall be prepared by the Contractor and submitted to the Owner within 10 days of the project award. **The project must be completed and invoiced by Friday June 15th, 2012 to receive payment.**

B. This project is located on the North Shore as well as the South Shore at total of five separate HRSD owned waste water pumping stations.
   - The North Shore Stations are:
     1. Rolling Hills – 402 Rolling Hills Dr. Williamsburg VA 23185
     2. Colonial Williamsburg – 1000 RT. 132 Williamsburg VA 23185
   - The South Shore Stations are:
     1. Rodman – 2412 Rodman Ave., Portsmouth VA 23707
     2. Suffolk – 1136 Sanders Dr., Suffolk VA 23434
     3. Quail PRS – 822 Quail Ave. Chesapeake VA 23324

C. The installation of the aluminum plate with the appropriate amount of panel receptacles and Deep Hinged Window Kit with locking wing knobs shall be determined at each location.

D. The location of where the junction boxes, panel receptacles, aluminum plate and Deep Hinged Window Kit with locking wing knobs will be determined at each location depending on equipment layout.
   - Special Notation
     - The preferred location will be as low to the finished floor as possible and towards the hinged side of the door or on a side of the transfer switch.
     - Where junction boxes are installed the preferred location is top of box at 6 feet from finished grade outside.

E. The successful contractor shall perform work in a safe and workmanship manner and adhere to all applicable codes.

F. The contractor must attend safety orientation training prior to starting construction, which will be facilitated by HRSD Safety Department. Call Jennifer See at (757) 460 - 7060 to schedule an appointment.

G. The successful contractor shall contact HRSD personnel when entering and exiting into the pump station. On North Shore call (757) 833-1720 and (757) 460-7072 on the South Shore, HRSD access badges and keys will be issued by HRSD. The contractor must make a log entry in the stations log book upon arrival and departure of the station.

H. The contractor shall coordinate all shutdowns with the contact personnel. Certain weather events may dictate rescheduling a shutdown at the last minute and is up to the discretion of the owner.

I. This work will require qualified personnel to work in proximity of energized parts; a energized work permit is required to perform work “hot”.

**Part 4 HRSD Contacts**

4.01 Contact personnel

A. North Shore Electrical Supervisor

Load Bank Rec.
Dean Lowery – 757-274-4947 cell  757-833-1702 desk
B. South Shore Electrical Supervisor
   Donnie Ward – 757-376-2721 cell  757-460-7348 desk
C. Electrical Superintendent
   John Haymore – 757-376-3376 cell  757-460-7033 desk
D. Electrical Manager
   Sherman Pressey – 757-274-8753 cell  757-833-1715 desk

Other
• Meetings (pre-bid, pre-construction, and other coordination meetings).
• Cost estimate breakdown (includes labor, material, and other associated cost).

Attachments
A – Hoffman Window Kits
B – Leviton Connectors
C – Photos
NOTES:
1. TYPICAL DIMENSIONS SHOWN FOR VARIOUS SERVICE SIZES. BOX MUST BE FIELD VERIFIED PRIOR TO FABRICATION AND INSTALLATION.
HAMPTON ROADS SANITATION DISTRICT
Electrical Department
2391 G Avenue
Newport News, VA 23602
Phone: 757-833-1702
Fax: 757-875-0273

Drive Specifications:
Date: 09-10-15

**Variable Frequency Drive w/ Waste Water Package**

1.) Horsepower: ________
2.) Full Load Amps: ________
3.) ________ VAC, Three Phase, 60 Hertz, with internal DC Link Choke and Line Reactor.
4.) NEMA 12 free standing enclosure, 90” x 36” x 20” with viewing window and positive pressure blower & filter. Viewing window shall be made by Tegam [www.tegam.com- Item# AWXXX]. Also note, width may vary depending on air exchanges needed for correct cooling factor and/ or dimension of the VFD. Tegam windows are not required if the VFD’s are installed in a controlled environment.
5.) Door mounted digital keypad operator
6.) Fully NEMA rated door interlocking circuit breaker approved for thermal & magnetic trips. **IEC or DUAL RATED NOT ACCEPTED.**
7.) Fully NEMA rated three contactor by-pass configuration fully rated for continuous drive operation. Also, shall operate automatically when in the by-pass position. **IEC or DUAL RATED NOT ACCEPTED.**
8.) NEMA rated – “Drive/ Off/ By-Pass” and “Test/Off/Run” selector switches.
9.) NEMA Rated- “Manual/Auto” selector switch programmed for a voltage (manual) and current (auto) input. Additional contact on “Auto” side of switch to provide closure in auto mode and wired to terminal on drive.

10.) Door mounted Yokogawa elapsed time meter Model # 240311AAAB7-120 VAC non- resettable. **Crompton elapsed time meter is UL listed**

11.) 4-20 MADC speed reference for input and output signals.

12.) NEMA rated speed potentiometer mounted on door for manual speed control.

13.) Isolation form “C” relay TPDT for each “Run”, “Fault” and “Man/ Auto” status.

14.) Enclosure shall be manufactured by Hoffman.

15.) Control transformer should be **1,000 VA or larger** based on control needs in cabinet.

16.) Auxiliary contact for cabinet cooling fans to be form “C” relay TPDT and controlled from Run Status contacts of VFD.

17.) Cooling air fans shall be sized to provide correct air exchanges in cabinet to maintain temperature in cabinet below VFD rating.

18.) Extended 5 year warranty must be included.

19.) The assembly shall be listed per UL508 and 508A or equivalent NRTL standard. The entire assembly shall be affixed with UL508A label prior to shipment.

20.) Application specific - evaluate need for soft start for bypass for 100 HP motors or greater.

21.) Door mounted cradle for controller that could be removed and connected via (3m or 9ft) cable so that drive can be operated outside of the arc flash boundary.

**Note for Vendor:**

1.) Must visit the site to verify that equipment ordered is correct for operation.

2.) Drawings for approval are required to be submitted to HRSD Electrical Department.

3.) Items 6 & 7 shall be approved NEMA rated Cutler-Hammer, Allen-Bradley or Square D. **Or other manufacture NEMA rated with written approval by the HRSD site.**
4.) All switches and lights shall be heavy duty NEMA Rated Cutler-Hammer or Allen-Bradley 30mm.

5.) All switches, lights and keypad shall be mounted inside of viewing window on door. **If applicable**

6.) All spare relay contacts should be wired to terminal blocks.

7.) Fault relay should be controlled from Normally Closed (N.C.) contacts of VFD MB & MC Terminals and to be wired after Overload (O/L) contacts on drawing.

8.) All VFD’s will be shipped attached Horizontally on pallets and with sufficient protection for the switches, lights and On/Off breaker.

9.) **THERE SHALL BE NO IEC OR DUAL RATED NEMA DEVICES ACCEPTED.**
Examples: Lights, position switches, circuit breakers, contactors and speed potentiometer.

Mount Thermostat above or close to the VFD. Not at the bottom of the cabinet.
The purpose of these guidelines is to provide direction for sustainable lighting solutions to meet the needs of facilities and help accomplish the Mission and Vision of HRSD.

Sustainable lighting meets the qualitative needs of the visual environment with the least impact on the physical environment.

- **Sustainable lighting elements**
  - Optimize use of daylight
  - Minimize use of energy
  - Reduce light pollution and light trespass
  - Minimize embodied environmental effects
  - Specify environmentally preferable materials and equipment
  - Ensure system quality, flexibility, adaptability, maintainability and durability
  - Provide staff orientation and training

- **Qualitative needs**
  - Support work
    - Productivity, safety, security
  - Regulatory
    - Minimum required light levels maintained
  - Human Centric
    - The psychological wellbeing, interest, and enthusiasm of people.

- **Optimize use of daylight**
  - Daylight can provide potential benefits in terms of health, performance, or general well being
  - Minimize electric lighting, turn off (or down) in response to daylight
    - Simple solution: Photo-sensor, controller, step-dimming ballast (bi-level option) for fixture retrofit
    - Optional feature for occupancy/vacancy sensors- Built in photo-sensor- Inhibits room lights from turning on when there is sufficient daylight present
• **Minimize use of energy**
  o Integrated design
    ▪ Optimize integration with daylighting
  o Appropriate, high quality design
    ▪ Appropriate light levels, noticeable improvement
  o Effective controls
    ▪ To reduce kWh by turning off lighting
      • Switching controls
    ▪ To reduce kW by turning down lighting
      • Dimming controls

• **Reduce light pollution and light trespass**
  o Light pollution is:
    ▪ Unnecessary, unwanted or wasted light
    ▪ Light that damages or degrades the nighttime luminous environment
    ▪ Light that negatively impacts humans, animals or plants
  o Sustainability issue because:
    ▪ Affects use of energy & enjoyment of natural nighttime sky
  o Light Trespass
    ▪ Obtrusive light that crosses a property line
    ▪ Difficult to quantify
      • When, where & how much light is unwanted
  o Can be avoided by:
    ▪ Aiming lights down
    ▪ Choosing fixtures with hoods or visors
    ▪ Installing motion sensors to turn off lights when not needed
    ▪ Use lowest wattage lamp to do the job
    ▪ Lighting should not be overly bright in relation to the surrounding area.
    ▪ B.U.G. rating of fixture, Back, Up, Glare.

• **Minimize embodied environmental effects**
  o Total energy required to produce a product, service or material including all life cycle phases from raw extraction to end of life
    ▪ Includes manufacturing, packaging, transportation, installation, recycling
  o Buy American (locally)
    ▪ Minimize transportation
  o Retrofit vs. Re-lighting (w/new fixtures)
    ▪ Retrofit uses less material (often w/ lamps & ballasts or LED retrofit kits only)
• **Specify environmentally preferable materials and equipment**
  o Lighting equipment manufacturers demonstrating their commitment to environmental responsibility with improvements to manufacturing
  o RoHS COMPLIANCE
    ▪ Reduction of Hazardous Substances Directive
    ▪ Aims to restrict certain dangerous substances commonly used in electronic equipment

• **Ensure system quality, flexibility, adaptability, maintainability and durability**
  o Quality
    ▪ Lighting that positively addresses human needs, architecture, economics, energy and the environment.
  o Flexibility
    ▪ To extend useful life of facility & better serve user’s changing needs
      • Ex: Flexible lighting controls, such as wireless
      • Ex: Flexible wiring systems
  o Adaptability
    ▪ Should anticipate change to allow system reconfiguration and reuse in future remodeling
      • LED’s improving Lumens Per Watt at 20% a year
      • Ex: Lighting controls – reprogram for new space uses
      • Ex: Lighting controls – wireless
  o Maintainability & Durability
    ▪ Lighting systems that perform the longest with the least maintenance effort have best economic and environmental value
      • SSL equipment & LED bulbs – lowest life-cycle cost
      • Long-life lamps have great value
      • Ex: Standardizing and minimizing the number of different lamp types reduces inventory and maintenance labor

• **Provide staff orientation and training**
  o Ensures operation and maintenance

• **Lighting Metrics**
  o Provides a means to make comparisons between various lighting sources
    ▪ Lumens-Total amount of light emitted by a source in all directions
    ▪ Lumens Per Watt-Measure of light source energy efficiency
    ▪ CRI- Color Rendering Index is the measurement of how colors look under a light source when compared with sunlight. The index is measured from 0-
100, with a perfect 100 indicating that colors under the light source appear
the same as they would under natural sunlight.

- **CCT** - Correlated Color Temperature, measured in degrees Kelvin, refers to
  the amount of orange vs blue hue to the white light. "Warm" Light has a
  more orange hue vs. "Cool" light, which has a more bluish tint to it.
- **Foot Candles** - Measurement of total quantity of light falling on a square foot
  of a surface. This measurement is useful because working conditions are often
  specified in foot candles.

**Warranties**
- Unfortunately there are still a number of unproven products and manufacturers out
  there that are causing challenges for both consumers and the industry.
- Half of new businesses last less than 5yrs

**Reference Resources**
- **Department Of Energy (DOE)**
  - **Caliper Reports**

- **DesignLights Consortium (DLC)**
The DesignLights Consortium® (DLC) is a non-profit organization dedicated to ac-
celerating the widespread adoption of high-performing commercial lighting solu-
tions. The DLC promotes high-quality, energy-efficient lighting products in collabo-
ration with utilities and energy efficiency program members, manufacturers, lighting
designers, and federal, state, and local entities. Through these partnerships, the DLC
establishes product quality specifications, facilitates thought leadership, and provides
information, education, tools and technical expertise.

- **Illuminating Engineering Society (IES)**

- **Occupational Safety and Health Administration (OSHA)**

- **International Dark Sky Association (IDA)**
  IDA is non-profit, tax-exempt, membership-based organization to help preserve &
  restore dark skies while maximizing the quality and efficiency of nighttime outdoor
  lighting
A Practical Guide for Choosing the Appropriate LED Lighting

There’s More To It Than Just Lumens Per Watt

General

- Deplete existing parts inventory
- Plan for future network connectivity
- Use motion activating controls with overrides
- Color Rendering (CRI) Index of 80 or greater
- Correlated Color Temperature (CCT) 3500-4000K, Exterior
- Correlated Color Temperature (CCT) 4000K and above, Interior
- Consider glare use diffuser and or indirect fixture
- Consider vertical and up-light levels of illumination
- Consider light trespass and pollution, Exterior
- Ask for photo metrics of fixtures

Recommendations

- LED replacement tubes and cob lamps (plug and play) are not recommended due to safety and efficiency concerns.
- New fixtures designed around the LED light source are recommended.
- LED fixture retrofits are an option if more feasible than new fixture.
- Buy a few or ask vendor to supply fixtures for a temporary trial
- Use a light meter and record foot-candle readings horizontal and vertical before and after changes

Difficult Access Areas

- Replace with LED fixture

Outside / Exterior Lighting

- High Mast Lighting
  - No new installations, Install LED street lighting
  - Replace with LED fixture
  - Consider light trespass and pollution
• Street Lighting/Building Exterior
  – LED replacement cob lamps not recommended due to safety and efficiency concerns
  – Low and High Pressure Sodium- replace with LED
  – Metal Halide- replace with LED
  – Incandescent/Halogen- replace with LED
  – Consider light trespass and pollution

**Fluorescent Lighting**

• LED replacement tubes not recommended due to safety and efficiency concerns
• Existing T-12, Fixtures 8’0
  – Retrofit with LED kit or replace with new LED fixture preferred
  – Consider vertical levels of illumination
  – Consider glare, use indirect or diffuser
• Existing T-12, Fixtures 4’0
  – Retrofit with LED kit or replace with new LED fixture preferred
  – Consider vertical levels of illumination
  – Consider glare, use indirect or diffuser

**Hazardous (Classified) Areas, PTF, Wet Well, Digester etc.**

• Replace with LED fixture rated for specific conditions, Class and Division
  – Correlated Color Temperature (CCT) 4000K and above
  – Color Rendering (CRI) Index of 90 or greater
  – Consider vertical and uplight levels of illumination
  – Consider glare, use diffuser
The following specifications shall be used for the purchase of new motors.

A. The motor shall meet or exceed the efficiency levels from NEMA MG1 Table 12-11 which comply with levels set by The Energy Policy Act and Conservation Act (EPCA), as amended by the Emergency and Security Act of 2007 (EISA). See NEMA MG1 Table 12-11.

B. The motor efficiency shall be determined using the test standards found in IEEE Standard 112-2004, Standard Test Procedure for Polyphase Induction Motors and Generators, or by other internationally accepted methods.

C. The motor shall be properly sized for the given load.

D. The motor shall be Totally-Enclosed, Fan-Cooled (TEFC), unless noted. Open Drip Proof (ODP) is acceptable in cases where TEFC is not available.

E. The motor shall have a minimum service factor of 1.15.

F. The motor shall have a minimum insulation class of F.

G. Motors used with variable frequency drives shall be examined for inverter duty motor applicability.

H. The following parameters shall be specified for the motor:

1. Motor horsepower
2. Voltage
3. Full load amps
4. Speed
5. Frequency
6. Phase
7. Shaft size
8. Environmental conditions (ambient operating temperature range, humidity level, etc.)
9. Starting torque (loaded or unloaded)
10. Classification of hazard (explosion proof, non-explosion proof, etc.)
11. Special equipment requirements (thermal protection, space heaters for outside, wet or high humidity area, standard or nonstandard conduit boxes, etc.)
12. Maximum number of starts per day/per hour
13. High temperature grease (for special cases, if required)
I. Where a Contractor is required to coat a motor, the motor shall be coated with an industrial enamel at a thickness of 5 mil D.F.T. The coating color shall be gray, U.S. Government Federal Register 595 Paint Color Number 16473.
## OPEN MOTORS

### NEMA MG1 Table 12-11
**Motor Efficiencies**

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### ENCLOSED MOTORS

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Notes:
1. Coordinate location of stilling well with FM prior to installation.
2. Center access for transducer removal over stilling well.

Stilling Well for Level Transducer
Pumping Station or Treatment Plant
Temporary Portable Pump Alarms and Setup Standards

When a project requires a temporary portable pump to be alarmed, the following guidelines need to be followed.

- **When work is performed at station:** If power is available, all alarms are to be routed through existing HRSD’s scada system. Portable pump manufacture call box is not acceptable unless otherwise approved for site specific situations. If power is not available then, HRSD solar Scada panel will be provided. A portable generator may be required depending on site specific situations.

- **When work is performed at a manhole:** If power is available, all alarms are to be routed through existing HRSD’s scada system. Portable pump manufacture call box is not acceptable unless otherwise approved for site specific situations. If power is not available then, HRSD solar Scada panel will be provided. A portable generator may be required depending on site specific situations. Naming of the alarms from a manhole should indicate the location of the manhole (i.e. Pearl and Ligon).

- The name of the site is to be used followed by temporary lead, lag or second lag, depending on the number of pumps. (Example: Arctic Temporary Lead, Arctic Temporary Lag and Arctic Second Lag.)

- Both contractor and HRSD will be alerted in the event of a pump alarm. The contractor is responsible to be primary responder with the support of HRSD staff.

- All pump maintenance and fuel requirement are the contractors responsibility.

- Pump maintenance records are to be provided monthly through the duration of the project by contractor, depending on length of project.

- Battery chargers are required with all pumps. In situations where power is not available a portable generator may be required.

- All discharge piping is to be pressure rated flanged or fused pipe. Isolations valves are required at each pump along with an additional external swing check valve. A means to bleed air off the discharge piping is required.

- Float balls, level transducers and pressure transducers are acceptable. In a Lift station or manhole application, level transducers are used. If float balls are used for control, a two float setup is required per pump. All floats are to be secured in manhole or wet well so as not to become tangled, hindering pump operation. In a temporary PRS setup, owner furnished sensor valve will be provided to allow contractor to connect pressure transducers for control. An isolation valve is required to be furnished by contractor at this location.

- If work is to be performed during cold weather, the contractor is responsible for providing freeze protection on pumps and controls, specifically transducers.

- Depending on location and duration of job, concrete protective barrier wall may be required.

- All manholes and wet wells where temporary pumps are being used must be secured to prevent trip hazards, fall risks and odor issues.

The following standard alarms are required. Site specific alarms will be evaluated on a as need basis.
## Two Pump Lift station Or Manhole (Diesel Pumps)

<table>
<thead>
<tr>
<th>Component</th>
<th>Lead</th>
<th>Lag</th>
<th>High well</th>
<th>Overflow</th>
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<td>On / off</td>
<td>Alarm / Normal (HRSD furnished float ball if station alarms cannot be used)</td>
<td>Alarm / Normal (Determined necessary according to length of Job. HRSD furnished float ball if station alarms cannot be used.)</td>
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## Three Pump Lift station Or Manhole (Diesel Pumps)

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<td>Alarm / Normal (HRSD furnished float ball if station alarms cannot be used)</td>
<td>Alarm / Normal (Determined necessary according to length of Job. HRSD furnished float ball if station alarms cannot be used.)</td>
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## Two Pump Lift Station or Manhole (Diesel Pumps) New Prime Guard Controller

<table>
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<tr>
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<th>High well</th>
<th>Overflow</th>
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</thead>
<tbody>
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<td>Fail / Normal</td>
<td>On / off</td>
<td>Alarm / Normal (HRSD furnished float ball if station alarms cannot be used)</td>
<td>Alarm / Normal (Determined necessary according to length of Job. HRSD furnished float ball if station alarms cannot be used.)</td>
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## Two Pump Lift Station or Manhole (One electric one diesel pump) New Prime Guard Controller

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<td>Alarm / Normal (Determined necessary according to length of Job. HRSD furnished float ball if station alarms cannot be used.)</td>
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</table>

(For HRSD monitoring purposes only, provide well level.)
Three Pump Lift Station or Manhole (One electric two diesel pump) New Prime Guard Controller

Dominion Power  On / OFF
Lead  Fail / Normal  (Electric)
Lag  On / off  and Fail / Normal
Second Lag  On / off  and Fail / Normal
High well  Alarm / Normal  (HRSD furnished float ball if station alarms cannot be used)
Overflow  Alarm / Normal  (Determined necessary according to length of Job. HRSD furnished float ball if station alarms cannot be used.)

(For HRSD monitoring purposes only, provide well level.)

Two Pump PRS (Diesel Pumps) New Prime Guard Controller

Lead  Fail / Normal
Lag  On / off  and Fail / Normal

(For HRSD monitoring purposes only, provide Suction and Discharge pressures.)

Three Pump PRS (Diesel Pumps) New Prime Guard Controller

Lead  Fail / Normal
Lag  On / off  and Fail / Normal
Second Lag  On / off  and Fail / Normal

(For HRSD monitoring purposes only, provide Suction and Discharge pressures.)

Two Pump PRS (One electric one diesel pump) New Prime Guard Controller

Dominion Power  On / OFF
Lead  Fail / Normal  (Electric)
Lag  On / off  and Fail / Normal

(For HRSD monitoring purposes only, provide Suction and Discharge pressures.)
Three Pump PRS (One electric two diesel pump) New Prime Guard Controller

Dominion Power   On / OFF
Lead                Fail / Normal (Electric)
Lag                  On / off and Fail / Normal
Second Lag          On / off and Fail / Normal
(For HRSD monitoring purposes only, provide Suction and Discharge pressures.)

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<tr>
<td>Alarm (OPEN) on 2nd LAG PUMP FAIL</td>
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A normally CLOSED contact state is required during normal operation.

Any OPEN contact will generate an Alarm Condition.
RECOMMENDED ADDITIONS/CHANGES TO SPECIFICATIONS FOR FUTURE SWIFT DESIGN

PREPARED BY HRSD EEM STAFF

SECTION 1  ELECTRICAL
1.1 ELECTRICAL CONDUIT / ROUGH IN / METHODS
1.2 LIGHTING
1.3 DESIGN / LAYOUT

SECTION 2  INSTRUMENTATION ELECTRICAL
2.1 MOLEX CONNECTORS
2.2 WIRING TERMINATIONS
2.3 VFD CABINET CONSTRUCTION
2.4 INSTRUMENT GENERAL

SECTION 3  INSTRUMENTATION PIPING METHODS
3.1 SAMPLE PIPING
3.2 DRAIN PIPING
3.3 GENERAL

SECTION 4  DCS
4.1 INTERPOSING RELAY CABINET
4.2 OPCON
4.3 CONTROL NETWORK

Exhibit I
ELECTRICAL

1.1 ELECTRICAL CONDUIT/ROUGH IN METHODS

A. ALL EXTERIOR POWER AND CONTROL CONDUCTORS MUST BE FULLY ENCASED IN CONDUIT. CABLE TRAY MAY NOT BE USED ON AREAS DEFINED AS “WET LOCATION” BY THE NEC. CONDUIT STUB UPS SHALL EXTEND COMPLETELY UP TO ALL ENCLOSURES, DISCONNECTS OR WIREWAYS. NO EXTERIOR CABLE WILL BE ALLOWED TO BE RAN “FREE AIR”. EXPANSION JOINTS TO BE USED WHERE REQUIRED.

B. ALL OUTLET BOX ROUGH-INS OF GWB CONSTRUCTION SHALL USE A BRACKET TO MOUNT TO AT LEAST TWO WALL STUDS. SCREW EAR BOXES ARE NOT ACCEPTABLE. USE OF THESE BRACKETS WILL ALSO INSURE THAT BOXES MOUNTED NEXT TO EACH OTHER WILL BE LEVEL.

C. ALL CONDUIT/RACEWAYS SHALL BE RAN CONCEALED IN AREAS OF GWB CONSTRUCTION.

D. ALLOW ½” TRADE SIZE EMT TO BE RAN ON RECEPTACLE AND LIGHTING CIRCUITS CONCEALED IN GWB CONSTRUCTION, OR ABOVE CEILING TILES.

1.2 LIGHTING

A. CONTROL ROOM LIGHTING SHALL BE OF A LOW GLARE DESIGN IN RELATION TO THE VIDEO DISPLAYS, WITH DIMMABLE SWITCHING AND OCCUPANCY SENSOR OVERRIDE.
B. ELECTRICAL AND MECHANICAL SPACES SHALL HAVE A MINIMUM LIGHTING LEVEL OF 30 VERTICAL AND HORIZONTAL FOOT CANDLES PER IES STANDARDS. 75% OF EACH ELECTRICAL AND MECHANICAL ROOM SPACE LIGHTING FIXTURES SHALL BE ON DUAL TECHNOLOGY OCCUPANCY SENSORS WITH ADEQUATE COVERAGE OF ENTIRE SPACE. THE 25% REMAINDER OF LIGHTING SHALL BE CONNECTED TO TRADITIONAL MANUAL SWITCHING.

C. NO STAIRWAY LIGHTING SHALL BE MOUNTED IN A LOCATION THAT IS NOT ACCESSIBLE VIA A STANDARD 8’ A-FRAME LADDER SET ON STAIR LANDINGS.

D. NO LIGHTING ABOVE FANS DUE TO STROBING EFFECT.
1.3 DESIGN / LAYOUT

A. LAB COUNTER TOP RECEPTACLES SHALL BE ONE DUPLEX EVERY FIVE FEET OF COUNTER WITH A MINIMUM OF TWO DUPLEX RECEPTACLES FOR ANY SIZE COUNTER SPACE.
B. CONTROL ROOM DESIGN SHALL INCLUDE RACEWAYS FOR VIDEO AND DATA CABLELING, AND A DUPLEX RECPTACLE BEHIND EACH WALL MOUNTED VIDEO MONITOR OR COMPUTER DISPLAY.


2.1 MOLEX CONNECTORS

A. FIELD POWERED TRANSMITTERS SHALL USE MOLEX CONNECTOR CAT. #WH1R3006A20M00568 MOUNTED ON THE BOTTOM OF THE TRANSMITTER. THE MATING PLUG/CABLE IS CAT. #WH10300045M0208 (2 METER CABLE LENGTH) FOR 120 VOLT POWER CONNECTIONS. THIS CONNECTOR WILL SERVE AS A MEANS OF DISCONNECT FOR INDIVIDUAL UNITS.

B. TRANSMITTERS AND SENSORS WILL USE A MOLEX CONNECTOR CAT. # WH8R4006A18M0058 MOUNTED ON THE BOTTOM OF TRANSMITTER/SENSOR WHEN POSSIBLE. THE MATING PLUG/CABLE IS CAT. # WH80400D01M0208 THIS IS A TWO PAIR CONFIGURATION THAT WILL ALLOW FOR TWO ANALOG 4-20MA CURRENT LOOPS OR TWO DIGITAL SIGNALS. IF THE EQUIPMENT REQUIRES MORE THAN TWO PAIR SHIELDED CONDUCTORS HARD WIRING IS ACCEPTABLE.
2.2 WIRING TERMINATIONS

A. ALL CONTROL WIRING TERMINATIONS WILL USE A CRIMP ON TYPE CONNECTOR OF EITHER A FORK TYPE OR A PIN TYPE APPROPRIATE FOR TERMINAL BLOCK STYLE.
B. UPON OWNER REVIEW AND APPROVAL THE MINIMUM CONTROL WIRE SIZE MAY BE REDUCED TO ACCOMODATE EQUIPMENT WITH SMALL/CONGESTED TERMINATION SPACES. EXAMPLE: METERING PUMPS WITH 12-16 CONTROL CONDUCTORS.

2.3 VFD CABINET CONSTRUCTION

A. THE MOUNTING LOCATION OF COOLING FAN THERMOSTAT INSIDE THE CABINET SHALL BE PARALLEL OR HIGHER THAN THE TOP OF THE ACTUAL VFD UNIT WHERE THE HEAT ORIGINATES.
B. COOLING FAN POWER SHALL BE RAN THROUGH THE RUN RELAY SO THAT THE FAN DOES NOT RUN IF VFD IS NOT IN RUN MODE.
C. COOLING FAN EXHAUST OUTLETS INSIDE CONDITIONED SPACES SHALL NOT HAVE FILTERS, AND SHALL EXHAUST OUT THE SIDE OR TOP OF THE CABINET CONSISTANT WITH U.L. STANDARDS.

D. INCLUDE A BULKHEAD MOUNT WITH DUST COVER USB CONNECTOR ON THE CONTROL SURFACE OF THE VFD CABINET WHICH IS CONNECTED TO THE DATA PORT ON THE VFD UNIT. THIS IS TO ALLOW A LAPTOP CONNECTION TO THE VFD TO MODIFY PARAMETERS, ETC. WITHOUT NEEDING TO OPEN THE CABINET.
2.4 INSTRUMENT GENERAL

A. WHERE POSSIBLE MOUNT ALL TRANSMITTERS AT APPROX 5’ AFF OR WALKWAY FOR EASE OF ACCESS AND VISUAL INSPECTION.

B. PROVIDE LOCAL AUDIBLE AND VISUAL ALARMS IN CHEMICAL ROOMS FOR CHLORINE AND SULPHER DIOXIDE GAS DETECTORS. CURRENTLY INSTALLED GAS DETECTORS ONLY HAVE A BLINKING DISPLAY WHEN ALARM CONDITION EXISTS.

C. PROVIDE A UPS TO POWER SHIMADZU TOC ANALYZER SIZED TO CARRY IT THROUGH GENERATOR STARTUP/SWITCHING.

INSTRUMENTATION PIPING METHODS

3.1 SAMPLE PIPING

A. FIRST SAMPLE INSTRUMENT IN A LINE UP SHALL NOT BE AFFECTED BY AIR BUBBLES. FOR EXAMPLE A pH PROBE FIRST IN LINE WILL ALLOW AIR TO ESCAPE BEFORE REACHING TURBIDITY METERS.

B. ALTERNATIVE METHODS SHOULD BE INVESTIGATED TO CONTROL FLOW TO INSTRUMENT LINE UPS ON INFLUENT AND FLOC/SED INSTRUMENTATION. ROTAMETERS AND REGULATORS ARE CLOGGING CAUSING LOW OR NO FLOW CONDITIONS.

C. PROVIDE A MEANS TO FLUSH BIOFILTER HEADLOSS TRANSCLUDER SAMPLE LINES.

D. INCORPORATE A FULL DIAMETER FLUSH VALVE AT LOW POINT OF INSTRUMENT LINEUP SAMPLE LINES.

3.2 DRAIN PIPING

A. FLOOR DRAINS AT EACH INTERIOR INSTRUMENT LINEUP.
B. INSTRUMENT DRAIN LINES ON FRONT OF INSTRUMENT LINEUP WITH AIR GAP TO ALLOW VISUAL FLOW CONFIRMATION.

3.3 GENERAL

C. METERING PUMPS ON TURBIDITY INSTRUMENTS.

D. SELF CLEANING DEVICES ON INFLOW AND FLOC/SED TURBIDITY INSTRUMENTS.

E. HEAT TRACING AND INSULATION ON ALL EXTERIOR SAMPLE AND DRAIN LINES INCLUDING PRESSURE TRANSMITTERS AND SWITCHES.

DCS

4.1 INTERPOSING RELAY CABINET

A. PROVIDE A POWER MONITORING OUTPUT POINT TO DCS THAT WILL INDICATE POWER LOSS TO ANY INTERPOSING Relay CABINET CONTROL CIRCUITS.

4.2 OPCON

A. AT LEAST ONE ADDITIONAL OPERATORS CONSOLE FOR DCS THAT IS NOT LOCATED IN THE MAIN CONTROL ROOM.

4.3 NETWORK

A. SPEC FIBER OPTIC CAPABLE CISCO NETWORK SWITCHES IN ALL VENDOR PROVIDED EQUIPMENT THAT WILL CONNECTED THIRD PARTY TO THE DCS.

B. ENCOURAGE THE USE OF FIBER OPTIC CABLE IN LEIU OF TYPE TC CAT-6 CABLE.

C. IF CAT-6 TYPE TC IS USED IT MUST BE TERMINATED TO A PATCH PANEL AND NOT DIRECTLY CONNECTED TO NETWORK EQUIPMENT. THIS IS TO PREVENT DAMAGE TO NETWORK JACKS FROM THE RELATIVELY LARGE HEAVY CABLE.

D. INVESTIGATE THE USE OF VENDOR NETWORKS TO ALLOW THIRD PARTY COMMUNICATION TO THE DCS. SUCH AS HACH INSTRUMENTS, YASKAWA VFD AND CHEMICAL METERING PUMPS. THIS WOULD ALLOW MORE DETAILED INFORMATION TO BE AVAILABLE TO THE DCS. IT WOULD ALSO ALLOW ALL CONTROL WIRING TO REMOTE AREAS SUCH AS RECHARGE WELL HOUSES TO BE FIBER OPTIC. THIS
NEEDS TO BE FURTHER DISCUSSED WITHIN HRSD TO DETERMINE IF WE WILL GET ALL NEEDED ALARMS
WE DESIRE FROM THE VFD CABINET. IE: POWER LOSS INDICATION

E. PROVIDE A HRSD CORPORATE NETWORK HARDWIRE CONNECTION OR WI-FI AT REMOTE
LOCATIONS SUCH AS PUMP HOUSES TO ALLOW TROUBLESHOOTING VIA EDS, ETC.

(Click here to return to Index)
Section 33 – Information Technology Infrastructure Hardware

A. Introduction – This section serves to provide information and standards pertaining to the hardware installation and/or upgrade of HRSD’s Information Technology assets to include new construction and renovation efforts, and to ensure consistency with HRSD’s internal policy related to IT infrastructure hardware.

B. General – The objectives are to standardize HRSD’s server and network infrastructure designs in an effort to:

1. Maximize functionality and performance.
2. Minimize time-to-resolution during troubleshooting efforts.
3. Facilitate the installation or upgrade process by clearly defining expectations so that re-work is minimized.

C. Specific Requirements

1. Fiber infrastructure shall be OM4, 50μm multimode unless otherwise specified.

2. All fiber terminations shall be of the LC type unless otherwise specified and approved by HRSD. All ends shall be terminated and landed in an industry standard closet connector housing such as Corning LANscape CCH-01U, or HRSD approved equivalent. Such housing must be capable of being fully extended to make any needed repairs. No fiber ends shall be left un-terminated. Protective dust caps shall remain in place on all unused connectors.

3. Copper infrastructure shall consist of CAT 6 cabling with matching patch panels, such as Leviton CAT6 eXtreme, or HRSD approved equivalent.

4. In the case of control network devices, copper patch cables shall be green and yellow to denote the primary and secondary network connections, if employed. Business network patch cables shall be blue, management network patch cables shall be white. Patch cables shall be of the snagless type and manufactured by Tripp-Lite or other HRSD approved equivalent.

5. With either connectivity type (fiber or copper), wire management devices shall be utilized in such a manner as to afford the cleanest and most organized appearance.

6. All network cables including fiber and copper shall be labeled to identify source switch port, switch name, destination port, and destination name. Due to the dependency of labeling nomenclature with respect to data centers, treatment plants,
pump stations, and other field cabling, IT should be consulted once all network
drops are patched down and the patch panel is ready to accept network equipment.

7. Servers, switches, and routers shall employ dual power supplies, where available,
and connected to separate dedicated UPS’ fed by separate circuits.

8. If dual power supplies are not available, automatic transfer switches (ATS) fed by
separate dedicated circuits shall be utilized.

9. Servers shall be manufactured by Hewlett-Packard (HP) unless an issue is
identified that can only be resolved by selecting another HRSD approved
vendor.

10. Switches, routers, and other active components making up the network
infrastructure shall be manufactured by Cisco, and be capable of remote
management. Under no circumstances shall a non-Cisco device or otherwise
unmanageable network device be employed for any purpose.

11. All server and network hardware shall be rack mounted and securely fastened using
the hardware recommended by the manufacturer, including the quantity (all mounting
provisions within reason shall be utilized). All systems shall have a 1U space between
them.

12. Servers shall employ wire managers or other equivalent hardware to allow for their
full extension away from the rack on their rails so that maintenance can be
performed when needed without disconnecting power, network, etc.

13. All server and network hardware shall be labeled to clearly identify its purpose.
Due to the dependency of labeling nomenclature with respect to data centers,
treatment plants, pump stations, and other field cabling, IT should be consulted
once all network drops are patched down and the patch panel is ready to accept
network equipment.

14. All active components (servers, switches, routers, etc.) shall be left de-energized until
the space they occupy is reasonably clean and free of construction activity.

15. The use of media converters and other extraneous hardware shall be kept to the absolute
minimum required to complete the design. In cases where media converters must be
used, they shall be mounted in a dedicated powered rack supplied by the manufacturer. If
this arrangement is not practical, they shall be securely and neatly fastened to a rigid shelf
mounted in the equipment cabinet. Wiring for the media converter shall be routed and
secured to afford the cleanest and most organized appearance. Like other network
devices, the media converters shall be labeled to indicate their intended purpose.

End of Section
Section 34 - Miscellaneous

A. Introduction – This section provides design criteria, specific requests/recommendations and preferences related to specifying and constructing systems and materials used in HRSD facilities for items not discussed in the other sections. HRSD plant sites are harsh and aggressive industrial environments and the information provided is based on experience within these environments. HRSD expects the FIRM to evaluate all conditions and criteria related to environmental conditions of each project and to recommend and design suitable systems and materials for the specific project conditions. This section includes site work, concrete, masonry, metals and plastics, thermal and moisture protection, doors, windows and glass, finishes sections of the technical specifications, and architectural standards.

B. Site

1. Site Drainage
   a. Refer to HRSD’s Master Specification “01560 – Environmental Protection and Special Controls” within this manual.
   b. Design site grading and surface paving to enhance natural stormwater sheet flow/runoff. Minimize underground storm piping systems to minimize maintenance.
   c. Require removal of all rocks, debris, etc. from finished grade soil.
   d. Ensure that drawings and or specifications define the finish grade material.
   e. Construction methods to comply with State and locality stormwater requirements.

2. Landscaping
   a. Specify grass seed appropriate for the specific times/seasons of year anticipated for planting.
   b. Specify grass seed mixtures that will initially develop and grow without supplemental watering.
   c. Provide a general stand of grass unless otherwise directed for specific locations. Do not specify elaborate grass planting plans with exotic fertilizers, mulches and other requirements.
   e. Require/specify stabilization matting in all drainage swales/ditches.
3. Plant Material - Specify minimum plant material required by local municipalities, unless directed by HRSD.

4. Concrete Curb and Gutter
   a. Specify only where required by municipalities or for other specific design/containment reasons.
   b. Specify curb and /or gutter as drive over similar to VDOT CG-3 or 7, when required.

5. Sidewalks
   a. Provide minimum width of three (3) feet.
   b. Specify specific compaction under sidewalks to allow plant maintenance equipment to cross without cracking.

C. Concrete
   1. Provide chamfered edges on all vertical and horizontal exposed edges. Prefer three-quarters to one (3/4 – 1) inch chamfered edges.
   2. Specify and detail water stop material to insure its proper installation and effectiveness.
   3. Specify and detail expansion and construction joints to ensure proper installation and effectiveness against water leaking.
   4. Design all plant and pump station concrete using ACI 350R.
   5. The FIRM shall conduct a pre-construction meeting specifically related to concrete. This meeting will be held separately and in addition to the traditional Project Pre-Construction Meeting.
      a. The following individuals should attend this meeting:
         i. FIRM’s structural design engineer
         ii. Inspectors
         iii. General and appropriate sub-contractors
         iv. Supplier's field quality control representative
         v. Concrete testing company representative
         vi. HRSD Project Manager
      b. Minimum issues to be discussed at the meeting include:
         i. Concrete placement schedule and sequencing
ii. Review of appropriate codes
iii. Cold/warm weather issues
iv. Workmanship and aesthetic issues
v. Approval and rejection of work
vi. Test panel as standard for approval of future work

D. Masonry

1. Specify and detail rubberized asphalt flashing over all required openings in non-corrosive environments.

2. Specify and detail stainless steel flashing over all required openings in corrosive environments.

3. Specify and detail flashing material and installation to ensure correct installation and effectiveness.

4. Provide galvanized steel lintels over all exterior openings in non-corrosive environments

5. Provide 316 stainless steel lintels over all exterior and interior openings in corrosive environments.

6. Do not use precast concrete or stone copings.

E. Metals and Plastics

1. Hand/Guard Rails, Stair Systems: Specify and design all materials and systems to meet the criteria and conditions of the specific application and environment considering the following.
   a. Provide aluminum or fiberglass materials for all corrosive interior and exterior environments.
   b. Provide galvanized steel, aluminum or fiberglass materials for all interior and exterior non-corrosive environments.

2. Hatches (including all pre-manufactured hinged systems solid cover plates and assemblies). Design and specify all materials and systems to meet the criteria and conditions of the specific application and environment.
   a. Specify anodized aluminum, fiberglass or stainless steel materials for all corrosive interior and exterior environments.
   b. Specify galvanized steel, anodized aluminum or fiberglass materials for all interior and exterior non-corrosive environments.
c. Design to be flush with surrounding surface (unless conditions require otherwise and design is approved by HRSD).

d. Provide hatches with opening and hold open hardware integral with the hatch assembly.

e. Provide 316 stainless steel hardware.

f. Provide a minimum two (2) inches of bearing surface along all sides of the hatch cover.

g. Specify and or design hatch covers to not exceed a maximum deflection of 1/150th of the span when loaded.

h. Provide post and chain or OSHA approved fall protection systems around all hatch openings.

i. Indicate design loading on the drawings.

3. Grating

   a. Provide anodized aluminum, fiberglass or stainless steel materials for all corrosive interior and exterior environments.

   b. Provide galvanized steel, anodized aluminum or fiberglass materials for all interior and exterior non-corrosive environments.

   c. Provide hardware compatible with the grating system material and environment.

   d. Design to be flush with surrounding surfaces (unless conditions require otherwise and design is approved by HRSD).

   e. Provide continuous perimeter banding. All openings within the grating shall have continuous banding.

   f. Design grating to not exceed a maximum deflection of 1/150th of the span when loaded.

   g. Indicate the design loading on the drawings.

F. Thermal and Moisture Protection

1. Roofing

   a. Provide a minimum of 1/4 inch of slope per foot.
b. Provide sumps around all roof drains.

c. Direct all roof surface water toward drains by built-up roof sections, crickets, etc.

d. Extend roof membrane up the backside of parapets.

e. Locate HVAC and other equipment off the roofs if feasible. If equipment is to be located on the roof, placement of equipment shall be more than ten (10) feet from any leading roof edge.

f. Provide minimum 36 inch wide walkway protection pads from the roof access point to all roof top equipment.

g. Provide minimum 36 inch walkway protection pads around all four sides of all roof mounted equipment.

h. Provide roof access by roof hatch with ladder or by an exterior wall mounted ladder for all plant buildings.


j. Specify 40-year composite type Architectural shingle for pump station A-frame roofs or as indicated in Section 2 – “Architectural and Landscaping Design and Review Process” and as selected by HRSD Architectural Review Committee.

k. Install fall protection per OSHA Guidelines

2. Specify pre-finished aluminum coping or gravel stop system.

G. Doors and Hardware

1. General

   a. Provide entry doors with threshold elevation high enough to avoid concerns with potential flooding at 100-year flood elevation as referenced in Section 10 – “Flood Elevation Requirements” in this standards manual.

   b. Provide non-removable hinge pins on outward swinging exterior doors.

   c. Provide heavy duty industrial grade hardware.

   d. Install kickplates on all exterior doors and all doors with closers.
e. Provide heavy duty industrial grade hardware on all overhead doors.

f. Provide overhead doors designed for 110 MPH wind load.

2. Pump Stations

a. Provide fiberglass doors and frames with stainless steel hardware in corrosive areas (i.e. wet wells).

b. Provide pre-finished aluminum doors in all other locations.

c. Provide double leaf (each three (3) feet wide) entry doors.

d. Provide continuous hinge on entry doors.

e. Specify that locksets shall be supplied by HRSD and installed by the Contractor.

3. Treatment Plants

a. Provide anodized aluminum exterior doors and frames in maintenance and process areas.

b. Provide aluminum doors with continuous hinges in maintenance and process areas.

c. Provide a vision glass in all exterior doors.

d. Provide hardware that is compatible with the door and frame material and the environment.

e. Provide locksets only on administration and storage spaces.

H. Painting and Coatings

1. Painting and Coatings Systems

a. Evaluate the various environments and recommend painting and coatings systems considering lifecycle costs and accessibility for re-coating. The FIRM shall carefully review the information in HRSD Master Specification 09900 Protective Coatings in Section 40 of this standards manual and discuss how and or why they anticipate complying with or deviating from the recommendation of the manual.

b. Provide a painting and coating schedule for the project.
2. Piping and Equipment Identification – Utilize the HRSD Piping Identification and Color Code. The identification specification for all piping and equipment shall include the color and labeling as detailed below.

a. Piping Identification Color Shades – Utilize identifying color shades listed below:

<table>
<thead>
<tr>
<th>Color Shade</th>
<th>U.S. Government Register 595 Paint Color Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>17178</td>
</tr>
<tr>
<td>Black</td>
<td>17038</td>
</tr>
<tr>
<td>Blue</td>
<td>15050</td>
</tr>
<tr>
<td>Brown</td>
<td>10091</td>
</tr>
<tr>
<td>Gray</td>
<td>16473</td>
</tr>
<tr>
<td>Green, Dark</td>
<td>14062</td>
</tr>
<tr>
<td>Green, Light</td>
<td>14533</td>
</tr>
<tr>
<td>Orange</td>
<td>12246</td>
</tr>
<tr>
<td>Red</td>
<td>11105</td>
</tr>
<tr>
<td>White</td>
<td>17875</td>
</tr>
<tr>
<td>Yellow</td>
<td>13655</td>
</tr>
<tr>
<td>Purple</td>
<td>17100</td>
</tr>
</tbody>
</table>


c. Piping and Equipment Identification

   i. Provide stenciled markings that include pipe unit process abbreviation and directional flow arrows.
   ii. Place stenciled markings on each side of wall penetrations, at the suction and discharge sides of pumps and both sides of valves, at intersections, and at regular intervals along pipe runs (not to exceed 20 feet). Provide color coding and stenciled markings on piping or tank insulation jackets as required.
   iii. Provide black or white stenciled markings to contrast with the pipe background color.
   iv. Use capital letters sized as follows:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Letter size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1-1/2 inch</td>
<td>1/2 inch</td>
</tr>
<tr>
<td>2 to 6 inches</td>
<td>1-1/2 inch</td>
</tr>
<tr>
<td>8 inches and up</td>
<td>2-1/2 inch</td>
</tr>
</tbody>
</table>
v. Locate stenciled identification markings to facilitate easy viewing from the floor. Specify that the Contractor, the FIRM, and HRSD must agree on locations of markings.

3. Limits of Coatings in Covered Tanks
   a. When covered tanks require coatings for corrosion protection, the coatings shall cover all surfaces in the vapor space and extending to one (1) foot below the minimum water surface and a minimum of four (4) inches beyond the edge of the cover.
   b. Pay special attention to the coatings termination details to prevent deterioration and undercutting.

4. Pump Stations
   a. Minimize surfaces to be painted.
   b. Do not paint concrete floors
   c. Do not paint interior CMU walls. Specify that the certain materials unfinished face shall be the final finish and workmanship is critical.

I. Architectural/Structural
   1. Shall be designed and constructed to Building Code requirements per locality where facilities are being built.
   2. Ride-out space at Treatment Plants and administrative buildings to be designed to withstand a Category I hurricane / wind event and to be functional at that corresponding flood level.
   3. Indicate the use classifications for all building spaces.
   4. Indicate design floor loads.
   5. Pumping stations and other buildings and sites constructed in public areas shall be designed and configured to be in harmony with the surrounding setting. Architectural and landscaping designs and renderings will be submitted to and approved by HRSD’s Architectural Review Committee at the PER stage.

End of Section
Section 35 – Standards for Capital Improvement Projects that Involve Construction Dewatering Activities

A. Introduction – This Section was developed to assist FIRMs with developing approaches for evaluating, permitting and monitoring suspected groundwater discharges from contaminated soils. Well point dewatering systems are often used to lower the groundwater for deep and long trench construction. The likelihood of encountering contaminated hot spots is increasing as programs to replacement and rehabilitation of HRSD aging infrastructure continue to grow in heavy urban corridors.

The Master Specification 02710 – Contaminated Groundwater Management was developed in conjunction with this Section and is to be used in the Bid Documents for contractors if groundwater contamination is anticipated.

B. Background - This Discharge Standard is designed to ensure that the discharge of groundwater from dewatering activities containing contaminants is undertaken in accordance with all applicable regulatory requirements to protect the waters of the state. The standard is also designed to ensure the requirements of the Municipal Separate Storm Sewer (MS4) are complied with where the discharge occurs.

The standard applies to construction dewatering activities managed by HRSD, and the selected FIRM and contractors. This standard shall be implemented by HRSD, the selected FIRM, and its contractor to ensure that proper characterization and treatment of groundwater occurs during construction prior to discharge. HRSD will typically let the contractor determine whether the discharge should be routed to a storm sewer, sanitary sewer or directly to a receiving water based on the availability of alternatives, ability to meet discharge criteria, and cost.

When groundwater dewatering is anticipated in an area that has a potential to have contaminated groundwater present due to the adjacent land use (ex. gasoline station, dry cleaner, industrial facility), the A/E firm shall conduct groundwater testing within the proposed limits of construction to determine the likelihood of encountering contaminated groundwater during construction. This information will normally be provided to the contractor during the bidding process.

If contaminated groundwater is likely to be encountered during construction, or known to exist within the footprint of the project, then the appropriate discharge permits shall be obtained by the contractor prior to commencement of dewatering activities. HRSD will require that the contractor be the permittee. As such, the contractor will be required to undertake all actions necessary to ensure that groundwater from dewatering is discharged in accordance with all applicable permit requirements. This will include securing the necessary permits, securing and operating all treatment equipment required to meet effluent requirements, monitoring the discharge for quality, and filing the necessary reports.
During dewatering the contractor is responsible for conducting all effluent testing required by the permit and meet the reporting requirements by filing within the required timeframe specified in the permit. HRSD shall be provided with copies of all reporting, to include Discharge Monitoring Reports (DMRs), if applicable.

If contaminated groundwater is encountered during construction dewatering activities and no discharge permits have been acquired and/or a groundwater treatment system is not operational, then dewatering activities shall cease immediately until appropriate action is taken.

Construction dewatering activities shall only be conducted in accordance with the applicable permit(s) to comply with the regulation under Sections 301(a) and 402 of the Clean Water Act (CWA), as well as the requirements of the MS4 Permit in the locality where the discharge will take place.

C. Requirements

Appropriate discharge permits must be secured by the selected contractor prior to discharging contaminated groundwater from dewatering sites. The permits available for the discharge of contaminated groundwater are as follows:

- VDEQ VPDES General Permit for discharges of contaminated groundwater into the storm sewer system or state waters (VAG83).
- VDEQ VPDES Individual Permit for discharges of contaminated groundwater into the storm sewer system or state waters.
- HRSD Industrial Wastewater Permit Letter of Authorization for discharges into the sanitary sewer system for treatment by HRSD.

VDEQ and HRSD will accept discharges of contaminated groundwater only after an assessment of groundwater quality has been performed, and only in accordance with permit conditions. A schedule of the approximate timelines from assessment to general permit acquisition and treatment is provided as Attachment A.

Chemical analyses shall be performed in accordance to EPA/VDEQ approved analytical methods by a laboratory accredited through the Virginia Environmental Laboratory Accreditation Program (1VAC30-45 or 1VAC30-46). Contaminant Identification Table for assistance in identifying parameters of concern is provided as Attachment B.

D. Receiving Sewer System

1. Storm Sewer System

Groundwater discharges into the storm sewer system or directly into a surface water body must be in accordance with VDEQ and any local MS4 requirements. VDEQ has issued a VPDES General Permit (VAG83) which governs the discharge of wastewaters from sites contaminated by petroleum products, chlorinated hydrocarbon solvents, the hydrostatic
testing of petroleum and natural gas storage tanks and pipelines, and the hydrostatic testing of water storage tanks and pipelines. Contaminated groundwater can only be discharged to state waters pursuant to this VPDES General Permit or an individual VPDES permit. The contractor must file a Registration Statement for coverage under VAG83 or file for an application for a VPDES Individual Permit.

Short-term discharges (14 days or less in duration) have immediate coverage under the VAG83 permit and are not required to submit a registration statement to the VDEQ to apply for permit coverage. However, written notification is required to be submitted to the VDEQ within 14 days of the completion of the discharge. This coverage may be used for emergency and planned short duration discharges. However, the contractor is still responsible for ensuring the discharge meets the criteria contained in the General Permit.

2. Sanitary Sewer System

When construction dewatering activities are discharged into the sanitary sewer, the discharge activities must be done in accordance with the HRSD Letter of Authorization. If the accepting sewage pump station is owned by a locality, the locality shall be contacted to confirm the volume of groundwater that can be discharged into its system.

For projects with high volume discharges or high concentrations of contaminants, the contractor may secure both the HRSD Letter of Authorization as well as the VDEQ General Permit to have the maximum flexibility during the discharge period. VDEQ constituent threshold levels in water discharged directly to state waters are more stringent than those that can be accepted by HRSD; however, the discharge of groundwater is not limited by volume. The HRSD Letter of Authorization contains a maximum allowable volume of groundwater discharge based on the capacity of the downstream sewage pump station.

Effluent from dewatering activities must be filtered to remove pollutants including sediment through an approved sediment trapping device, or both, prior to release to state waters, the storm sewer system, or sanitary sewer system as required by the Virginia erosion and sediment control regulations (9 VAC 25-850-10 et seq.), the Virginia stormwater management regulations (9 VAC 25-870-10 et seq.) and the Virginia Stormwater Management Program Construction General Permit regulations (9 VAC 25-880-10 et seq.) as applicable.

If treatment is necessary, the groundwater treatment system shall be designed to remove sediments from the discharge and have the capacity to fully treat groundwater to the applicable discharge standard at the maximum expected concentrations of the constituent(s) of concern and at maximum discharge rate of the pump(s) being used for the anticipated duration of dewatering. EPA recommended treatment for constituents of concern is contained in Attachment B.
E. Contacts

Permit Contacts:
HRSD: Pretreatment & Pollution Prevention Division
North Shore................................................................. (757) 833-1750
South Shore........................................................... (757) 460-7048

VDEQ: Tidewater Region
Remediation Specialist........................................... (757) 518-2117
Main Number.............................................................. (757) 518-2000
http://www.deq.state.va.us/Locations/TidewaterRegionalOffice.aspx

VDEQ: Piedmont Region
Remediation Specialist........................................... (804) 527-5057
Main Number.............................................................. (804) 527-5020
http://www.deq.virginia.gov/Locations/PiedmontRegionalOffice.aspx
## Schedule of Events For CIP Dewatering Activities

### Stage Progression

<table>
<thead>
<tr>
<th>Stage</th>
<th>Month 1</th>
<th>Month 2</th>
<th>Month 3</th>
<th>Project out to Bid</th>
<th>Month A</th>
<th>Month B</th>
<th>or until end of dewatering activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform CHMRS and/or Phase I ESA</td>
<td>Week 1 Week 2 Week 3 Week 4</td>
<td>Week 1 Week 2 Week 3 Week 4</td>
<td>Week 1 Week 2 Week 3 Week 4</td>
<td>Week 1 Week 2 Week 3 Week 4</td>
<td>Week 1 Week 2 Week 3 Week 4</td>
<td>Week 1 Week 2 Week 3 Week 4</td>
<td>Week 1 Week 2 Week 3 Week 4</td>
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<tr>
<td>Phase II ESA (sampling &amp; analyses)</td>
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<tr>
<td>Treatment System Design</td>
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<tr>
<td>Apply For &amp; Acquire VPDES Permit</td>
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<td>Construction/Dewatering Activities Commence</td>
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<tr>
<td>Apply For &amp; Acquire HRSD Permit</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Construction/Dewatering Activities Commence</td>
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<tr>
<td>Order Groundwater Treatment System</td>
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<tr>
<td>System Delivery &amp; Onsite Set-up (if req.)</td>
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<td>Inspection by HRSD personnel</td>
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<td>Activate Permit (HRSD/VDEQ)</td>
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<td>Monthly VPDES Sampling and Reporting</td>
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<td>Weekly HRSD Sampling &amp; Reporting</td>
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<td>Deactivate Permit(s) (HRSD/VDEQ)</td>
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</tbody>
</table>

### Notes

- **Week 1:** Initial Investigation
- **Week 2:** Detailed Site Survey
- **Week 3:** Data Analysis & Report
- **Week 4:** Final Report Submission

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**Stage Progression Details:**
- **Perform CHMRS and/or Phase I ESA:** Week 1 to Week 4
- **Phase II ESA (sampling & analyses):** Week 1 to Week 4
- **Treatment System Design:** Week 1 to Week 4
- **Apply For & Acquire VPDES Permit:** Week 1 to Week 4
- **Apply For & Acquire HRSD Permit:** Week 1 to Week 4
- **Order Groundwater Treatment System:** Week 1 to Week 4
- **System Delivery & Onsite Set-up (if req.):** Week 1 to Week 4
- **Inspection by HRSD personnel:** Week 1 to Week 4
- **Activate Permit (HRSD/VDEQ):** Week 1 to Week 4
- **Dewatering Activities:** Week 1 to Week 4
- **Monthly VPDES Sampling and Reporting:** Week 1 to Week 4
- **Weekly HRSD Sampling & Reporting:** Week 1 to Week 4
- **Deactivate Permit(s) (HRSD/VDEQ):** Week 1 to Week 4

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## Attachment B: Contamination Identification Table

<table>
<thead>
<tr>
<th>Land Uses of Concern</th>
<th>Chemical Family</th>
<th>Contaminant Identification</th>
<th>Subsurface Water Treatment Method</th>
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</thead>
<tbody>
<tr>
<td><strong>Zoning Indicator</strong></td>
<td><strong>Zoning Code</strong></td>
<td><strong>Historical Land Use</strong></td>
<td><strong>Chemical of Concern</strong></td>
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<td><strong>Dry Land Uses</strong></td>
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</tr>
<tr>
<td><strong>Residential</strong></td>
<td>R-40 R-30 R-20 R-15 R-10 R-7.5 R-5 R-5 R-2.5 A-12 A18 A-24 A36</td>
<td>Residential (Heating Oil Storage Tanks)</td>
<td>Total Petroleum hydrocarbon (TPH)</td>
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<tr>
<td></td>
<td></td>
<td>Residential (Septic Fields Present)</td>
<td>Volatile Organic Compounds (VOCs) Human Bacteria/Viruses</td>
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<tr>
<td></td>
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<td>Solvents <em>Escherichia Coli</em> (E. Coli) <em>Fecal Coliform Enrichment</em></td>
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<td><strong>Agricultural</strong></td>
<td>AG-1 AD-2</td>
<td>Farming/Agricultural Storage Facilities</td>
<td>Inorganic Volatile Organic Compounds (VOCs) Pesticides, Herbicides, Fungicides</td>
</tr>
<tr>
<td></td>
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<td>S CRRA 8 Metals Solvents (DDT), Chlorodane, Alphine, Endrin</td>
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<td><strong>Municipal</strong></td>
<td></td>
<td>Utility Easements - Wastewater or Oil/Gas Pipelines</td>
<td>Inorganic Volatile Organic Compounds (VOCs) PCRs CRRA 8 Metals Solvents</td>
</tr>
<tr>
<td></td>
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<td>Site Specific</td>
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</tbody>
</table>

*Note: Site specific test methods and treatment methods are used in site specific cases.*

### Chemical Test Methods

- EPA Method 8260
- EPA Method 8260 (Membrane Filter Method)
- EPA Method 8151
- EPA Method 6010/7471
- EPA Method 8015
- EPA Method 8081
- EPA Method 8270
- EPA Method 8280
- Site Specific

### Treatment Methods

- Air-Stripping
- Activated Carbon Filtration
- Filtration
- Site Specific

### Hazardous Waste Generator - Small Scale

<table>
<thead>
<tr>
<th>Land Uses of Concern</th>
<th>Chemical Family</th>
<th>Contaminant Identification</th>
<th>Subsurface Water Treatment Method</th>
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<td><strong>Specialty Industrial/Commercial</strong></td>
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<td>Chemical Manufacture</td>
<td>Volatile Organic Compounds (VOCs)</td>
<td>Solvents</td>
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<td>Automotive/Boat Repair</td>
<td>Volatile Organic Compounds (VOCs) Semi-Volatile Organic Compounds (SVOCs)</td>
<td>PCBs CRRA 8 Metals Solvents</td>
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<tr>
<td><strong>General Industrial/Commercial (specific use unknown)</strong></td>
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<td>General Commercial/Industrial</td>
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<td>Site Specific</td>
<td>Site Specific</td>
<td>Site Specific</td>
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</tbody>
</table>

### Site Specific Test Methods

- EPA Method 8260
- EPA Method 8280
- EPA Method 8015
- EPA Method 8081
- EPA Method 8270
- EPA Method 8280
- EPA Method 8151
- Site Specific

### Site Specific Treatment Methods

- Site Specific
**Section 36 - Standard Details**

A. **Introduction** – Standard Details have been developed to provide uniformity throughout HRSD. These details can be provided in electronic format. The FIRM must review all the Standard Details and select the ones that are appropriate for any given project. The FIRM must develop other details as required to incorporate into Bid Documents.

B. **Listing of Standard Details** – These standard details are available in AutoCAD format upon request. These listed Standard Details are included as PDF files in this manual.

1. **Series 100: Miscellaneous**
   - 100 - Standard Cover Sheet
   - 101 - Easement Plat
   - 102 - Exterior Bollard Detail
   - 103 - Bollard Location Detail
   - 104 - Load Test Hinged Bank Box
   - 105A/B - Flush-mount Groundwater Monitoring Well
   - 106 - Recovery Sheet Template

2. **Series 200: Collection Systems and Appurtenances**
   - 200A/B - Precast Concrete Manhole with Extended Monolithic Base
   - 201 - Precast Concrete Shallow Manhole with Extended Base
   - 202A/B - Sanitary Sewer Straddle Manhole
   - 203 - Connection into Existing Manholes
   - 204 - Manhole Invert Shaping
   - 205 – Precast Concrete or Brick Manhole Inside Gravity Drop Connection to Existing Manhole
   - 206 – Precast Concrete Outside Drop Manhole
   - 207 - Precast Concrete or Brick Manhole Inside Force Main Drop Connection to Existing Manhole
   - 208 – Precast Concrete Sanitary Sewer Manhole Adjustment
   - 209 - Manhole Insert
   - 226 – Stub-out Connection for Existing Manholes
   - 227 - Standard Manhole Frame and Cover
   - 228 - Manhole Frame and Cover – Watertight
   - 229A/B – Sanitary Sewer Lateral Installation
   - 230 – Sanitary Sewer Service Connection for New Developments
   - 231 – Deactivation at HRSD Gravity Main
   - 232 – Alternate Service Lateral Connection to Existing Gravity Sewer Main
   - 233 – Permanent Sewer Lateral Deactivation at HRSD Manhole
   - 251 – Sanitary Sewer Service Clean Out Frame and Cover (Non-Traffic Rated)
   - 252 – Sanitary Sewer Service Clean Out Frame and Cover (Traffic Rated)
   - 253 – Tracer Wire Locator Box
   - 276 – Vacuum Air Intake Valve
   - 277 – Lateral Connection to Existing Vacuum Valve Pit
   - 278 – Vacuum System Division Valve
3. Series 300: Interceptors and Appurtenances
   300 - Connection to Existing HRSD Valve (No Potential for Additional Development)
   301 - Connection to Existing HRSD Valve (Additional Development Possible)
   302 - Connection to Existing HRSD Valve (Additional Development Imminent)
   303 – New Wet Taps (No Potential for Additional Development)
   304 – New Wet Taps (Additional Development Possible)
   305 – New Wet Taps (Additional Development Imminent)
   306A – 2’ Private Connection to Existing 2” HRSD Stub
   306B – Valve Vault for 2” HRSD Valve
   306C – Vault Lid for 2” HRSD Valve
   307 – Lawnes Point Private Connection Detail
   308 – Private Force Main to HRSD Asset
   309 – New Grinder Pit Connection to Existing HRSD Force Main
   326 – Horizontal Gate Valve
   327 – Vertical Gate Valve
   328 – Valve Box and Riser for Mainline Valve
   329 – Valve Box and Riser for Bypass Valves
   330 – Valve Riser Adjustment
   331A/B - Roadside Ditch – Valve Box
   351 - Air Vent
   352A/B - Air Release Valve Box Adjustment
   353 - Roadside Ditch – Air Vent
   354 - Air Vent Frame and Cover
   376 - Tapping Saddle for Cast Iron, Ductile Iron, Reinforced Concrete and PVC Pipes
   377 - Tapping Saddle for Concrete Cylinder Pipe
   378A/B - Steel Casing Detail
   379 - Ductile Iron MJ Spigot to Concrete Transition Adaptor (Male)
   380 - Ductile Iron MJ Spigot to Concrete Transition Adaptor (Female)
   381 - Pressure Sensor Installation
   382 – Concrete Cylinder Pipe Line Stop Detail
   383 – Ductile / Cast Iron Line Stop Detail

4. Series 400: Pump Stations and PRS
   400A/B – Small Communities Sample Design Detail – Submersible Pump Station
   401A/B – Underground Storage Tank
   402A/B – Underground Fuel Tank

5. Series 500: Cathodic Protection for Pipes
   500 - Cathodic Protection Test Station
   501 - Cathodic Protection Isolation Detail
   502 – Anode Test Station
   503 – Monitoring Test Station
   504 – Monitoring Test Station (with Riser)
   505 – Isolation Flange Test Station
   506 – Isolation Flange Test Station (with Riser)
6. Series 600: Cathodic Protection for Buildings
   600 – Installation of Discrete Galvanic Anodes
   601 – Installation of Distributed Galvanic Anodes
   602 – Distributed Galvanic Anodes at Top of Wall
   603 – Installation of Drilled-in Galvanic Anodes
   604 – Conductive Mortar Bridge for use with High Resistivity Repair Mortars
   605 – Typical Galvanic Anode Layout
   606 – Typical Galvanic Anode Connections
   626 – Removal of Unsound Concrete Typical Section
   627 – Concrete Rebuild Typical Section
   628 – Concrete Rebuild to Provide Minimum Cover Typical Section
   629 – Removal of Unsound Concrete Typical Corner Section
   630 – Concrete Rebuild Typical Corner Section
   631 – Reinforcing Section Loss Table
   632 – Lap Splice – Option 1
   633 – Lap Splice Lengths – Option 1
   634 – Mechanical Splice – Option 2 Typical Removal Section
   635 – Mechanical Splice – Option 2 Typical Rebuild Section
   636 – Weld Splice – Option 3
   637 – Weld Splice Details A – Option 3
   638 – Weld Splice Details B – Option 3
   639 – Supplemental Reinforcement Requirements
   640 – Adhesive Grouted Dowel Layout
   641 – Typical Concrete Rebuild Section at Embed Plate
   642 – Shallow Depth (2” Max) Concrete Rebuild Horizontal
   643 – Shallow Depth (2” Max) Concrete Rebuild Vertical
   644 – Partial Depth Core Hole Concrete Rebuild
   645 – Full Depth Core Hole Concrete Rebuild
   646 A/B – Typical Spall Repair with Exposed Reinforcing Steel
   651 – Typical Sealant Details
PAINT SAFETY YELLOW TYP. ALL BOLLARDS

6" Ø, SCHEDULE 80 STEEL PIPE FILLED WITH CONCRETE

FINISHED GRADE

POURED CONCRETE (3,500 P.S.I.)

#5 BAR, 12" LONG THROUGH PIPE

1'-6" SQ.

1" ROUNDING OF CONCRETE

3'-6"

4'-0"

6"

SLOPE TO DRAIN

NOT TO SCALE

STANDARD DESIGN DETAIL

EXTERIOR BOLLARD DETAIL
Main Line valve in agricultural area

Air Vent in agricultural area

Branch valve in agricultural area

Cathodic test station in agricultural area

Branch valve or Air vent in agricultural area next to roadside

All measurements from center of casting

DITCH

Street

STANDARD DESIGN DETAIL

BOLLARD LOCATION DETAIL
Notes:
1. Typical dimensions shown for various service sizes. Box must be field verified prior to fabrication and installation.
*SEE PAGE 2 FOR DETAIL NOTES

NOT TO SCALE

STANDARD DESIGN DETAIL

FLUSH-MOUNT GROUNDWATER MONITORING WELL
<table>
<thead>
<tr>
<th>WELL DEPTH (FT)</th>
<th>PVC PIPING DIAMETER</th>
<th>SCREEN LENGTH* (FT)</th>
<th>SLOTTING SIZE</th>
<th>RISER PIPE LENGTH (FT)</th>
<th>FILTER SAND MEDIA</th>
<th>SEALING MEDIA</th>
<th>SURFACE FINISHING</th>
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</thead>
<tbody>
<tr>
<td>12</td>
<td>0.75 ID</td>
<td>9</td>
<td>0.010</td>
<td>2.5</td>
<td>#2</td>
<td>BENTONITE</td>
<td>FLUSH MOUNT CASING</td>
</tr>
<tr>
<td>17</td>
<td>0.75 ID</td>
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<td>3.5</td>
<td>#2</td>
<td>BENTONITE</td>
<td>FLUSH MOUNT CASING</td>
</tr>
</tbody>
</table>

*SCREENS LENGTHS COME IN 3FT AND 5FT SECTIONS

NOTES:

1. ONCE THE SCREEN INTERVAL IS INSTALLED, A MINIMUM OF 2 FEET OF SAND SHOULD BE PLACED ABOVE THE SCREEN. ONCE INSTALLED, A MINIMUM OF ONE FOOT THICK SEAL OF BENTONITE SLURRY OR NEAT CEMENT GROUT SHOULD BE PLACED.

2. AT FINAL SURFACE GRADE, THE MONITORING WELL SHALL BE PROTECTED WITH FLUSH MOUNT RISER CASING.

3. UPON COMPLETION OF WELL INSTALLATION, THE CONTRACTOR WILL DEVELOP THE WELL TO REMOVE SILT FROM WITHIN THE SCREEN INTERVAL.
**Standard Precast Concrete Manhole W/Extended Monolithic Base**

- **Precautions:**
  - Adjustment ring (Typ.) rings to be coated and sealed smooth on all inside surfaces.
  - 3/8" thick (min.) with hydraulic cement high strength grout.
  - Manhole casting and adjustment rings to be set & embedded in bed joint material and capped with hydraulic cement grout over frame flange, adjustment rings and section.
  - Grout joint inside and out after installation w/ hydraulic cement grout.
  - Flexible boot connection.
  - Match crowns of the tributary sewers with the crown of the main sewer.
  - See HRSD detail #26 sanitary sewer manhole invert shaping detail.
  - Support pipe and manhole on 6" min. of compacted #57 stone (greater depth may be required in poor soils).

- **Instructions:**
  - Depth of main channel shall be from main sewer pipe invert to main sewer pipe crown. Bench shall be sloped to prevent accumulation of solids.

- **Notes:**
  - See drawing #200B for notes.

**Not to Scale**
### CHART 1

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>MANHOLE DIAMETER</th>
<th>BASE UNIT HEIGHT</th>
<th>WALL THICKNESS–MIN.</th>
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</thead>
<tbody>
<tr>
<td>&lt; OR = 24&quot;</td>
<td>48&quot;</td>
<td>24&quot;-48&quot;</td>
<td>5&quot;</td>
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<tr>
<td>27&quot;-36&quot;</td>
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<td>60&quot; (MIN.)</td>
<td>6&quot;</td>
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<tr>
<td>42&quot;</td>
<td>72&quot;</td>
<td>72&quot; (MIN.)</td>
<td>7&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>72&quot;</td>
<td>48&quot; (MIN.)</td>
<td>7&quot;</td>
</tr>
</tbody>
</table>

### NOTES:

1. PRECAST CONCRETE MANHOLE TO BE IN COMPLIANCE WITH ASTM C-478.

2. PROVIDE A MAXIMUM OF TWO LIFT HOLES PER SECTION. PLUG LIFT HOLES WATERTIGHT WITH RUBBER PLUGS AND GROUT AFTER INSTALLATION.

3. REGARDLESS OF PIPE SIZE, INSIDE DIAMETER OF MANHOLE SHALL BE 60" (MIN.) WHEN MANHOLE DEPTH IS 12' OR GREATER. 60" DIAMETER SHALL BE CONTINUOUS UP TO CONE SECTION.

4. MAXIMUM OF FOUR LATERALS PER MANHOLE.

5. ALL MANHOLES SHALL RECEIVE CONSHELI ADDITIVE OR APPROVED EQUAL DURING CASTING.

6. CONCRETE USED TO FORM THE BENCH SHALL RECEIVE THE CONSHELI ADDITIVE, OR APPROVED EQUAL.

7. COAT EXTERIOR OF MANHOLE IN ACCORDANCE WITH THE HRSD COATTINGS MANUAL, CURRENT REVISION, COATING SYSTEM E–2–C. COATING SHALL BE FIELD APPLIED.
NOT TO SCALE

STANDARD DESIGN DETAIL – PRECAST

CONCRETE SHALLOW MANHOLE WITH EXTENDED BASE
NOTE:
MANHOLE MAXIMUM DEPTH = 25'-0"
MANHOLE DEPTH DEFINED AS LOWEST INVERT TO TOP OF RIM

BASE SLAB

SEE HRSD SANITARY SEWER MANHOLE FRAME AND COVER DETAIL.
FRAME AND COVER TYPE TO BE SPECIFIED BY HRSD ENGINEER.

PLAN

PRECAST CONCRETE ADJUSTMENT RING (TYP).
RINGS TO BE COATED AND SEALED SMOOTH ON ALL INSIDE SURFACES,
3/8" THICK (MIN.) WITH HYDRAULIC CEMENT HIGH STRENGTH GROUT.

FINISHED GRADE

MANHOLE CASTING AND ADJUSTMENT RINGS TO BE SET & EMBEDDED IN BUTYL JOINT MATERIAL AND CAPPED WITH HYDRAULIC CEMENT GROUT OVER FRAME FLANGE, ADJUSTMENT RINGS AND SECTION.

GROUT JOINT INSIDE AND OUT AFTER INSTALLATION W/ HYDRAULIC CEMENT GROUT

PRECAST CONCRETE MANHOLE SECTIONS MATCH CROWN OF NEW SEWER WITH CROWN OF EXISTING SEWER

FLEXIBLE BOOT CONNECTION APPLY WATERSTOP GRouting BETWEEN MANHOLE WALL AND PIPE

SUPPORT PIPE AND MANHOLE ON 6" MIN. OF COMPACTED #57 STONE (GREATER DEPTHS MAY BE REQUIRED IN POOR SOILS)

FIELD POUR BASE SLAB UNDER EXISTING SEWER.
REINFORCE W/ #5 REBAR @ 12" O.C. EACH WAY. ALL REBAR TO HAVE 1-1/2" MIN. COVER. CONCRETE TO BE CLASS A-3.

CONSTRUCT CONCRETE CHANNEL AND BENCH IN FIELD. SEE SANITARY MANHOLE INVERT SHAPING DETAIL #204 4" MIN. EMBEDMENT

8" MIN.

DEPTH OF MAIN CHANNEL SHALL BE FROM EXISTING SEWER PIPE INVERT TO EXISTING SEWER PIPE CROWN. BENCH SHALL BE SLOPED TO PREVENT ACCUMULATION OF SOLIDS.

SEE DETAIL #202B, SHEET 2 OF 2 FOR NOTES.

NOT TO SCALE

STANDARD DESIGN DETAIL
SANITARY SEWER STRADDLE MANHOLE

HRSD

DRAWING NO. 202A
SHEET 1 OF 2
DATE 1/2020
CHART 1

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>MANHOLE DIAMETER</th>
<th>BASE UNIT HEIGHT</th>
<th>WALL THICKNESS—MIN.</th>
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<tr>
<td>&lt; OR = 24”</td>
<td>48”</td>
<td>24”–48”</td>
<td>5”</td>
</tr>
<tr>
<td>27”–36”</td>
<td>60”</td>
<td>60” (MIN.)</td>
<td>6”</td>
</tr>
<tr>
<td>42”</td>
<td>72”</td>
<td>72” (MIN.)</td>
<td>7”</td>
</tr>
<tr>
<td>48”</td>
<td>72”</td>
<td>48” (MIN.)</td>
<td>7”</td>
</tr>
</tbody>
</table>

NOTES:

1. PRECAST CONCRETE MANHOLE TO BE IN COMPLIANCE WITH ASTM C–478.

2. PROVIDE A MAXIMUM OF TWO LIFT HOLES PER SECTION. PLUG LIFT HOLES WATERTIGHT WITH RUBBER PLUGS AND GROUT AFTER INSTALLATION.

3. REGARDLESS OF PIPE SIZE, INSIDE DIAMETER OF MANHOLE SHALL BE 60” (MIN.) WHEN MANHOLE DEPTH IS 12’ OR GREATER. 60” DIAMETER SHALL BE CONTINUOUS UP TO CONE SECTION.

4. MAXIMUM OF FOUR LATERALS PER MANHOLE.

5. ALL MANHOLES SHALL RECEIVE CONSHIELD ADDITIVE OR APPROVED EQUAL DURING CASTING.

6. COAT EXTERIOR OF MANHOLE IN ACCORDANCE WITH HRSD COATINGS MANUAL, CURRENT REVISION, COATING SYSTEM E–2–C. COATING SHALL BE FIELD APPLIED.

7. CONCRETE USED TO FORM THE BENCH SHALL RECEIVE THE CONSHIELD ADDITIVE, OR APPROVED EQUAL.
WHERE APPROVED BY HRSD, CORE CUT HOLE OR BREAK OUT BRICKS CAREFULLY AND NEATLY. FASTEN STUB INTO HOLE WITH WATERSTOP GROUTING.

EXISTING INLET

CORE CUT HOLE

STUB

EXISTING INLET

SECTION A–A

REPAIR LINER IF APPLICABLE

EXISTING SHELF

EXISTING OUTLET

EXISTING CHANNEL

D” X 12” STUB

B

BASE PLAN OF BRICK MANHOLE

CHISEL OUT EXISTING CONCRETE SHELF TO FORM NEW CHANNEL.
SMOOTH CHANNEL SURFACE WITH 1/2” CEMENT MORTAR.

EXISTING SHELF

EXISTING CHANNEL

EXISTING INLET

C

BASE PLAN OF PRE-CAST MANHOLE

SECURELY FASTEN STUB INTO CORED HOLE WITH FLEXIBLE BOOT CONNECTION

NEW CHANNEL

EXISTING MANHOLE

EXISTING OUTLET

STUB

SECTION B–B

1/2” CEMENT MORTAR

NOTES:
MATCH CROWN OF NEW PIPE STUB TO EXISTING PIPE CROWNS.

NOT TO SCALE

STANDARD DESIGN DETAIL

CONNEXTION INTO EXISTING MANHOLES

DRAWING NO. 203

SHEET 1 OF 1

DATE 17/2020
FORM TRIBUTARY CHANNELS OF CONCRETE (2000 P.S.I.) (CROWEL FINISH) ON A CONTINUOUS CURVE TO MAIN CHANNEL. DEPTH OF CHANNEL SHALL EQUAL THE DEPTH OF THE CONTRIBUTING SEWER.

MANHOLE WALL (SEE ASSOCIATED SANITARY SEWER MANHOLE DETAILS)

INVERT OF SEWER MAIN CARRIED THROUGH MANHOLE W/SPLIT PIPE SECTIONS OR FORMED CONCRETE (2000 P.S.I.) CHANNEL. DEPTH OF MAIN CHANNEL SHALL EQUAL THE DEPTH OF THE CONTRIBUTING SEWER.

SLOPE BENCH TO CHANNEL @ 2":12" COAT BENCH WITH APPLICATION OF AN APPROVED COATING, IF SPECIFIED.

NOTES:
1. SPLIT PIPE ONLY ALLOWED IN STRADDLE MANHOLES.
2. CONCRETE USED TO FORM THE BENCH SHALL RECEIVE THE CONSHIELD ADDITIVE, OR APPROVED EQUAL.
3. BENCH SHALL BE FORMED TO ACCOMMODATE CCTV EQUIPMENT.

NOT TO SCALE

STANDARD DESIGN DETAIL

MANHOLE INVERT SHAPING
INSIDE DROP BOWL (RELINER INC.) OR APPROVED EQUAL

TRACE WIRE SHALL TERMINATE AT MANHOLE WALL AT A MAX DISTANCE OF 24" BELOW MANHOLE FRAME AND COVER. TRACER WIRE SHALL BE ATTACHED TO MANHOLE WALL WITH 316 STAINLESS STEEL CLAMP AND BOLT.

STRAP – 3/8" X 1-1/2" FLAT BAR FABRICATED AND INSTALLED TO SUPPORT PIPE (MATERIAL SHALL BE 316 STAINLESS STEEL) ATTACHED TO MANHOLE WITH (2) 3/8" 316 STAINLESS STEEL ANCHOR BOLTS, MIN 3" EMBEDMENT. PROVIDE A MINIMUM OF TWO STRAPS (TOP AND BOTTOM) AND ONE EVERY 4' IN BETWEEN.

DROP PIPE MATERIAL TO MATCH INCOMING PIPE MATERIAL.

90° BEND RESTING ON RE-FORMED CHANNEL & TURNED IN DIRECTION OF EXIST. SEWER FLOW. SEE HRSD INVERT SHAPING DETAIL.

MATCH CROWNS OF THE TRIBUTARY SEWERS WITH THE CROWN OF THE MAIN SEWER.

NOTES:

1) THIS CONNECTION WILL ONLY BE CONSIDERED FOR MANHOLES GREATER THAN 6’ IN DEPTH FROM RIM TO INVERT AND WILL ONLY BE APPROVED ON A CASE BY CASE BASIS BY HRSD OPERATIONS.

2) NO LATERAL ENTRY SHALL BE ALLOWED WITHIN THE TAPER UNIT OF THE MANHOLE.

3) IF LATERAL CONNECTION IS GREATER THAN 6’ IN DEPTH FROM GRADE, MARKING TAPE SHALL BE INSTALLED 3’ BELOW GRADE.

SEE HRSD DETAIL #203, CONNECTION INTO EXISTING MANHOLE

TRACER WIRE AWG-10 SOLID COPPER WIRE W/POLYETHYLENE INSULATION. SHALL BE TAPPED AT A MAXIMUM INTERVAL OF 4'.

MAX 4 ø: GRAVITY MAIN PIPE MATERIAL SHALL BE PVC C-900 OR SDR26

NOT TO SCALE

STANDARD PRECAST CONCRETE OR BRICK MANHOLE

INSIDE GRAVITY DROP CONNECTION TO EXISTING MANHOLE
SEE HRSD DETAIL #26, SANITARY SEWER MANHOLE INVERT SHAPING

#4 REBAR - SPACED 6" O.C.

8"(MIN.) STRAP

CONCRETE ENCASEMENT

ANCHOR BOLTS (MIN. 3" EMBEDMENT)

WALL OF MANHOLE LOWER CONCRETE ENCASEMENT NOT SHOWN FOR CLARITY.

ANCHOR BOLTS (MIN. 3" EMBEDMENT)

PLAN

SECTION B-B

BRICK OR PVC CAP 2/3 OF DIAMETER

FLEXIBLE BOOT CONNECTION SIZE-ON-SIZE TEE

COMPACTED SELECT BACKFILL

STRAP-3/8"x1-1/2" FLAT BAR FABRICATED AND INSTALLED TO SUPPORT PIPE (MATERIAL SHALL BE 316 STAINLESS STEEL). ATTACH TO MANHOLE WITH 3/8" 316 SS INSERT ANCHOR BOLTS (SEE SECTION B-B). PROVIDE A MINIMUM OF TWO STRAPS (TOP AND BOTTOM) AND ONE EVERY FOUR FEET IN BETWEEN.

TOP OF CONCRETE TO MATCH SPRING LINE OF 90° BEND

#4 BARS - SPACED 6" O.C.

CONCRETE ENCASEMENT

MATCH CROWN OF PIPE WITH CROWN OF MAIN SEWER PIPE

DOWEL

SECTION A-A

NOT TO SCALE

STANDARD PRECAST CONCRETE

OUTSIDE DROP MANHOLE
TRACE WIRE SHALL TERMINATE AT MANHOLE WALL AT A MAX DISTANCE OF 24" BELOW MANHOLE FRAME AND COVER. TRACER WIRE SHALL BE ATTACHED TO MANHOLE WALL WITH 316 STAINLESS STEEL CLAMP AND BOLT.

LONG RADIUS 90° BEND

STRAP – 3/8” X 1-1/2” FLAT BAR FABRICATED AND INSTALLED TO SUPPORT PIPE (MATERIAL SHALL BE 316 STAINLESS STEEL) ATTACHED TO MANHOLE WITH (2) 3/8” 316 STAINLESS STEEL ANCHOR BOLTS, MIN 3” EMBEDMENT. PROVIDE A MINIMUM OF TWO STRAPS (TOP AND BOTTOM) AND ONE EVERY 4’ IN BETWEEN.

DROP PIPE MATERIAL TO MATCH INCOMING FORCE MAIN MATERIAL

90° BEND RESTING ON RE-FORMED CHANNEL & TURNED IN DIRECTION OF EXIST. SEWER FLOW. SEE HRSD INVERT SHAPING DETAIL.

MATCH CROWNS OF THE TRIBUTARY SEWERS WITH THE CROWN OF THE MAIN SEWER

SEE HRSD DETAIL #203, CONNECTION INTO EXISTING MANHOLE

TRACER WIRE AWG–10 SOLID COPPER WIRE W/POLYETHYLENE INSULATION. SHALL BE TAPED AT A MAXIMUM INTERVAL OF 4’.

MAX 4”Ø: FORCE MAIN PIPE MATERIAL SHALL BE HDPE MINIMUM DR–26

NOTES:

1) THIS CONNECTION WILL ONLY BE CONSIDERED FOR MANHOLES GREATER THAN 6’ IN DEPTH FROM RIM TO INVERT AND WILL ONLY BE APPROVED ON A CASE BY CASE BASIS BY HRSD OPERATIONS.

2) NO FORCE MAIN ENTRY SHALL BE ALLOWED WITHIN THE TAPER UNIT OF THE MANHOLE.

3) REFERECE HRPDC SAXOPHONE CONNECTION DETAIL

4) ALL BURIED PIPING SHALL BE HDPE DR–17, IF FUSION IS REQUIRED IT SHALL BE BUTT FUSION WELDED

5) IF LATERAL CONNECTION IS GREATER THAN 6’ IN DEPTH FROM GRADE. MARKING TAPE SHALL BE INSTALLED 3’ BELOW GRADE.

STANDARD PRECAST CONCRETE OR BRICK MANHOLE

INSIDE FORCE MAIN DROP CONNECTIONS TO EXISTING MANHOLE
NOTES:

1. PRECAST CONCRETE ADJUSTMENT RINGS SHALL BE USED TO RAISE THE MANHOLE FRAME FROM THE CONE SECTION. JACK UP RINGS BETWEEN THE FRAME AND COVER ARE NOT ACCEPTABLE.

2. GROUT MIX SHALL BE 1:3 CEMENT:SAND MORTAR. CAP EXTERIOR WITH GROUT OVER FRAME FLANGE, ADJUSTMENT RING(S), AND THE TOP 18” OF THE CONE SECTION. COAT INSIDE SURFACE OF THE ADJUSTMENT RINGS AND SEAL SMOOTH WITH 3/8” THICK GROUT.

3. IN LIEU OF PRECAST CONCRETE, ADJUSTMENT RINGS MAY BE COURSES OF HARD, SOUND, COMMON BRICK LAID RADIALY AND FULLY SUPPORTING THE FRAME FLANGE. BRICK SHALL BE LAID WITH 1:3 CEMENT:SAND MORTAR WITH SHAVED JOINTS NOT TO EXCEED 3/8” THICKNESS. CAP WITH GROUT OVER FRAME FLANGE, ADJUSTMENT RING(S), AND THE TOP 18” OF THE CONE SECTION (AS SHOWN ABOVE).


5. THE EXISTING BARREL SECTION(S), FOUNDATION, FOOT PAD, AND MANHOLE PIPES SHALL NOT BE DISTURBED.

6. MANHOLES TO BE LOWERED MAY BE LOWERED BY REMOVING EXISTING ADJUSTMENT RINGS. IF ADJUSTMENT RINGS ARE NOT PRESENT BETWEEN THE FRAME AND THE CONE SECTION, OR IF THEIR REMOVAL PROVIDES INSUFFICIENT ADJUSTMENT, CONTACT THE HRSD ENGINEER.
NOTES:
1. ACTUAL DIMENSIONS MUST BE COMPATIBLE WITH MANHOLE CASTING DIMENSIONS.
2. DUST COVER NOT REQUIRED WHEN USING MANHOLE INSERT.
3. GAS RELIEF VALVE SHALL BE CAPABLE OF RELEASING GAS AT A PRESSURE OF 0.5 TO 1.5 PSI AND HAVE A WATER LEAK DOWN RATE NO GREATER THAN 5 GALLONS/24 HOURS.
4. LOAD TEST STRENGTH MUST EXCEED 3,000 POUNDS.
5. HANDLE MUST BE CAPABLE OF WITHSTANDING A MINIMUM 500 POUND PULL FORCE.

NOT TO SCALE

STANDARD DESIGN DETAIL

MANHOLE INSERT
STUB-OUT CONNECTION FITTING SCHEDULE

<table>
<thead>
<tr>
<th>STUB-OUT MATERIAL</th>
<th>FITTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC</td>
<td>PVC COUPLING</td>
</tr>
<tr>
<td>DI/CI</td>
<td>JCM 201</td>
</tr>
<tr>
<td>VITRIFIED CLAY</td>
<td>FERNCO 102 SERIES</td>
</tr>
</tbody>
</table>

NOTE:
1. CONTRACTOR SHALL FIELD VERIFY ALL PIPE MATERIAL AND SIZES PRIOR TO PROCURING MATERIAL

STANDARD DESIGN DETAIL

SERVICE LATERAL & GRAVITY MAIN CONNECTION TO EXISTING STUB-OUT

NOT TO SCALE
6 WEBS @ 60° SPACING

NOTES:
1. CASTINGS TO BE SHOT BLASTED
2. CASTING TO BE ASTM A-48 CLASS 30
3. TOLERANCE ±.125"
4. MACHINE SEATING SURFACE ON BOTH FRAME & COVER
5. 0.375" MIN. THICKNESS OF DUST COVER
6. MINIMUM WEIGHTS:
   COVER—165 LBS.
   FRAME—303 LBS.

COVER

* USE WHERE 24" WATERTIGHT M.H.
MAY NOT BE APPLICABLE.

NOT TO SCALE

STANDARD DESIGN DETAIL

STANDARD MANHOLE FRAME AND COVER

DRAWING NO.
227

SHEET
1 OF 1

DAY
1/2020
NOTES
1. CASTINGS TO BE SHOT BLASTED.
2. CASTINGS SHALL MEET OR EXCEED ASTM A-48-76 CLASS 30-B.
3. TOLERANCE ± 0.125”.
4. MACHINE SEATING SURFACE ON BOTH FRAME & COVER.
5. FRAME & COVER TO BE DEWEY BROS. INC. MH-RCR-3000W (WATERTIGHT) OR EQUAL.
6. MINIMUM WEIGHTS:
   COVER = 170 LBS.
   FRAME = 262 LBS.

SECTION A-A
NOT TO SCALE

GASKET IN VERTICAL FACE OF COVER.

STANDARD DESIGN DETAIL
MANHOLE FRAME AND COVER—WATERTIGHT
SEE STANDARD DETAILS #251 OR #252

PRIMARY CONNECTION POINT. A MIN OF 3' OF STRAIGHT PIPE SHALL REMAIN WITH A PERMANENT CAP PLACED ON THE END OF STRAIGHT PIPE UNLESS ACTIVATED AT THE TIME OF CONSTRUCTION.

LATERAL PIPE IS TO BE COMPLETELY REMOVED FROM EXISTING HRSD GRAVITY MAIN. A MINIMUM OF 36” LATERAL PIPE IS TO BE REMOVED AWAY FROM THE MAIN.

FERNCO WILL TIE-IN THE NEW SCHEDULE 80 PVC PIPE

BREAK-IN TAP DEACTIVATION

CAP SHALL BE INSTALLED ON ENDS OF CONNECTION. CAP SHALL BE OF THE SAME PIPE MATERIAL AS THE EXISTING

WYE OR TEE DEACTIVATION

*SEE SHEET 2 FOR NOTES

NOT TO SCALE

STANDARD DESIGN DETAIL

SANITARY SERVICE LATERAL INSTALLATION/DEACTIVATION
NOTES:

1. TYPICAL LATERAL LAYOUT:
   1.1. SHALL ONLY UTILIZE THE PRIMARY CONNECTION POINT WHEN TYING TO AN EXISTING LATERAL.
   1.2. THE CONNECTION POINT TO THE PRIVATE LATERAL AND TO THE SANITARY SERVICE LATERAL CLEANOUT SHALL BE MADE WITH SOLID SLEEVES.
   1.3. FERNCO COUPLINGS OR EQUIVALENTS ARE NOT PERMITTED ON THE LATERAL CONNECTION OR AT THE CONNECTION POINT TO THE PRIVATE LATERAL, UNLESS THE PRIVATE LATERAL IS VCP (VITRIFIED CLAY PIPE). CONNECTIONS WILL NOT BE ALLOWED IF THE PRIVATE LATERAL PIPE MATERIAL IS ORANGEBURG PIPE (BITUMINIZED FIBER SEWER PIPE).
   1.4. RC STRONG BACK FERNCO COUPLINGS SHALL BE ENCASED IN CONCRETE AND SHALL ONLY BE ALLOWED ON VITRIFIED CLAY PIPE (VCP). CONCRETE SHALL BE DIRT FORMED IN A 6” BOX TO ENCOMPASS THE ENTIRE FITTING.
   1.5. CLEANOUT RISER ASSEMBLY AND FITTING SHALL BE SAME MATERIAL AS THE SEWER LATERAL

2. CLEANOUT RISER ASSEMBLY, LATERAL CLEANOUT AND TRACER WIRE SHALL BE INSTALLED PRIOR TO FINAL INSPECTION/ACCEPTANCE. LOCATION OF WYE AND CLEANOUT MAY BE VARIED BY HRSD STAFF IF NECESSARY DUE TO UNUSUAL DEPTH OR CONDITIONS. MINIMUM COVER OF 3.0 FEET REQUIRED FOR SERVICE.

3. LATERAL MATERIAL SHALL BE POLYVINYLCHLORIDE (P.V.C.), ASTM D-3034 SDR 26, AWWA C900–CLASS 150 (DR–18) OR ASTM D–1785 SCHEDULE 40. FOR DEPTHS LESS THAN 2’ OR GREATER THAN 10’ CONTACT HRSD FOR PIPE MATERIAL.

4. TRACER WIRE SHALL BE AWG 10 SOLID COPPER WIRE WITH POLYETHYLENE INSULATION. THE TRACER WIRE SHALL BE ATTACHED TO THE LATERAL PIPE WHEN THE DEPTH IN NO GREATER THAN 4.0 FEET. THE WIRE SHALL BE BURIED OVER THE CENTERLINE OF THE LATERAL PIPE AT 3.0 FEET BELOW GRADE WHEN THE LATERAL DEPTH IS GREATER THAN 4.0 FEET.

5. INSTALL DETECTABLE WARNING TAPE CONTINUOUSLY FROM THE MAIN TO THE HRSD CLEANOUT 1’ ABOVE TOP OF TRACER WIRE. TAPE SHALL BE GREEN IN COLOR AND STATE ” CAUTION BURIED SEWER LINE BELOW”

6. CONTRACTOR SHALL UTILIZE NO MORE THAN FOUR (4) FITTINGS FROM THE HRSD CONNECTION POINT TO THE HRSD CLEANOUT.

7. ALL PIPE DEACTIVATION SHALL BE ENCASED IN CONCRETE AT THE HRSD GRAVITY MAIN. CONCRETE SHALL SPAN 6” PAST THE FERNCO, WYE, TEE, OR FITTING.

8. DEACTIVATED LATERAL SHALL BE REMOVED TO THE EASEMENT/ROW/PROPERTY LINE OR CAPPED AND FLOWABLE FILLED.
NOTES:

1. PROVIDE A CAPPED EXTENSION TO PROPERTY LINE PER HRSD REQUIREMENTS IF SEWER SERVICE WILL NOT BE ACTIVATED AT THE TIME OF CONSTRUCTION.
2. CLEAN OUT SHALL BE INSTALLED AT THE ROW OR HRSD EASEMENT/PROPERTY LINE, UNLESS OTHERWISE STATED.
3. CONTRACTOR SHALL USE NO MORE THAN FOUR (4) FITTINGS. BENDS SHALL HAVE A MAX ANGLE OF 60° AND A MINIMUM OF 30°. ALL BENDS SHALL BE LONG RADIUS.
4. WYE CONNECTION SHALL BE PLACED BETWEEN THE 1:30-3 O’CLOCK OR 9 TO 10:30 O’CLOCK POSITION ON THE GRAVITY MAIN.
5. THIS DETAIL SHALL BE USED IN CONJUNCTION WITH STANDARD DETAILS 229A & 229B AND DETAILS 251 & 252.
6. PIPING BEDDING SHALL BE TYPE IV BEDDING REFERENCE HRPDC DETAIL EW_01.
FERNCO WILL TIE-IN THE NEW SCHEDULE 80 PVC PIPE

LATERAL PIPE IS TO BE COMPLETELY REMOVED FROM EXISTING HRSD GRAVITY MAIN. A MINIMUM OF 36” LATERAL PIPE IS TO BE REMOVED AWAY FROM THE MAIN.

BREAK-IN TAP DEACTIVATION DETAIL

CAP SHALL BE INSTALLED ON ENDS ON CONNECTION. CAP SHALL BE OF THE SAME PIPE MATERIAL AS THE EXISTING

WYE OR TEE DEACTIVATION DETAIL

NOTES:

1) ALL PIPE DEACTIVATION SHALL BE ENCASED IN CONCRETE AT THE HRSD GRAVITY MAIN. CONCRETE SHALL SPAN 6” PAST THE FERNCO, WYE, OR TEE FITTING.

2) DEACTIVATED LATERAL SHALL BE REMOVED TO THE EASEMENT/ROW/PROPERTY LINE OR CAPPED AND FLOWABLE FILLED.

NOT TO SCALE

STANDARD DESIGN DETAIL

DEACTIVATION AT HRSD GRAVITY MAIN
NOTES:

1. MIN OF 2' OF STRAIGHT PIPE FROM CONNECTION IS REQUIRED BEFORE INSTALLING ANY FITTING.

2. 4" SADDLE SHALL BE COMPLETELY ENCOMPASSED WITH COMPACTED #57 STONE.

3. TERMINATION OF TRACER WIRE SHALL BE AT THE BOLTS OF ROMAC FITTING. EXPOSED BARE COPPER SHALL BE WRAPPED AROUND THE BOLTS.

4. THIS DETAIL SHALL BE USED ON A CASE BY CASE BASIS, AD CONTINGENT UPON HRSD APPROVAL.

NOT TO SCALE

STANDARD DESIGN DETAIL

ALTERNATIVE SERVICE LATERAL CONNECTION TO EXISTING GRAVITY SEWER MAIN

01/2020
THE REMAINING LATERAL PIPE SHALL BE REMOVED TO THE EASEMENT/R.O.W./PROPERTY LINE AND CAPPED AT BOTH ENDS WITH FLOWABLE FILL.

CONTRACTOR SHALL REMOVE A MINIMUM OF 36” OF THE EXISTING LATERAL PIPE AWAY FROM THE MANHOLE.

EXISTING LATERAL SHALL BE REMOVED FROM MANHOLE

NOTES:

1. VOID (CREATED FROM THE REMOVED LATERAL) SHALL BE FILLED WITH CONCRETE THAT HAS CONSHIELD ADDITIVE.

2. THE EXTERIOR SURFACE SHALL BE PARGED WITH NON-SHRINK HIGH STRENGTH GROUT.

NOT TO SCALE

STANDARD DESIGN DETAIL

PERMANENT SERVICE LATERAL DEACTIVATION AT HRSD MANHOLE

HRSD
NOTES:

1. CLEAN OUT FRAME & COVER TO BE PART NUMBER NPN-CW-18 SUPPLIED BY CAPITAL FOUNDRY OF VIRGINIA, INC. OR APPROVED EQUAL.
2. ALL GRAY IRON CASTINGS SHALL CONFORM TO LATEST EDITION OF ASTM A-48, CLASS 30 AND SHALL BE OF UNIFORM QUALITY.
3. ALL CASTING DIMENSIONS SHALL HAVE A TOLERANCE OF 1/8"±
4. ALL CASTINGS SHALL BE CLEANED BY SHOT BLASTING AND HAND CHIPPING UTILIZING STANDARD
5. INDUSTRY PRACTICES PRIOR TO SHOP APPLICATION OF ASPHALTIC COATING, BY DIPPING.
6. THE TRACER WIRE POLYETHYLENE INSULATION SHALL ONLY FROM THE LAST INCH. TRACER WIRE SHALL HAVE A SURPLUS OF 2' OF WIRE CONNECTED INSIDE OF CASTING.

NOT TO SCALE

STANDARD DESIGN DETAIL

SANITARY SEWER SERVICE CLEAN OUT FRAME AND COVER (NON-TRAFFIC RATED)
NOTES:

1. CLEAN OUT FRAME & COVER HIGHWAY LOAD RATED FOR USE IN DRIVEWAYS, PARKING LOTS, ETC.
2. CLEAN OUT FRAME & COVER TO BE PART NUMBER VB-9*S SUPPLIED BY CAPITAL FOUNDRY OF VIRGINIA, INC. OR APPROVED EQUAL.
3. ALL GRAY IRON CASTINGS SHALL CONFORM TO LATEST EDITION OF ASTM A-48, CLASS 30 AND SHALL BE OF UNIFORM QUALITY.
4. ALL CASTING DIMENSIONS SHALL HAVE A TOLERANCE OF 1/8"±
5. ALL CASTINGS SHALL BE CLEANED BY SHOT BLASTING AND HAND CHIPPING UTILIZING STANDARD INDUSTRY PRACTICES PRIOR TO SHOP APPLICATION OF ASPHALTIC COATING, BY DIPPING.
NOTES:
1. MATERIAL, CAST IRON, GRADE TO BE SPECIFIED ON PURCHASE ORDER.
2. ALL RADIi SHALL BE $\frac{1}{8}$" MINIMUM.
3. ESTIMATED WEIGHT 37#.

NOTES:
1. ALL INTERNAL EDGES SHALL HAVE A $\frac{1}{16}$" RADIUS.
2. ALL EXTERNAL RADII $\frac{1}{16}$" TO $\frac{1}{8}$" AS NEEDED FOR CASTING RELIEF.
3. MATERIAL, CAST IRON, GRADE TO BE SPECIFIED ON PURCHASE ORDER.
4. ESTIMATED WEIGHT 12#.
5. RISER TO BE FILLED WITH PEA GRAVEL.
1. Construct air intake valve with concrete elevation rings as manufactured by Nansemond Pre-Cast Concrete Co., Inc. Model AV-ER-CH and AV-BS.
2. Jack up rings between the frame and cover not acceptable.
3. Parge concrete elevation rings with grout inside and out, continue on to casting.
4. If reducers are required they must be installed onto sweeping Wye.
5. Solvent weld PVC coupling shall be used to connect sweeping Wye to existing vacuum main.
6. Accepted Wyes are 6"x6"x4", 6"x6"x2", and 4"x4"x2".
7. Wye shall match vacuum main diameter.
8. Tees with the following dimensions can be used 6"x6"x2", and 4"x4"x2".
NOTES:

SEQUENCE FOR CONNECTION
1) CONTRACTOR WILL HAVE TO EXCAVATE TO THE BOTTOM THE EXISTING VALVE PIT
2) UTILIZING THE TABLE TO THE RIGHT MEASURE AND MARK THE CENTER OF A 5" CORE HOLE
3) CORE A 5" HOLE INTO THE SUMP AND INSTALL A 4" DOUBLE LIP SEAL RUBBER GROMMET WITH 4" SCH 40 PVC PIPE

*NOTE IF THE LATERAL IS 6" CORE WILL BE 7" AND CONTRACTOR WILL UTILIZE 6" DOUBLE LIP SEAL RUBBER GROMMET

<table>
<thead>
<tr>
<th>DIM &quot;A&quot;</th>
<th>4&quot; GRAVITY</th>
<th>6&quot; GRAVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1'-6&quot;</td>
<td>1'-7&quot;</td>
<td></td>
</tr>
</tbody>
</table>
HRSD 24" MANHOLE FRAME
AND COVER (HRSD DETAIL
228, RUBBER GASKET NOT
REQUIRED)
MANHOLE FRAME SHALL BE
SET IN MORTAR BED
CENTERED OVER THE RCP PIPE
MORTAR BED
SHALL BE 8" X 8"
AND SPAN THE FULL
CIRCUMFERENCE OF
THE MANHOLE FRAME

GRADE

COMPACTED FILL

8" PVC RISER
SCHEDULE 40
OR BETTER

CONCRETE
FOUNDATION
SHALL BE
8" X 8" AND
SPAN THE FULL
CIRCUMFERENCE
OF THE RCP

VDOT #57 STONE
TO BE USED
TO BACK
FILL TO THE
TOP OF PIPE

3' MINIMUM DUCTILE IRON
PIPE SHALL BE CONNECTED
WITH LONG BODY SLEEVE
AND TWO (2) MEGALUGS,
MEGALUGS SHALL MATCH PIPE
MATERIAL
(E.G. PVC PIPE=PVC MEGALUG)

MANHOLE FRAME AND RCP
TO BE JOINT SHALL HAVE
BUTYL SEALANT.

3/4" X 1/4" REDUCING
BUSHING (BRASS) WITH
1/4" PLUG

BRASS BALL VALVE
NIBCO MODEL #
T5857066-3/4

MALE ADAPTER 3/4"
SOLDER CONNECTION

3/4" TYPE K COPPER
PIPE, ONE SINGLE
PIECE, NO JOINTS

6" PVC RISER SCHEDULE
40 OR BETTER

MALE ADAPTER 3/4"
SOLDER CONNECTION

CORPORATION STOP FORD
F-1000-3CC-3FIP

FLOW

ROMAC TAPPING SADDLE
TYPE 202-NS-SIZE-3CC

BLOCKS OR MASS CONCRETE

GATE VALVE WITH NON-RISING STEM AND
RESILIENT COATED WEDGE, MECHANICAL
JOINT CONNECTIONS

DIVISION VALVE SUPPORT INFORMATION

<table>
<thead>
<tr>
<th>VALVE SIZE</th>
<th>SUPPORT SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot;</td>
<td>6&quot; THICK X 1.75' SQUARE</td>
</tr>
<tr>
<td>6&quot;</td>
<td>6&quot; THICK X 2.25' SQUARE</td>
</tr>
<tr>
<td>8&quot;</td>
<td>6&quot; THICK X 3.00' SQUARE</td>
</tr>
<tr>
<td>10&quot;</td>
<td>6&quot; THICK X 3.50' SQUARE</td>
</tr>
</tbody>
</table>

NOT TO SCALE
NOTES:

1. FL X PE NIPPLE WITH MEGA-LUG.
2. PE X PE NIPPLES WITH MEGA-LUGS. THE USE OF FOSTER ADAPTERS WILL BE CONSIDERED ON A CASE-BY-CASE BASIS BY HRSD.
3. JURISDICTION VALVE.
   a. JURISDICTION VALVE TO BE SAME SIZE AS EXISTING HRSD VALVE.
   b. ECCENTRIC REDUCERS TO BE INSTALLED AS NEEDED AFTER JURISDICTION VALVE.
   c. HRSD PIPELINES THAT HAVE CORROSION PROTECTION IN PLACE WILL REQUIRE AN ISOLATION COUPLING. CONTACT THE HRSD ENGINEER FOR DETAILS.
NOTES:

1. FL X PE NIPPLE WITH MEGA-LUG.
2. PE X PE NIPPLES WITH MEGA-LUGS. THE USE OF FOSTER ADAPTERS WILL BE CONSIDERED ON A CASE-BY-CASE BASIS BY HRSD.
3. MJ CAP/PLUG.
   a. JURISDICTION TO OWN TEE AND VALVE UPSTREAM OF HRSD VALVE.
   b. TEE AND JURISDICTION VALVE TO BE SAME SIZE AS EXISTING HRSD VALVE.
   c. ECCENTRIC REDUCERS TO BE INSTALLED AS NEEDED AFTER JURISDICTION VALVE.
   d. HRSD PIPELINES THAT HAVE CORROSION PROTECTION IN PLACE WILL REQUIRE AN ISOLATION COUPLING. CONTACT THE HRSD ENGINEER FOR DETAILS.

STANDARD DESIGN DETAIL

CONNECTION TO EXISTING HRSD VALVE
ADDITIONAL DEVELOPMENT IS POSSIBLE

NOT TO SCALE
NOTES:

1. FL X PE NIPPLE WITH MEGA-LUG.
2. PE X PE NIPPLES WITH MEGA-LUGS. THE USE OF FOSTER ADAPTERS WILL BE CONSIDERED ON A CASE-BY-CASE BASIS BY HRSD.
3. MJ CAP/PLUG.
   a. JURISDICTION TO OWN TEE AND VALVES UPSTREAM OF HRSD VALVE.
   b. TEE AND JURISDICTION VALVES TO BE SAME SIZE AS EXISTING HRSD VALVE.
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   d. HRSD PIPELINES THAT HAVE CORROSION PROTECTION IN PLACE WILL REQUIRE AN ISOLATION COUPLING. CONTACT THE HRSD ENGINEER FOR DETAILS.

NOT TO SCALE

STANDARD DESIGN DETAIL

CONNECTION TO EXISTING HRSD VALVE
ADDITIONAL DEVELOPMENT IS IMMINENT

1/2020
NOTES:

1. TAPPING SADDLE PER HRSD STANDARD DETAILS.
2. TAPPING VALVE (8" MIN.) (FL X MJ). TO BE OWNED BY HRSD.
3. FOSTER ADAPTER OR PE X PE NIPPLE WITH MEGA-LUGS USE OF FOSTER ADAPTORS SHALL BE APPROVED BY HRSD ON A CASE BY CASE BASIS.
4. JURISDICTION VALVE.
   a. JURISDICTION VALVE TO BE SAME SIZE AS HRSD VALVE.
   b. ECCENTRIC REDUCERS TO BE INSTALLED AS NEEDED AFTER JURISDICTION VALVE.
   c. HRSD PIPELINES THAT HAVE CORROSION PROTECTION IN PLACE WILL REQUIRE AN ISOLATION COUPLING. CONTACT THE HRSD ENGINEER FOR DETAILS.
NOTES:

1. TAPPING SADDLE PER HRSD STANDARD DETAILS.
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3. FOSTER ADAPTERS OR PE X PE NIPPLES WITH MEGA-LUGS USE OF FOSTER ADAPTORS SHALL BE APPROVED BY HRSD ON A CASE BY CASE BASIS.
4. MJ CAP/PLUG.
   a. JURISDICTION TO OWN TEE AND VALVE UPSTREAM OF HRSD VALVE.
   b. TEE AND JURISDICTION VALVE TO BE SAME SIZE AS HRSD VALVE.
   c. ECCENTRIC REDUCERS TO BE INSTALLED AS NEEDED AFTER JURISDICTION VALVE.
   d. HRSD PIPELINES THAT HAVE CORROSION PROTECTION IN PLACE WILL REQUIRE AN ISOLATION COUPLING. CONTACT THE HRSD ENGINEER FOR DETAILS.
NOTES:

1. TAPPING SADDLE PER HRSD STANDARD DETAILS.
2. TAPPING VALVE (8" MIN.) (FL X MJ). TO BE OWNED BY HRSD.
3. FOSTER ADAPTERS OR PE X PE NIPPLES WITH MEGA-LUGS USE OF FOSTER ADAPTORS SHALL BE APPROVED BY HRSD ON A CASE BY CASE BASIS.
4. MJ CAP/PLUG.
   a. JURISDICTION TO OWN TEE AND VALVES UPSTREAM OF HRSD VALVE.
   b. TEE AND JURISDICTION VALVE TO BE SAME SIZE AS HRSD VALVE.
   c. ECCENTRIC REDUCERS TO BE INSTALLED AS NEEDED AFTER JURISDICTION VALVE.
   d. HRSD PIPELINES THAT HAVE CORROSION PROTECTION IN PLACE WILL REQUIRE AN ISOLATION COUPLING. CONTACT THE HRSD ENGINEER FOR DETAILS.

NOT TO SCALE

STANDARD DESIGN DETAIL

NEW WET TAPS
ADDITIONAL DEVELOPMENT IS IMMINENT

DRAWING NO.
305

SHEET
1 OF 1

DATE
1/2020
NOTES:

1. CHECK VALVE MUST BE INSTALLED ON PRIVATE DISCHARGE FORCE MAIN, INSIDE OF FRAME & COVER VB 7160 FROM CAPITAL FOUNDRY OF VIRGINIA.

2. ALL FITTINGS INSIDE OF HRSD VALVE VAULT SHALL BE 2” NPT.

NOT TO SCALE
NOTES:
1. VALVE VAULT TO BE SUPPLIED BY CAPITAL FOUNDRY OF VIRGINIA, INC. (MODEL #MBX-1) OR APPROVED EQUAL.
2. ALL GRAY IRON CASTINGS SHALL CONFORM TO LATEST EDITION OF ASTM A-48, CLASS 30 AND SHALL BE OF UNIFORM QUALITY.
3. ALL CASTING DIMENSIONS SHALL HAVE A TOLERANCE OF 1/8"±.
4. ALL CASTINGS SHALL BE CLEANED BY SHOT BLASTING AND HAND CHIPPING UTILIZING STANDARD INDUSTRY PRACTICES PRIOR TO SHOP APPLICATION OF ASPHALTIC COATING, BY DIPPING.
PLAN: LID

SECTION D–D

SECTION C–C

NOT TO SCALE

STANDARD DESIGN DETAIL

VAULT LID FOR 2" HRSD VALVE
NOTES:
1. TRACER WIRE CAN BE TERMINATED INSIDE OF VALVE VAULT.
2. ALL FITTINGS AND PIPING TO BE BRASS WITH THREADED ENDS WITHIN THE VALVE VAULT.
3. OPERATION OF HRSD VALVES SHALL BE DONE BY HRSD PERSONNEL ONLY.
4. DEVIATION FROM THIS DETAIL WILL REQUIRE APPROVAL FROM HRSD.
PRIVATELY OWNED GRINDER PIT (MUST HAVE CHECK VALVE FOLLOWED BY ISOLATION VALVE ON DISCHARGE PIPING)

LOCATOR BOX CASTING, TOP OF LOCATOR BOX SHALL BE FLUSH WITH GRADE. SEE HRSD STANDARD DETAIL 15A

EXPOSED BARE COPPER WIRE AWG–10 WRAPPED AROUND CLAMP

CLAMP SHOULD BE ATTACHED TO THE SIDE OF LOCATOR BOX

TRACER WIRE AWG–10 SOLID COPPER WIRE W/POLYETHYLENE INSULATION

LOCATOR BOX NOT TO SCALE

ALL BURIED PIPING SHALL BE HDPE DR–26, IF FUSION IS REQUIRED IT SHALL BE BUTT FUSION WELDED

PIPE DIAMETER SHALL BE MAX 4"

SEE FORCE MAIN DETAIL FOR EITHER EXTERNAL/INTERNAL DROP

TRACER WIRE AWG–10 SOLID COPPER WIRE W/POLYETHYLENE INSULATION SHALL BE TAPE AT A MAXIMUM INTERVAL OF 4'.

HRSD MANHOLE

*IF CONNECTING TO HRSD FORCE MAIN REFERENCE HRSD STANDARD DETAIL 328

NOT TO SCALE

STANDARD DESIGN DETAIL

PRIVATE FORCE MAIN TO HRSD ASSET
NOTE:
1. TAP WILL BE COMPLETED BY HRSD APPROVED CONTRACTOR. CONTRACTOR IS RESPONSIBLE FOR CONFIRMING PIPE MATERIAL AND SIZE, PROCURING CORRECT MATERIAL, EXCAVATION AND TRENCH SHORING, BACKFILLING AND INSTALLING HRSD VALVE AND ALL ASSOCIATED FITTINGS AND PIPE INSTALLATION.
2. TYPE IV BEDDING IS REQUIRED FOR THIS CONNECTION. SEE HRPD C DETAIL EW_01
3. REFER TO STANDARD DETAIL 306B FOR VAULT DETAIL
4. SERVICE CONNECTION SHALL BE ROMAC SERVICE SADDLE 202

STANDARD DESIGN DETAIL

NEW GRINDER PIT CONNECTION TO EXISTING HRSD FM

NOT TO SCALE

HRSD

DRAWING NO. 309

1 OF 1

DATE 1/2020
NOTE:
1. SEE SPECIFICATIONS FOR HORIZONTAL OR VERTICAL POSITION AND BY-PASS REQUIREMENT.
2. EXTENSION STEMS ARE NOT ACCEPTABLE.
3. INSTALL CRIBBING AS NECESSARY.
SEE HRSD DETAILS 328 & 329 FOR VALVE BOX & RISER DETAIL

GATE VALVE

SUPPORT VALVE ON 6" MIN #57 STONE (GREATER DEPTHS MAY BE REQUIRED IN POOR SOILS). EXTEND BASE BEYOND VALVE 3' IN ALL DIRECTIONS.

NOTE:
1. SEE SPECIFICATIONS FOR HORIZONTAL OR VERTICAL POSITION AND BYPASS REQUIREMENT.
2. EXTENSION SYSTEMS ARE NOT ACCEPTABLE.
3. INSTALL CRIBBING AS NECESSARY.
4. THIS DETAIL ONLY APPLICABLE FOR VALVES 14' AND SMALLER.
5. MINIMUM VALVE SIZE SHALL BE 8".

NOT TO SCALE

STANDARD DESIGN DETAIL

VERTICAL GATE VALVE
MINIMUM WEIGHTS:
COVER = 22 LBS.
FRAME = 110 LBS.

SECTION A-A

NOTES:
1. RISER TO BE 8" C900 PVC OR 8" SCH. 80 PVC. (ONE PIECE).
   [BELL END PIECE SHALL NOT BE ALLOWED.]
2. TOLERANCE TO BE +/- .125" FOR ALL DIMENSIONS.
3. CASTING TO BE SHOT BLASTED.
4. CASTING TO BE ASTM A-48 CLASS 30.
5. JACK UP RINGS NOT ACCEPTABLE.
6. TOP OF RISER PIPE SHALL BE 5" BELOW THE LIP FOR THE CASTING LID.
7. RISER SHALL BE CENTERED ON THE FORCE MAIN AND SHALL BE PLUMB AND STRAIGHT.

NOT TO SCALE
MINIMUM WEIGHTS:
COVER = 25 LBS.
FRAME = 75 LBS.

EXISTING
GRADE OR
PAVEMENT

12"

10-1/2"

1/2"

1-3/4"

3-1/2"

CLEAR OPENING

8"

8"

NOT TO SCALE

NOTES:
1. RISER TO BE 8" C900 PVC OR 8" SCH. 80 PVC. (ONE PIECE).
   BELL END PIECE SHALL NOT BE ALLOWED.
2. TOLERANCE TO BE +/- .125" FOR ALL DIMENSIONS.
3. CASTING TO BE SHOT BLASTED.
4. CASTING TO BE ASTM A-48 CLASS 30.
5. JACK UP RINGS NOT ACCEPTABLE.
6. TOP OF RISER PIPE SHALL BE 5" BELOW THE LIP FOR THE CASTING LID.
7. RISER SHALL BE CENTERED ON THE NUT AND SHALL BE PLUMB AND STRAIGHT.
MINIMUM WEIGHTS:
COVER = 22 LBS.
FRAME = 110 LBS.

FOR ADJUSTMENT, REMOVE FRAME AND ADD CRUSH AND RUN STONE AS NECESSARY TO ADJUST TOP TO GRADE. IF INSERTION IS LESS THAN 2", CONTRACTOR MUST DIG DOWN ON VALVE AND ADJUST RISER PIPE ON VALVE BY ADDING STONE OR NEW 8" PIPE OF APPROPRIATE LENGTH.

NOT TO SCALE

STANDARD DESIGN DETAIL

VALVE RISER ADJUSTMENT
NOTES:

1. VALVE BOXES ARE TO BE ALIGNED TRUE AND SQUARE WITH EDGE OF PAVEMENT.
2. STORM PIPE SHALL EXTEND A MINIMUM OF FOUR (4) FEET TO EITHER SIDE OF VALVE BOX.
3. FILL MATERIAL SHALL CONFORM TO RIGHT OF WAY PERMIT REQUIREMENTS.
4. SLOPE FILL MATERIAL TO DRAIN AWAY FROM VALVE BOX TOWARDS DITCH.
5. MAINTAIN 24 INCH MINIMUM HORIZONTAL DISTANCE BETWEEN STORM PIPE AND VALVE RISER PIPE.
6. WHEN VALVE FACES AWAY FROM DITCH, MAINTAIN 30 INCH MINIMUM HORIZONTAL DISTANCE BETWEEN STORM PIPE AND FORCE MAIN.
7. STORM PIPE SHALL BE SIZED IN ACCORDANCE WITH RIGHT OF WAY PERMIT.
8. UPON COMPLETION OF VALVE BOX AND STORM PIPE INSTALLATION, CONTACT HRSD INSPECTOR FOR FINAL INSPECTION.
2" BRONZE PLUG WITH SQ. TOP (1-1/4"

SEE HRSD AIR VENT AND COVER DETAIL #354

2"(MIN) – 6"(MAX)

3" MINIMUM CLEARANCE, SUCH THAT 2" BALL VALVE BODY & HANDLE ARE BELOW TOP OF BRICK (OR CONCRETE ELEVATION RINGS)

CLASS "B" CONCRETE (2,500 PSI) 48" DIA OR 48" SQ MIN

6" PVC SLEEVE (PACK WITH PEA GRAVEL)

MUeller 2" CORP STOP CAT # H10045N

SEE NOTE 2

FORCE MAIN

NOTE: HANDLE AS SHOWN IS VALVE INSTALLED IN OPEN POSITION

JCM SERVICE SADDLE WITH 2" THREADED OUTLET (MUeller CC THREADS). STYLE 404 FOR PIPE 24" DIA AND LESS, STYLE 418 FOR PIPE GREATER THAN 24", AND STYLE 425 FOR ALL PCCP ONLY. NO SUBSTITUTIONS WILL BE ACCEPTED WITHOUT HRSD OPERATIONS APPROVAL.

NOTES:
1. CONSTRUCT AIR VENT USING REQUIRED NUMBER OF COURSES OF HARD SOUND COMMON BRICK LAID ON EDGE OR CONCRETE ELEVATION RINGS AS MANUFACTURED BY NANSEMOND PRE-CAST CONCRETE CO, INC. MODEL AV-ER-CH AND AV-BS.
2. 2" TAP FOR AIR VENT SHALL BE STANDARD SADDLE TAP.
3. SERVICE SADDLE COATING SHALL BE FUSION BONDED EPOXY. SADDLE STRAPS AND HARDWARE SHALL BE STAINLESS STEEL. STAINLESS STEEL SHALL BE MINIMUM 304.
4. JACK UP RINGS BETWEEN THE FRAME AND COVER NOT ACCEPTABLE.
5. PARGE BRICK WORK OR CONCRETE ELEVATION RINGS WITH GROUT INSIDE AND OUT, CONTINUE ONTO CASTING.

NOT TO SCALE

STANDARD DESIGN DETAIL

AIR VENT
PROPOSED GRADE

REQUESTED LIFT OF ADJUSTMENT

EXISTING GRADE

EXISTING CASTING

EXISTING MORTAR BED

EXISTING BRICK OR PRECAST RINGS (SEE HRSD STD DETAIL #351)

B"

CORPORATION STOP

*SEE SHEET 2 FOR NOTES

NOT TO SCALE

STANDARD DESIGN DETAIL

AIR RELEASE VALVE BOX ADJUSTMENT
GENERAL ADJUSTMENT NOTES:
1. REFER TO HRSD STD. DETAIL #351 FOR TYPICAL AIR VENT VALVE BOX CONSTRUCTION.
2. REFER TO HRSD STD. DETAIL #354 FOR AIR VENT VALVE BOX CASTING LID AND FRAME (IF CASTING ON SITE IS NOT AS SHOWN IN DETAIL #354, NOTIFY HRSD ENGINEER).
3. TOP OF VALVE’S BRONZE PLUG SHALL BE NO CLOSER TO BOTTOM OF FRAME THAN TWO (2") INCHES NOR FARTHER THAN SIX (6") INCHES.
4. BED CAST IRON FRAMEoundly in mortar grout.
5. PARGE ENTIRE VALVE BOX (INSIDE & OUT) WITH GROUT.

LOWERING TO GRADE:
6. EXCAVATE TO CORPORATION STOP AND CLOSE IT.
7. REMOVE AND REPLACE BALL VALVE AND RISER PIPE.
8. OPEN CORPORATION STOP 100%. MODIFY/RECONSTRUCT BOX AS REQUIRED.

RAISING OF GRADE:
9. WHEN ADJUSTMENT "A" DOES NOT VIOLATE NOTE #3, ABOVE, CASTING MAY BE LIFTED BY REMOVING EXISTING MORTAR BED AND ADDING COURSES OF HARD, SOUND, COMMON BRICK OR CONCRETE ELEVATION RINGS.
10. WHEN ADJUSTMENT "A" VIOLATES NOTE #3, FOLLOW STEPS 6–8 ABOVE.
NOTES:

1. AIR VENT LID TO MATCH EXISTING SHOULDER.
2. 30" MIN. SHALL BE MAINTAINED BETWEEN STORM PIPE & FORCE MAIN.
   INCREASE DITCH AWAY FROM ROAD IF REQUIRED.
3. MINIMUM DISTANCE TO EXTEND STORM PIPE FROM HYDRAULIC BOX SHALL BE 4 FEET.
4. SLOPE FILL MATERIAL TO DRAIN AWAY FROM AIR RELEASE VENT BOX AND INTO DITCH.

PLAN
NOT TO SCALE

STANDARD DESIGN DETAIL
ROADSIDE DITCH—AIR VENT
NOTES
1. MACHINE ALL SEATING SURFACES ON BOTH COVER & FRAME
2. TOLERANCE TO BE ±0.125" FOR ALL DIMENSIONS.
3. CASTING TO BE SHOT BLASTED.
4. CASTING TO BE ASTM A-48 CLASS 30.
5. MINIMUM WEIGHTS:
   FRAME - 114 LBS.
   COVER - 50 LBS.
6. JACK UP RINGS NOT ACCEPTABLE.

STANDARD DESIGN DETAIL
AIR VENT FRAME & COVER

DRAWING NO.
Sheet 1 of 1
Date 1/2020
NOTES:

1. FULL BACK SADDLES ONLY, EXCEPT IN ACCORDANCE WITH PIPE MANUFACTURER’S RECOMMENDATIONS FOR SP-5 AND SP-12 (SEE H.R.S.D. STANDARD DESIGN DETAIL #377 – TAPPING SADDLE FOR CONC. CYLINDER PIPE).

2. THE NUMBER, SPACING, SIZE AND INSTALLATION OF BOLTS SHALL BE IN ACCORDANCE WITH SADDLE MANUFACTURER’S RECOMMENDATIONS.

3. CONTRACTOR SHALL SUPPLY TO HAMPTON ROADS SANITATION DISTRICT SYSTEMS ENGINEER THREE (3) CLEAR COPIES OF TAPPING SADDLE MANUFACTURER’S CATALOG CUT AND INSTALLATION INSTRUCTIONS 14 DAYS PRIOR TO INSTALLATION OF SADDLE.

4. TAPPING VALVE TO MEET ANSI/AWWA STANDARDS C500, C509 OR C515.

5. ALL BOLTS, NUTS AND WASHERS SHALL BE STAINLESS STEEL.

6. SADDLE COATING SHALL BE FUSION BONDED EPOXY.

7. TAPPING SADDLE MANUFACTURER SHALL BE SMITH–BLAIR STYLE 622 OR HRSD APPROVED EQUAL.

NOT TO SCALE
NOTES:

1. Banded tapping saddles only accepted on SP-5 & SP-12 pipe per pipe manufacturer's recommendations (see standard design detail #12 – standard tapping saddle for cast iron pipe, ductile iron, RC, & PVC pipe).
2. The number, spacing, size and installation of bands shall be in accordance with saddle manufacturer's recommendations.
3. All tapping saddles shall receive 4", 3000 psi concrete cover with 6"x6"x6" gauge welded wire reinforcement.
4. Contractor shall supply to Hampton Roads Sanitation District Systems Engineer Three (3) clear copies of tapping saddle manufacturer's catalog cut and installation instructions 14 days prior to installation of saddle.
5. Tapping saddle manufacturer shall be Smith-Blair Style 625 or JCM Style 415.

NOT TO SCALE

STANDARD DESIGN DETAIL

TAPPING SADDLE FOR CONCRETE CYLINDER PIPE
2" BRASS RISER, ONE PIECE, W/VENT CAP FOR LEAK DETECTION. RISER, BOX, AND BEDDING ARE IDENTICAL TO WHAT'S SHOWN IN THE AIR VENT DETAIL #06. USE ONLY AT THE LOW END OF THE TUNNEL.

STEEL CASING (SIZE & THICKNESS SPECIFIED IN SPECS.)

USE OIL PIPE VENT CAP W/INTEGRATED SCREEN

2" WELDED COUPLING

CARRIER PIPE

(RESTRAINED JOINT)

STAINLESS STEEL OR POLYETHYLENE CASING SPACER

PREMOLDED MATERIAL AROUND PIPE (HEAVY RUBBER, WATER STOP, OR EXPANSION JOINT MATERIAL)

BRICK & GROUT BULKHEAD

NOTE: INSTALL CASING PIPE AS SHOWN ON DRAWINGS OR MIN. 4' BEYOND EDGE OF PAVEMENT.

END ELEVATION

PARTIAL SECTION

NOT TO SCALE

STANDARD DESIGN DETAIL

STEEL CASING PIPE DETAIL
NOTES:

A. STAINLESS STEEL SPACERS

Spacers shall be bolt on style with a two piece shell made from T-304 stainless steel of a minimum 14 gauge thickness. The shell shall be lined with a ribbed P.V.C. sheet of a 0.090" thickness that overlaps the edges. Runners made from UHMW polymer, shall be attached to risers at appropriate positions to properly locate the carrier within the casing and to ease installation. Risers to be made from T-304 stainless steel of a minimum 14 gauge thickness and shall be attached to the shell by Mig welding. All welds shall be fully passivated. All fasteners shall be made from T-304 stainless steel casing spacers shall be model CCS as manufactured by Cascade Waterworks Manufacturing Company of Yorkville, IL. or approved equal.

B. HIGH DENSITY POLYETHYLENE

Spacers shall be projection type, totally non-metallic constructed of preformed sections of high-density polyethylene and ISO 9002 certified for strength and quality. Spacers shall provide support around the periphery of the pipe. The minimum number of projections around the circumference shall be total number of pipe diameter inches. Spacers shall use double back tape to fasten tightly onto the carrier pipe. Spacer span shall be in accordance with the manufacturer’s recommendations to prevent sagging of the pipe. The maximum load shall not exceed manufacturer’s recommendations. Spacers shall have minimum height that clears the pipe bell or as otherwise indicated on the plans. Spacers shall be manufactured by RACI Spacers North America Inc. or approved equal.

C. SPACER WIDTH AND PLACEMENT INTERVALS

In all instances spacer should be placed so as to support the carrier within 1/2 of the ends of the pipe. Consult pipe manufacturer for recommendations on spacer width and additional placement intervals.
MJ LONG BODY SLEEVE

FORCE MAIN

24” MIN.

EXISTING CONCRETE FORCE MAIN

RESTRAINED CONNECTIONS

D.I. TO CONCRETE TRANSITION PIECE

GROUT BAND

A

B

M.J.S. O.D.

16”
18”
20”
24”
30”
36”
42”
48”
30.0”
30.0”
30.0”
30.0”
30.0”
30.0”
30.0”
30.0”
17.4”
19.5”
21.6”
25.8”
32.0”
38.3”
44.5”
50.8”

GROUT BAND

BELL ADAPTER

"B" LAYING LENGTH

"A" PIPE DIAMETER
M.J.S. O.D.

EXISTING CONCRETE FORCE MAIN

NOT TO SCALE

STANDARD DESIGN DETAIL

D.I. M.J. SPIGOT TO
CONCRETE TRANSITION ADAPTER (MALE)
NOTES:

1. THE CENTERLINE OF THE 4" OUTLET FLANGE SHALL BE LOCATED AT THE 3 O’CLOCK POSITION.
<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DOUBLE WALL FIBERGLASS STORAGE TANK</td>
</tr>
<tr>
<td>2</td>
<td>42&quot; FIBERGLASS ATTACHED MANWAY</td>
</tr>
<tr>
<td>3</td>
<td>42&quot; WATERTIGHT FIBERGLASS ATTACHED MANWAY EXTENSION</td>
</tr>
<tr>
<td>4</td>
<td>MONITORING WELL</td>
</tr>
<tr>
<td>5</td>
<td>FIBERGLASS HOLD DOWN STRAP W/ TURNBUCKLE ASSEMBLY (TYPICAL)</td>
</tr>
<tr>
<td>6</td>
<td>CAST IN PLACE CONCRETE SLAB</td>
</tr>
<tr>
<td>7</td>
<td>TANK MONITORING SYSTEM PROBE</td>
</tr>
<tr>
<td>8</td>
<td>DISTINGUISHING LEAK SENSOR</td>
</tr>
<tr>
<td>9</td>
<td>NONDISTINGUISHING LEAK SENSOR</td>
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<tr>
<td>10</td>
<td>LEVEL PROBE</td>
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<tr>
<td>11</td>
<td>FIVE GALLON SPILL FILL MANHOLE</td>
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<tr>
<td>12</td>
<td>VAPOR RECOVERY CONNECTION</td>
</tr>
<tr>
<td>13</td>
<td>TANK FILL CONNECTION</td>
</tr>
<tr>
<td>14</td>
<td>FUEL OIL SUPPLY DROP TUBE</td>
</tr>
<tr>
<td>15</td>
<td>OVERFILL PREVENTION VALVE</td>
</tr>
<tr>
<td>16</td>
<td>MONITORING MANHOLE</td>
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<tr>
<td>17</td>
<td>SECONDARY TANK OPENING FOR LEAK SENSOR</td>
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<tr>
<td>18</td>
<td>EXTRACTOR ASSEMBLY WITH FOOT VALVE</td>
</tr>
<tr>
<td>19</td>
<td>BALL FLOAT</td>
</tr>
<tr>
<td>20</td>
<td>2&quot; DOUBLE WALL VENT PIPING</td>
</tr>
<tr>
<td>21</td>
<td>DOUBLE WALL PRODUCT SUPPLY PIPING</td>
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<tr>
<td>22</td>
<td>DOUBLE WALL PRODUCT RETURN PIPING</td>
</tr>
<tr>
<td>23</td>
<td>FUEL OIL RETURN DROP TUBE</td>
</tr>
<tr>
<td>24</td>
<td>WIRING CONNECTION IN CONDUIT</td>
</tr>
<tr>
<td>25</td>
<td>FUEL OIL RETURN CONNECTION</td>
</tr>
<tr>
<td>26</td>
<td>SECONDARY FUEL SUPPLY CONNECTION</td>
</tr>
<tr>
<td>27</td>
<td>FUEL OIL SUPPLY DROP TUBE</td>
</tr>
<tr>
<td>28</td>
<td>TANK FILL DROP TUBE</td>
</tr>
<tr>
<td>29</td>
<td>CONCRETE APRON</td>
</tr>
</tbody>
</table>
UNDERGROUND FUEL TANK STANDARD

1. 1,000 gallon fiberglass double wall primary underground storage fuel tank with
   2. underground fuel monitoring system.
5. 3. Additional spill detection and alarm devices required.
8. 4. Fuel piping shall be provided with the tank, sized and
10. 5. Frost protection system shall be provided with the underground fuel tank.

FUEL TANK

1. The fuel tank shall be installed in accordance with the standard design detail.
4. The fuel tank shall be installed in accordance with the standard design detail.
7. The fuel tank shall be installed in accordance with the standard design detail.
10. The fuel tank shall be installed in accordance with the standard design detail.

FUEL PUMP

1. The fuel pump shall be installed in accordance with the standard design detail.
4. The fuel pump shall be installed in accordance with the standard design detail.
7. The fuel pump shall be installed in accordance with the standard design detail.
10. The fuel pump shall be installed in accordance with the standard design detail.

PUMP ASSEMBLY

1. The pump assembly shall be installed in accordance with the standard design detail.
4. The pump assembly shall be installed in accordance with the standard design detail.
7. The pump assembly shall be installed in accordance with the standard design detail.
10. The pump assembly shall be installed in accordance with the standard design detail.

STANDARD DESIGN DETAIL

1. The design shall be in accordance with the standard design detail.
4. The design shall be in accordance with the standard design detail.
7. The design shall be in accordance with the standard design detail.
10. The design shall be in accordance with the standard design detail.
NOTES:
1. MATERIAL, CAST IRON, GRADE TO BE SPECIFIED ON PURCHASE ORDER.
2. ALL RADIi SHALL BE 1/8" MINIMUM.
3. ESTIMATED WEIGHT 37#.

NOTES:
1. ALL INTERNAL EDGES SHALL HAVE A 1/8" RADIUS.
2. ALL EXTERNAL RADIi 1/8" TO 1/2" AS NEEDED FOR CASTING RELIEF.
3. MATERIAL, CAST IRON, GRADE TO BE SPECIFIED ON PURCHASE ORDER.
4. ESTIMATED WEIGHT 12#.
5. RISER TO BE FILLED WITH PEA GRAVEL.

STANDARD DESIGN DETAIL
CATHODIC PROTECTION TEST STATION
NOTES:

1. Locality to own all piping, fittings, valves, and cathodic protection systems upstream of HRSD valve.
2. Isolation piece shall be approximately 24" long.
TERMINAL BOARD LAYOUT. 
SEE INSERT BELOW

TWO (2) #10 BLACK THHN WIRES TO PIPE

SEE THERMITE WELD DETAIL

UNDERGROUND PIPELINE

REFERENCE ELECTRODE

# 8 HEADER CABLE

AWG #12 THW

TOP OF ANODES MUST BE 
BELOW CENTERLINE OF PIPE

17-LB MAGNESIUM ANODE 
(NUMBER OF ANODES TBD)

5 FT. (TYP)

TERMINAL BOARD

0.1 Ω SHUNT (YELLOW)

2 - ANODE LEAD WIRES

TERMINAL BOARD LAYOUT

24"x24"x8" CONCRETE 
TEST STATION PAD

FLUSH TO GRADE TEST 
STATION W/ CAST IRON LID

AWG #10 BLACK THWN

AWG #10 BLACK THWN

AWG #14 BLUE HMWPE

1 FT. (MAX)

AWG #8 HMWPE ANODE 
HEADER CABLE (RED)

SEE ANODE HEADER CABLE SPLICE
DETAIL (TYP.)

COPPER/COPPER 
SULFATE REFERENCE
ELECTRODE

10 FT. (MIN)

SECTION A-A

17-LB. MAGNESIUM 
ANODES INSTALLED TO 
DEPTH OF PIPELINE 
(NUMBER OF ANODES TBD)

NOT TO SCALE

STANDARD DESIGN DETAIL

ANODE TEST STATION

HRSD
NOTES:

1. WHEN TEST STATION IS OUT OF THE ROAD, USE A GREEN RISER PROTECTED BY BOLLARDS.
NOTES:
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NOTES:
1. WHEN TEST STATION IS OUT OF THE ROAD, USE A GREEN RISER PROTECTED BY BOLLARDS.
3 - LAYERS OF HALF LAPPED RUBBER TAPE (SCOTCH 23)

3 - LAYERS OF HALF LAPPED VINYL TAPE (SCOTCH 33)

COAT ENTIRE SPLICE WITH ELECTRICAL COATING COMPOUND (SCOTCHKOTE)

COPPER CRIMP CONNECTOR (BURNDY YC8C8)

ANODE LEAD WIRE

AWG #8 HMWPE ANODE HEADER CABLE

AWG #8 HMWPE ANODE HEADER CABLE

3" MIN 3" MIN

NOT TO SCALE

STANDARD DESIGN DETAIL

ANODE HEADER CABLE SPLICE
EXOTHERMIC WELDING INSTRUCTIONS

1. REMOVE PIPE COATING APPROXIMATELY 4" DIAMETER SPOT FROM STRUCTURE.
2. CLEAN AREA APPROXIMATELY 2" DIAMETER TO BRIGHT METAL.
3. REMOVE 1–1/4" OF INSULATION FROM END OF WIRE.
4. WELD CONDUCTOR TO PIPE. USE APPROPRIATE GRAPHITE MOLD AND CARTRIDGE CHARGE SIZE.
5. TEST THE EXOTHERMIC WELD CONNECTION BY STRIKING THE CONNECTION SEVERAL BLOWS ON THE SIDE USING A ONE POUND HAMMER. TOP OF WELD MAY BE HAMMERED FLAT IF REQUIRED.
6. REFER TO MANUFACTURER FOR RECOMMENDED CARTRIDGE SIZE.
NOTES:

1. AFT ER ASSEMBLY, TEST TO VERIFY THAT ISOLATION IS EFFECTIVE. IF ISOLATION IS NOT EFFECTIVE, REPAIR AS NECESSARY AND RETEST. THIS PROCESS SHALL CONTINUE UNTIL ISOLATION IS VERIFIED AS EFFECTIVE.

2. AFTER VERIFYING EFFECTIVE ISOLATION, COAT THE ENTIRE FLANGE AND ALL EXPOSED METAL INCLUDING BOLTS, NUTS, AND WASHERS WITH FOUR COMPONENTS OF DENSO OR TRENTON WAX TAPE COATING SYSTEM. COATING SYSTEM SHALL EXTEND A MINIMUM OF 12 INCHES ON EITHER SIDE OF FLANGE.

3. ALL INSULATING FLANGES TO BE PROVIDED WITH TEST STATIONS.

NOT TO SCALE

STANDARD DESIGN DETAIL

ISOLATING FLANGE KIT
1. TEST STATIONS LOCATED ALONG PAVED ROADWAYS SHALL GENERALLY BE LOCATED 3 FEET OUTSIDE OF THE EDGE OF PAVEMENT IN A NON-PAVED AREA. ROUTE ALL TEST WIRES AT A MINIMUM DEPTH OF 24 INCHES TO THE FINAL TEST STATION LOCATION. TEST STATION LOCATIONS SHALL BE FIELD ADJUSTED.
2. ROUTE WIRES IN 1 INCH PVC CONDUIT TO TEST BOX. INSTALL CABLE WARNING TAPE 18 INCHES ABOVE PVC CONDUIT.
3. MAINTAIN SUFFICIENT SLACK IN THE TEST WIRES SO THAT THE WIRES CAN EXTEND A MINIMUM OF 18 INCHES FROM THE TEST BOX.
4. INSTALL 0.1 OHM SHUNT (YELLOW) BETWEEN TERMINALS #1 AND #4.
5. AT FIRE HYDRANTS, VAULTS, AND OTHER APPURTENANCES, ZINC RIBBON ANODE SHALL BE COILED AROUND FIRE HYDRANT, VAULT, OR APPURtenance.
NOTES:

1. AFTER ASSEMBLY, TEST TO VERIFY THAT ISOLATION IS EFFECTIVE. IF ISOLATION IS NOT EFFECTIVE, REPAIR AS NECESSARY AND RETEST. THIS PROCESS SHALL CONTINUE UNTIL ISOLATION IS VERIFIED AS EFFECTIVE.

2. AFTER VERIFYING EFFECTIVE ISOLATION, COAT THE ENTIRE CORPORATION AND ALL EXPOSED METAL WITH FOUR COMPONENTS OF DENSO OR TRENTON WAX TAPE COATING SYSTEM. COATING SYSTEM SHALL EXTEND A MINIMUM ON EITHER SIDE OF CORPORATION.

NOT TO SCALE
BOND WIRE (TYP.), SEE NOTE #2

TYPICAL MAIN JOINT BOND

BOND WIRE (TYP.), SEE NOTE #2

VALVE

BOND WIRE (TYP.), SEE NOTE #2

MECHANICAL COUPLING

BOND WIRE (TYP.), SEE NOTE #2

BEND, REDUCER, SOLID SLEEVE

NOTES:
1. THERMITE WELD BONDING WIRES TO TOP OF MAIN FITTINGS.
2. WIRE SIZE FOR BONDING JOINTS SHALL BE AS FOLLOWS:

<table>
<thead>
<tr>
<th>MAIN SIZE</th>
<th>WIRE SIZE</th>
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</thead>
<tbody>
<tr>
<td>LARGER THAN 36 INCHES</td>
<td>AWG #2 HMWPE</td>
</tr>
<tr>
<td>16 INCHES TO 36 INCHES</td>
<td>AWG #4 HMWPE</td>
</tr>
<tr>
<td>12 INCHES AND SMALLER</td>
<td>AWG #6 HMWPE</td>
</tr>
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</table>

STANDARD DESIGN DETAIL

DUCTILE IRON PIPE GALVANIC SYSTEM

MAIN BONDING
INSTALL PROTECTIVE REBAR COATING. REFERENCE DETAIL #606 FOR TYPICAL REQUIREMENTS.

EXISTING CONCRETE TO REMAIN.

NEW CONCRETE REBUILD MATERIAL.

FINISHED SURFACE.

INSTALL DISCRETE GALVANIC ANODES AT REBUILD PERIMETER OR AS OTHERWISE SPECIFIED. REFERENCE DETAIL #605 FOR TYPICAL ANODE LAYOUT.

CONDUCTIVE EMBEDDED MORTAR AS REQUIRED. REFERENCE SECTION XX FOR TYPICAL REQUIREMENTS.

1" MIN. CLEAR.

EXCAVATE AS REQUIRED TO OBTAIN MINIMUM CLEAR COVER.

NOTES:
1. REFERENCE SPECIFICATION 03700 FOR CONCRETE REBUILD INFORMATION NOT OTHERWISE SHOWN.
2. GALVANIC ANODE SIZES AND SHAPES MAY VARY.

NOT TO SCALE.
INSTALL PROTECTIVE REBAR COATING.
REFERENCE DETAIL #606 FOR TYPICAL REQUIREMENTS

NEW CONCRETE REBUILD MATERIAL

FINISHED SURFACE

INSTALL DISTRIBUTED GALVANIC ANODES AT REBUILD PERIMETER OR AS OTHERWISE SPECIFIED

EXCAVATE AS REQUIRED TO OBTAIN MINIMUM CLEAR COVER

1" MIN. CLEAR

EXISTING CONCRETE TO REMAIN

NOTES:
1. REFERENCE SPECIFICATION 03700 FOR CONCRETE REBUILD INFORMATION NOT OTHERWISE SHOWN.
2. CONDUCTIVE MORTAR NOT SHOWN. ENCAPSULATE ANODES IN CONDUCTIVE MORTAR AS REQUIRED BY MANUFACTURER.
3. GALVANIC ANODE SIZES AND SHAPES MAY VARY.

NOT TO SCALE

STANDARD DESIGN DETAIL
INSTALLATION OF
DISTRIBUTED GALVANIC ANODES

DRAWING NO. 601
SHEET 1 OF 1
DATE 1/2020
INSTALL DISTRIBUTED GALVANIC ANODES AT REBUILD PERIMETER OR AS OTHERWISE SPECIFIED

INSTALL PROTECTIVE REBAR COATING. REFERENCE DETAIL #606 FOR TYPICAL REQUIREMENTS

TOP OF WALL

NEW CONCRETE REBUILD MATERIAL

EXISTING CONCRETE WALL AND REINFORCEMENT

1" CLR. MIN., TYP.

VARIES F.V.

NOTES:
1. REFERENCE SPECIFICATION 03700 FOR CONCRETE REBUILD INFORMATION NOT OTHERWISE SHOWN.
2. CONDUCTIVE MORTAR NOT SHOWN. ENCAPSULATE ANODES IN CONDUCTIVE MORTAR AS REQUIRED BY MANUFACTURER.
3. GALVANIC ANODE SIZES AND SHAPES MAY VARY.

NOT TO SCALE

STANDARD DESIGN DETAIL

DISTRIBUTED GALVANIC ANODES AT TOP OF WALL
INSTALL ANODE 4” MINIMUM FROM REINFORCEMENT, TYP.

SAW CUT GROOVE FOR ANODE WIRE (OPTION 1)

MANUFACTURER’S REINFORCEMENT CONNECTION

EXISTING REINFORCEMENT

EXCAVATE FOR ANODE WIRE (OPTION 2)

Drilled-in Galvanic Anode

Existing Concrete to Remain

Reference Manufacturer’s Requirements for Drilled Hole Diameter and Depth

Not to Scale

Standard Design Detail

Installation of Drilled-in Galvanic Anodes
NOTES:
1. CONDUCTIVE BEDDED MORTAR SHALL BE INSTALLED FOR ANODES WHEN NEW CONCRETE REBUILD MATERIAL ELECTRICAL RESISTIVITY IS GREATER THAN 15,000 OHM-CM.
2. GALVANIC ANODE SIZES AND SHAPES MAY VARY.

NOT TO SCALE

STANDARD DESIGN DETAIL
CONDUCTIVE MORTAR BRIDGE FOR USE WITH HIGH RESISTIVITY REPAIR MORTARS
NOTES:
1. REFERENCE SPECIFICATION 03700 FOR CONCRETE REBUILD INFORMATION NOT OTHERWISE SHOWN.
2. GALVANIC ANODE SPACING SHALL BE IN ACCORDANCE WITH SPECIFICATION REQUIREMENTS.
3. SEE DETAIL #606 FOR TYPICAL ANODE CONNECTION DETAILS.

NOT TO SCALE

STANDARD DESIGN DETAIL

TYPICAL GALVANIC ANODE LAYOUT
TYPICAL INSTALLATION TO SIDE REBAR

TYPICAL INSTALLATION ABOVE/BELLOW REBAR

TYPICAL INSTALLATION AT REBAR INTERSECTION

NOTES:
1. GALVANIC ANODE SIZES AND SHAPES MAY VARY.

NOT TO SCALE
FINISH SURFACE OF CONCRETE MEMBER

ABRASIVE BLAST CLEAN EXPOSED SURFACES

REMOVE UNSOUND AND, AS NECESSARY, SOUND CONCRETE

SAWCUT PERIMETER 1” DEEP. AVOID DAMAGING REINFORCEMENT

ABRASIVE BLAST CLEAN EXPOSED STEEL AND COAT WITH CORROSION-INHIBITING MATERIAL

EXISTING CONCRETE TO REMAIN

1” MIN. CLEAR

VARIES

NOT TO SCALE

STANDARD DESIGN DETAIL

REMOVAL OF UNSOUND CONCRETE TYPICAL SECTION
NOTES:
1. GALVANIC ANODES NOT SHOWN FOR CLARITY. REFER TO SPECIFICATION 03800 FOR REQUIREMENTS.
NOTES:
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NOTES:
1. GALVANIC ANODES NOT SHOWN FOR CLARITY. REFER TO SPECIFICATION 03800 FOR REQUIREMENTS.
### 10% Section Loss

<table>
<thead>
<tr>
<th>BAR NO.</th>
<th>DIAMETER IN.</th>
<th>AREA IN.²</th>
<th>BAR DIAMETER WITH 10% SECTION LOSS (IN.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CIRCUMFERENTIAL LOSS</td>
</tr>
<tr>
<td>3</td>
<td>0.375</td>
<td>0.110</td>
<td>0.356</td>
</tr>
<tr>
<td>4</td>
<td>0.500</td>
<td>0.196</td>
<td>0.474</td>
</tr>
<tr>
<td>5</td>
<td>0.625</td>
<td>0.307</td>
<td>0.593</td>
</tr>
<tr>
<td>6</td>
<td>0.750</td>
<td>0.442</td>
<td>0.712</td>
</tr>
<tr>
<td>7</td>
<td>0.875</td>
<td>0.601</td>
<td>0.830</td>
</tr>
<tr>
<td>8</td>
<td>1.000</td>
<td>0.785</td>
<td>0.949</td>
</tr>
<tr>
<td>9</td>
<td>1.128</td>
<td>0.999</td>
<td>1.070</td>
</tr>
<tr>
<td>10</td>
<td>1.270</td>
<td>1.267</td>
<td>1.205</td>
</tr>
<tr>
<td>11</td>
<td>1.410</td>
<td>1.561</td>
<td>1.338</td>
</tr>
</tbody>
</table>

- CIRCUMFERENTIAL LOSS
- ONE-SIDED LOSS

**Standard Design Detail**

**Reinforcing Section Loss Table**
SUPPLEMENTAL REINFORCING BAR TO MATCH EXISTING

EXISTING REINFORCING BAR WITH 10% OR MORE SECTION LOSS OR DESIGNATED BY ENGINEER TO BE SUPPLEMENTED

PLAN OR ELEVATION

EXTENT OF CONCRETE REMOVAL AREA

NOT TO SCALE

STANDARD DESIGN DETAIL

LAP SPLICE - OPTION 1
## Tension Lap Length - Class B Splice - Top & Bottom Bars

(Grade 60 Uncoated Bars & Normal Weight Concrete)

<table>
<thead>
<tr>
<th>BAR NO.</th>
<th>fc=4,000PSI</th>
<th>fc=5,000PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TOP</td>
<td>BOT</td>
</tr>
<tr>
<td>3</td>
<td>15&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4</td>
<td>20&quot;</td>
<td>15&quot;</td>
</tr>
<tr>
<td>5</td>
<td>24&quot;</td>
<td>19&quot;</td>
</tr>
<tr>
<td>6</td>
<td>29&quot;</td>
<td>22&quot;</td>
</tr>
<tr>
<td>7</td>
<td>42&quot;</td>
<td>33&quot;</td>
</tr>
<tr>
<td>8</td>
<td>48&quot;</td>
<td>37&quot;</td>
</tr>
<tr>
<td>9</td>
<td>60&quot;</td>
<td>46&quot;</td>
</tr>
<tr>
<td>10</td>
<td>74&quot;</td>
<td>57&quot;</td>
</tr>
<tr>
<td>11</td>
<td>89&quot;</td>
<td>68&quot;</td>
</tr>
</tbody>
</table>

### NOTES:

1. This table is based on ACI 318-11, Equation 12-1 with a minimum clear cover of 2 inches and minimum center-to-center bar spacing of 5 inches.

2. "Top" bars are horizontal reinforcing bars with more than 12 inches of fresh concrete cast below the bars at the development length. All other bars are considered "bot" bars.

3. For epoxy coated or zinc and epoxy dual coated bars, multiply the table values by 1.5 for bottom bars, or 1.3 for top bars. If the concrete cover is at least 3x the bar diameter and clear spacing at least 6x the bar diameter, multiply values by 1.2.

4. For Class A splice, divide values by 1.3.

5. For lightweight concrete, multiply values by 1.33.
NOTES:
1. GALVANIC ANODES NOT SHOWN FOR CLARITY. REFER TO SPECIFICATION 03800 FOR REQUIREMENTS.
SUPPLEMENTAL REINFORCING BAR TO MATCH EXISTING

EXISTING REINFORCING BAR WITH 10% OR MORE SECTION LOSS OR DESIGNATED BY ENGINEER TO BE SUPPLEMENTED

MIN. EFFECTIVE WELD LENGTH, SEE TABLE

CONCRETE REMOVAL AREA

MIN. EFFECTIVE WELD LENGTH, SEE TABLE

PLAN OR ELEVATION

NOTE 1: CUT BAR 3 INCHES MINIMUM BEYOND SECTION LOSS AND/OR CORROSION AND REMOVE

NOTE 2: SEE DETAILS 637 & 638 FOR SECTIONS

NOTE 3: GALVANIC ANODES NOT SHOWN FOR CLARITY. REFER TO SPECIFICATION 03800 FOR REQUIREMENTS.

NOT TO SCALE

STANDARD DESIGN DETAIL

WELD SPLICE - OPTION 3
WELD SPLICE LENGTHS

<table>
<thead>
<tr>
<th>BAR NO.</th>
<th>MINIMUM EFFECTIVE WELD LENGTH, in.</th>
<th>BAR RADIUS, S, in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>3.5</td>
<td>0.188</td>
</tr>
<tr>
<td>4</td>
<td>4.5</td>
<td>0.250</td>
</tr>
<tr>
<td>5</td>
<td>5.5</td>
<td>0.313</td>
</tr>
<tr>
<td>6</td>
<td>7.0</td>
<td>0.375</td>
</tr>
<tr>
<td>7</td>
<td>8.0</td>
<td>0.438</td>
</tr>
<tr>
<td>8</td>
<td>9.0</td>
<td>0.500</td>
</tr>
<tr>
<td>9</td>
<td>10.0</td>
<td>0.563</td>
</tr>
<tr>
<td>10</td>
<td>11.5</td>
<td>0.625</td>
</tr>
<tr>
<td>11</td>
<td>12.5</td>
<td>0.688</td>
</tr>
</tbody>
</table>

EFFECTIVE THROAT, 0.65
BASED ON E70XX ELECTRODES

NOT TO SCALE

STANDARD DESIGN DETAIL

WELD SPLICE DETAILS - OPTION 3
SECTION C – SINGLE V – GROOVE WELD SPLICE

NOT TO SCALE
NOTES:
PROVIDE SUPPLEMENTAL REINFORCEMENT FOR EXISTING REINFORCEMENT THAT:

1. IS LOCATED 3” OR MORE BELOW NEW CONCRETE SURFACE; OR
2. HAS PROVIDED 2” MINIMUM CLEAR COVER, BUT SPACED GREATER THAN 12” O.C.
3. IS LOCATED 6” OR MORE FROM EXISTING CONCRETE TO REMAIN.
TYPICAL SECTION AT CONC. REMOVAL AREAS — VERTICAL AND OVERHEAD SURFACES

ADHESIVE—GROUTED DOWEL LAYOUT DIMENSIONS

<table>
<thead>
<tr>
<th>DOWEL SIZE</th>
<th>ALLOWABLE TENSION LOAD PER ANCHOR, lbs</th>
<th>MINIMUM EMBEDMENT DEPTH, in.</th>
<th>MINIMUM CONCRETE THICKNESS, in.</th>
<th>MINIMUM EDGE DISTANCE, in.</th>
<th>MINIMUM SPACING, in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{1}{4}$ $\phi$</td>
<td>950</td>
<td>3</td>
<td>6</td>
<td>4.0</td>
<td>8.0</td>
</tr>
<tr>
<td>#3</td>
<td>2,100</td>
<td>4</td>
<td>6</td>
<td>6.0</td>
<td>12.0</td>
</tr>
<tr>
<td>#4</td>
<td>2,800</td>
<td>4</td>
<td>6</td>
<td>6.0</td>
<td>12.0</td>
</tr>
</tbody>
</table>

NOTES:
1. TABLE VALUES FOR SINGLE ANCHORS IN TENSION ONLY; REINFORCING STEEL YIELD STRENGTH OF 60 KSI; THREADED RODS A276, TYPE 316, YIELD STRENGTH OF 30 KSI; HILTI HIT-HY 200 OR HILTI HIT-RE 500 V3 ADHESIVE, 4,000 PSI CONCRETE.
2. IF CONDITIONS ARE DIFFERENT THAN THOSE LISTED ABOVE, TABLE VALUES SHALL BE ADJUSTED BY A LICENSED PROFESSIONAL ENGINEER BASED ON ACTUAL DOWEL SYSTEM USED AND REQUIRED DOWEL CAPACITY.

NOT TO SCALE

STANDARD DESIGN DETAIL

ADHESIVE—GROUTED DOWEL LAYOUT
DO NOT EXTEND DEMOLITION BEHIND EMBED PLATE GREATER THAN 1" WITHOUT APPROVAL OF ENGINEER

EXISTING CONCRETE TO REMAIN

NEW CONCRETE REBUILD MATERIAL

FINISHED SURFACE

EXISTING EMBED PLATE

EXTEND DEMOLITION & REBUILD 1" BEHIND EMBED PLATE; CLEAN PLATE SURFACES & COAT W/ CORROSION-INHIBITING MATERIAL

REINF. NOT SHOWN FOR CLARITY, REF. DETAILS 626 – 628 FOR REQUIREMENTS NOT OTHERWISE SHOWN

NOT TO SCALE

STANDARD DESIGN DETAIL

TYPICAL CONCRETE REBUILD SECTION AT EMBED PLATE
DEMOlITION IS TYP. AT HORIZ. & VERT. LOCATIONS

SAWCUT CONC. 1/2" DEEP AT PERIMETER, CHIP BACK & REMOVE CONC.; IF REINF. IS EXPOSED, REF. DETAILS 626 – 628 FOR TYP. CONCRETE REBUILD REQUIREMENTS

FINISHED SURFACE

1" (MIN.); 2" (MAX)

EXISTING CONCRETE TO REMAIN

EXISTING CONCRETE TO BE REMOVED

DEMOlITION

1/4" DIA. S.S. CONCRETE SCREWS OR 3/8" DIA. BENT S.S. HELICAL ANCHORS, 6" O.C., MAX. EA. WAY W/ 2" MIN. EMBED INTO EXISTING CONC., TYP.

T.O. CONC. EL.=VARIES

16 GA. S.S. WIRE REINF. WRAPPED AROUND CONCRETE SCREWS OR HELICAL ANCHORS, TYP.

NEW CONCRETE REBUILD MATERIAL

3" 6" 3"

TYP. TYP. TYP.

SHALLOW CONCRETE REBUILD – HORIZONTAL

NOT TO SCALE

STANDARD DESIGN DETAIL

SHALLOW DEPTH (2" MAX) CONCRETE REBUILD HORIZONTAL
EXISTING CONCRETE TO REMAIN

1/4" DIA. S.S. CONCRETE SCREWS OR
3/8" DIA. BENT S.S. HELICAL ANCHORS,
6" O.C., MAX. EA. WAY W/ 2" MIN.
EMBED INTO EXISTING CONC., TYP.

16 GA. S.S. WIRE REINF. WRAPPED
AROUND CONCRETE SCREWS
OR HELICAL ANCHORS, TYP.

NEW CONCRETE REBUILD MATERIAL

T.O. CONC.
EL.=VARIATES

2" MIN.
1" (MIN.)
2" (MAX.)

6" TYP.
3" TYP.
1 1/2" MIN., EA. WAY, TYP.

SHALLOW CONCRETE REBUILD – VERTICAL

NOT TO SCALE

STANDARD DESIGN DETAIL

SHALLOW DEPTH (2" MAX) CONCRETE REBUILD

VERTICAL
EXISTING CONCRETE

EXISTING PARTIAL-DEPTH CORED HOLE, ROUGHEN & CLEAN INTERIOR SURFACES BY WIRE BRUSHING, THEN FLUSHING W/ WATER, TYP.

½" MIN. COUNTERSINK, FILL HOLE W/ SPECIFIED EPOXY REBUILD MATERIAL

(2) ½" DIA. X 1'-0" LONG S.S. HELICAL ANCHORS AT EA. CORED HOLE LOCATION W/ 3" MIN. EMBEDMENT INTO EXISTING CONCRETE, TYP.

SPECIFIED CONCRETE REBUILD MATERIAL; INSTALL LIFTS PER MANUFACTURER REQUIREMENTS

REBUILD SECTION

INSTALL ANCHORS AROUND PERIMETER OF CORED HOLE PER FIGURE BELOW, TYP.

REBUILT CORE HOLE, DIA. VARIES; F.V., TYP.

POSITION ANCHORS AROUND PERIMETER OF CORED HOLE 90° FROM ADJACENT ANCHOR

S.S. HELICAL ANCHORS, TYP.

½" MIN. COUNTERSINK, FILL HOLE W/ SPECIFIED EPOXY REBUILD MATERIAL

REBUILD ELEVATION

NOT TO SCALE

STANDARD DESIGN DETAIL

PARTIAL-DEPTH CORE HOLE

CONCRETE REBUILD
HOLE DEPTH VARIES, F.V.

EXISTING CONCRETE

EXISTING FULL-DEPTH CORED HOLE, ROUGHEN & CLEAN INTERIOR SURFACES BY WIRE BRUSHING, THEN FLUSHING W/ WATER, TYP.

½" MIN. COUNTERSINK, FILL HOLE W/ SPECIFIED EPOXY REBUILD MATERIAL

(2) ½" DIA. X 1'-0" LONG S.S. HELICAL ANCHORS AT EA. CORED HOLE LOCATION W/ 3" MIN. EMBEDMENT INTO EXISTING CONCRETE, TYP.

SPECIFIED CONCRETE REBUILD MATERIAL; INSTALL LIFTS PER MANUFACTURER REQUIREMENTS

REBUILD SECTION

INSTALL ANCHORS AROUND PERIMETER OF CORED HOLE PER FIGURE BELOW, TYP.

REBUILD ELEVATION

ANCHOR INSTALLED AT WALL FACE BEYOND, TYP.

INSTALL ANCHORS AT WALL FACE BEYOND AT OPPOSITE POSITIONS, TYP.

POSITION ANCHORS AROUND PERIMETER OF CORED HOLE 90° FROM ADJACENT ANCHOR

½" MIN. COUNTERSINK, FILL HOLE W/ SPECIFIED EPOXY REBUILD MATERIAL

REBUILD CORE HOLE, DIA. VARIES; F.V., TYP.

NOT TO SCALE

STANDARD DESIGN DETAIL

FULL-DEPTH CORE HOLE CONCRETE REBUILD
CONCRETE SURFACE

CHIP BACK TO SOUND CONCRETE

EXPOSED REINFORCING (TYP.)

APPLY CORROSION INHIBITOR TO EXPOSED SURFACES OF REINFORCING

SPALLED AREA

WATER BLAST OR SAND BLAST EXISTING CONCRETE AND REINFORCING TO SSPC5 (WHITE METAL BLAST)

SEE DETAIL 646B FOR SECTION VIEW AND NOTES

NOT TO SCALE
NOTES:

1. IF SECTION LOSS OF REBAR IN A MEMBER (SLAB AREA, BEAM OR COLUMN) EXCEEDS 25% THIS REPAIR SHALL BE REVIEWED BY A STRUCTURAL ENGINEER.

2. WATER BLAST OR SAND BLAST EXPOSED CONCRETE AND REBAR (SSPC5 WHITE METAL BLAST) IN SPALLED AREA.

3. CHIP OUT CONCRETE AROUND EXISTING REBAR TO LEAVE A ONE INCH SPACE (MIN.) BETWEEN REBAR AND CONCRETE. CHIP BACK FURTHER IF NECESSARY TO ACHIEVE SOUND CONCRETE.

4. ROUGHEN CONCRETE SURFACE, CLEAN DEBRIS AND DIRT FROM REPAIR AREA, COAT REBAR WITH CORROSION INHIBITOR. WET CONCRETE SURFACE PRIOR TO PLACING NEW CONCRETE.

5. CORROSION INHIBITOR SHALL MEET REQUIREMENT OF ASTM C1582.

6. CONCRETE SHALL HAVE A MINIMUM COMpressive STRENGTH OF \( f'c \) 5000 psi AT AN AGE OF 28 DAYS. MAXIMUM WATER-CEMENT RATIO (W/C) SHALL BE 40% BY WEIGHT. CEMENT SHALL BE ASTM C150 TYPE II WITH A MAXIMUM OF 0.6% ALKALIS BY WEIGHT. CONCRETE SHALL CONTAIN 7% SILICA FUME OR 15% FLYASH AS WEIGHT PERCENT OF CEMENTITIOUS MATERIALS.
ROUT OR SAWCUT CONC. SQUARE TO PROVIDE SOUND INTERFACE FOR SEALANT JOINT; CLEAN SUBSTRATES PRIOR TO INSTALLING NEW SEALANT

CONCRETE REMOVAL & SURFACE PREPARATION

SEALANT JOINT INSTALLATION

HORIZONTAL SEALANT JOINT NOTES

1. IF \( W < \frac{1}{2}'' \); \( D = W; \frac{1}{8}'' \) MIN.
2. IF \( W > \frac{1}{2}'' \) TO 1''; \( D = (\frac{3}{4})W \)
3. IF \( W > 1'' \); \( D = \frac{1}{8}'' \)
4. ENSURE BACKER ROD DIA. IS 25% \((\pm)\) LARGER THAN WIDTH OF THE JOINT, TYP.

NOT TO SCALE

STANDARD DESIGN DETAIL

TYPICAL SEALANT DETAILS
Section 37 - Suggested Division 1 Items

A. Introduction – HRSD prefers the use of the Construction Specifications Institute (CSI), 2004 Master Format comprised of 16 Divisions. HRSD provides specific input on a number of items that are normally located in Division 1 of the specifications. Among the Master Specifications sections included in this manual, some sections that comprise Division 1 are included and are to be used as a starting point for editing. Items covered in Division 1 should not be repeated in the other divisions of the technical specifications unless additional division or item specific requirements exist. Any Division 1 items must be coordinated with the General Conditions where appropriate. With few exceptions, the below list of Division 1 items should serve as a checklist and instruction sheet and is intended to provide HRSD requirements. It should not be considered as a complete list of items which may be required in Division 1 of the specifications.

B. The following table includes items that the FIRM should carefully review with the HRSD Project Manager and Contract Specialist in the preparation of Division 1 of the specifications. Typical sections where these items are commonly provided are indicated.

<table>
<thead>
<tr>
<th>Potential Division 1 Items</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alterations to Existing Buildings (Section 01520)</td>
<td>If this work is to be extensive, a separate section listing specific constraints and sequence of construction may be required.</td>
</tr>
<tr>
<td>Construction Photographs (Section 01100)</td>
<td>For treatment plant projects, provide digital aerial photographs with sufficient clarity for enlarging to 16 x 20 inch at the completion of the project. During the progress of the project, the FIRM shall take progress photos with emphasis on buried work including pipe crossings of other utilities, reference points, connections, changes in direction and wall penetrations. Take photographs with a digital camera and provide the images in electronic (jpeg) format. Provide index with each photo’s description, direction of image, date, time, project name and location. Consider need for aerial progress photos.</td>
</tr>
<tr>
<td>Confined Space/Hot Work Permit/Explosion Proof Area Designations (01800)</td>
<td>The FIRM should review with HRSD the project work areas and designate specific work areas on the drawings. Contractor to follow appropriate OSHA requirements when working in these areas.</td>
</tr>
<tr>
<td>Potential Division 1 Items</td>
<td>Comments</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Maintenance of Operations - Construction Sequencing/MOPO (Section 01520)</td>
<td>HRSD requests the FIRM to provide sufficient details on required sequencing to ensure the continuous maintenance of plant, pump station and pipeline operations. This will ensure that all parties know of at least one way to construct the project and will have a better handle on proposed contract time. This also provides input to the question of multiple substantial completion items and dates.</td>
</tr>
<tr>
<td>Construction Trailers (Section 01590)</td>
<td>All temporary construction offices and trailers (including contractor provided FIRM field offices) shall be sufficiently anchored to withstand 100 mile per hour wind. Review location and size of FIRM and Contractor trailers with HRSD’s Project Manager.</td>
</tr>
<tr>
<td>Special Conditions - contaminated materials (Section 01060)</td>
<td>If contaminated materials are encountered during construction, Contractor must immediately contact HRSD and follow all VDEQ standards. Include HRSD P3 Division emergency contact phone number(s) in the specifications. Compensate Contractor as changed condition unless specifically identified in contract documents.</td>
</tr>
<tr>
<td>Demolition – Salvaged Equipment (Section 01100)</td>
<td>Provide specific lists of any items to be salvaged. Work with users to specify location to be delivered to.</td>
</tr>
<tr>
<td>Emergency Assistance (N/A to small in-house projects)</td>
<td>See standard HRSD wording. Covers Contractor providing labor and equipment on current contracts for HRSD assistance in emergency situations.</td>
</tr>
<tr>
<td>FIRM Field Offices (N/A to small in-house projects)</td>
<td>Specify requirements and have Contractor provide. As a minimum, cell phone and fax for inspectors.</td>
</tr>
<tr>
<td>Special Conditions - Progress Meetings (Section 01060)</td>
<td>Require monthly project meetings and special coordination meetings as required.</td>
</tr>
<tr>
<td>Summary of Work - Limits of Work Area (Section 01010)</td>
<td>Show limits on drawings. Include access routes and Contractor parking areas.</td>
</tr>
<tr>
<td>Miss Utility (Section 01040)</td>
<td>Require Contractor to contact Miss Utility before performing any excavation.</td>
</tr>
<tr>
<td>Special Conditions - Notification of Property Owners (Section 01060)</td>
<td>Clarify with HRSD’s Public Information Specialist whether the Contractor or the FIRM will be responsible for notifying all easement owners or adjacent property owners who will be affected by the project at least seven (7) calendar days in advance of work.</td>
</tr>
<tr>
<td>Number of Sets of Plans and Specifications to be Provided to Contractor (List in Supplementary Conditions)</td>
<td>Estimate a “reasonable” number or consider providing reproducibles if the Contractor desires format other than digital.</td>
</tr>
<tr>
<td>Potential Division 1 Items</td>
<td>Comments</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Submittals – Operation and Maintenance Manuals (Section 01340)</td>
<td>Contractor should provide a complete indexed Operation and Maintanence Manual. Correct all copies after startup to represent final record conditions. Provide final record version in PDF format per <em>HRSD Design and Construction Standards</em>.</td>
</tr>
<tr>
<td>Maintenance of Operations - Partial Use of Facilities (Section 01520)</td>
<td>If multiple startups are anticipated, provide specifics and address in liquidated damages and contract times sections of the specifications.</td>
</tr>
<tr>
<td>Summary of Work - Permits and Fees (Section 01010)</td>
<td>Highlight any permits requiring bonds or for which plan approval has been received. Identify what fees and who is responsible for. Include copies of VDOT, Railroad, Corps of Engineers or other permits which have been obtained for the project. Advise Contractor of existing HRSD permits and requirements. Contractor required to obtain storm water permit for construction activities. If fees cannot be reasonably determined prior to bid, consider direct reimbursement by change order.</td>
</tr>
<tr>
<td>Project Close-out (Section 01700)</td>
<td>Specification section may be required on longer projects to discuss details of startup and requirements for closeout to include inspections, spare parts, etc.</td>
</tr>
<tr>
<td>Record Documents (Section 01323)</td>
<td>FIRM is responsible for final Record Drawings to HRSD. Require Contractor to keep records and submit to FIRM to assist in preparation of final Record Drawings. Require periodic review of Contractor markups by FIRM.</td>
</tr>
<tr>
<td>Restoration (Section 01700)</td>
<td>Specify short time frames for restoration to minimize inconvenience to public and private property owners.</td>
</tr>
<tr>
<td>Safety and Security Requirements</td>
<td>Refer to Section 22 – “HRSD Safety Programs” in the standards manual.</td>
</tr>
<tr>
<td>Schedules (Covered in General Conditions)</td>
<td>Require a scheduling method appropriate for the project. It is essential that the Contractor develop a well thought out schedule that is used to build the project rather than creating a schedule that is submitted only to meet specification requirement and not used to manage project work.</td>
</tr>
<tr>
<td>Security/Site Access (Section 01550)</td>
<td>HRSD plant sites operate under a closed gate policy. Contact the Project Manager for specific requirements at each plant site.</td>
</tr>
<tr>
<td>Severe Weather (Section 01100)</td>
<td>In the event of pending hurricanes or other projected severe weather, Contractor must have plan for securing site to avoid damage to existing facilities.</td>
</tr>
</tbody>
</table>
**Potential Division 1 Items** | **Comments**
--- | ---
Submittals (Section 01340) | HRSD requires one complete set of all shop drawings when issued. The inspector shall also keep a complete set that will be turned over to HRSD upon completion of the project. If multiple HRSD sites are involved in the project, additional sets (paper or digital) of approved drawings may be required.
Substitutions (Covered in General Conditions) | Add special requirements for submissions on substitutions.
Special Conditions - Surveys and Layout (Section 01060) | FIRM to provide baseline and benchmarks. Contractor to provide detailed project layout based on baseline and benchmarks. Contractor to have any benchmarks or property markers damaged or destroyed during construction reset by a surveyor licensed in Virginia.
Special Conditions - Temporary Facilities (Section 01060) | HRSD will provide access points for power and water and provide reasonable quantities without charge at developed sites; Contractor to provide at undeveloped sites. Contractor to provide own temporary sanitary services at all sites. Contractor to provide own telephone service.
Testing Labs (Soils, Concrete, Asphalt Testing) (N/A) | FIRM shall competitively acquire services of an independent testing lab under Professional Services Agreement additional services and provide one copy of test reports to HRSD. Contractor may be required to provide concrete cylinder storage boxes or other support.
Traffic Control (Section 01060) | Refer to Permits.
Special Conditions - Work Hours (Section 01060) | Highlight HRSD hours and holidays. Require Owner / FIRM approval for weekend work. Highlight any work hour restrictions. No tie-ins or work requiring Owner coordination on holidays or weekend without special approval.
Special Conditions - Wastewater Spills (Section 01060) | Refer to Section 21 – “Regulatory Reporting Requirements for Spills” in this standards manual. Contractor must notify FIRM and HRSD of any wastewater spill caused by his work. This is an HRSD permit issue.

End of Section
Section 38 - Front End Documents

A. Introduction – The Hampton Roads Sanitation District (HRSD) Commission has approved a set of front-end documents (advertisement through supplementary conditions) which must be used on HRSD construction projects. HRSD documents for use on Design-Bid-Build project deliveries and Design-Build project deliveries are based on the two versions of Engineering Joint Contract Documents Committee (EJCDC) standards. Verify with HRSD on which project delivery method is to be used along with the appropriate front-end documents. A complete set of the EJCDC documents for the traditional Design-Bid-Build project delivery is included at the end of this Section. The FIRM to coordinate with HRSD’s Project Manager and Contract Specialist for Design-Build project delivery and/or Construction Manager project delivery for the appropriate front-end documents.

B. Responsibilities of the FIRM

1. Review the HRSD standard front-end documents.

2. Prepare a marked-up set of front end documents providing required input including selecting options and filling in blanks. Provide information for the specification cover, table of contents (including all specification sections and complete list of drawings) and bid schedule (for anything other than single lump sum contracts) in Word. Forward to HRSD’s Contract Specialist for final typing.

3. Verify the project title, CIP Project Number (if applicable) and the date appearing on the drawings. The date appears on the specification cover.

4. Prepare technical specifications and construction drawings that are coordinated with the front-end documents.

5. Provide plans and technical specifications to Contract Specialist for incorporation with front end documents.

6. The Bid Form document is no longer a part of the front-end documents.

   a. Determine if lump sum or unit prices apply to this project. If unit prices apply, provide a bid summary sheet.

   b. If Mobilization is to be included as a line item on the Bid Form, it shall be defined as not exceeding 6% of the total bid amount.

      i. Clearly define this item on the bid summary sheet and in the measurement and payment section of the specs.

      ii. Review mobilization bid item at all pre-bid meetings.

      iii. Closely check each bid for conformance with this requirement.

      iv. Review how the percentage of mobilization vs. demobilization should be applied on each project with HRSD’s Project Manager.
v. Any variance from Mobilization as defined above shall be approved by HRSD’s Project Manager. Do not cut and paste from past work!

C. Standard Front-End Documents are included at the end of this Section.

1. Project Specification Cover
2. Table of Contents
3. Advertisement for Bids
4. Instructions to Bidders
5. Questionnaire
6. Bid Bond
7. Agreement
8. Performance Bond
9. Payment Bond
10. Escrow Agreement (where applicable)
11. General Conditions of the Construction Contract
12. Supplementary Conditions

D. Specific Documents Requiring FIRM Input – The FIRM is responsible for preparing a specification cover sheet and table of contents, as well as the complete set of technical specifications and drawings. Specific input which must be provided to HRSD is listed below.

1. Advertisement for Bid – Fill in the following:
   a. Project title
   b. Project location
   c. FIRM name and address
   d. Bid time and date (work with the project manager to accomplish this based on Commission meeting schedule)
e. Provide a brief general project description.

f. Decide if pre-bid conference is required and establish the time, date, and location.

g. If the project is being funded by the Virginia Clean Water Revolving Loan Fund (VCWRLF), contact HRSD’s Project Manager for additional advertisement requirements.

h. FIRM shall make recommendation on the use of partnering on this project.

i. Work with Project Manager to set the advertisement date. HRSD usually advertises in the Sunday newspaper and will need advertisement by Noon on the Wednesday before to post the advertisement.

2. Instructions to Bidders

a. Article -3 – Complete qualifications Bidder must possess in order to submit the bid. Coordinate with HRSD’s Project Manager and Contract Specialist to establish these qualifications at the 90 percent design stage.

b. Article -4 – If pre-bid conference is to be held, provide input.

c. Paragraph 5.02.4 – Work with HRSD’s Project Manager if Geotechnical Baseline Report/Geotechnical Data Reports are needed.

d. Paragraph 5.03 – Work with HRSD’s Project Manager if Other Site-related Documents are needed

e. Paragraph 5.04.B – Work with HRSD’s Project Manager if a site visit will be scheduled following the pre-bid conference.

f. Article -14 – Identify basis of bid (-Lump Sum, Base Bid with Alternates or Unit Price)

g. Article -23 – Work with HRSD’s Project Manager to determine if state tax exemption will apply to this project.

h. Article -26 – Leave in if Partnering is being considered.

i. Article -25– Work with HRSD’s Project Manager to see if there are any contracts to be assigned for this project.

j. If VCWRLF funding is involved, coordinate with HRSD’s Project Manager and Contract Specialist for additional required instructions to bidders. (Article 3 and 27)
3. Agreement
   a. Project Information – Provide project title.
   b. Article 1 – Update Project Description
   c. Article 2 – Provide official name of FIRM (Engineer).
   d. Paragraph 3.02 – Determine the time for Substantial Completion and Final Completion.
   e. Paragraph 3.03 – Work with HRSD’s Project Manager to see if there are any Milestones
   f. Paragraph 3.04 – Provide the liquidated damages amount and bonus (if applicable) for Substantial Completion and Final Completion. The FIRM must prepare a memorandum stating how the amounts were calculated and submit to the Contract Specialist prior to advertisement for construction bids as identified in Section 14 – “Coordination of Preconstruction Phase Issues” of these Standards.
   g. Article 4 – The Contract Specialist will complete this section when drafting the Agreement for the successful Bidder.
   h. Paragraph 7.01.A.5 – List number of Drawings and Project title.
   i. Paragraph 7.01.A.9 – List other exhibits to this Agreement, if needed

4. Supplementary Conditions
   a. No longer needed, standard will now be 4 copies
   b. Paragraph 5.03 – Provide the required information on reports of explorations and test of subsurface conditions.
   c. Paragraph 5.06 – Determine if asbestos, PCBs, petroleum, hazardous waste, or radioactive materials have been identified at the site.
   d. Paragraph 6.03.-H – Provide names and addresses for additional insureds on insurance policies.
   e. Paragraph 6.04.A Have HRSD’s Project Manager and Contract Specialist review with Director and Insurance Consultant if project will be over $10 million. Provide dollar value if HRSD supplies equipment/material if cost is over $100,000.
   f. Paragraph 7.07 – Select the appropriate option.
g. Paragraph 7.-10 – Determine if the state tax exemption is applicable to this project and include or delete as appropriate.

h. Paragraph 7.-13 – Determine if applicable and provide additional information.

i. Paragraph 8.02 – Determine if other work will be performed at the site by others.

j. Paragraph 10.03 – No longer needed, updated standard to have it as Engineer. Review and modify duties between RPR and Contract Administrator.

End of Section
PROJECT MANUAL
for the construction of
[PROJECT NAME]
CIP No. [Number]
City of [City], Virginia
[Date]

VOLUME 1 OF [#]
HAMPTON ROADS SANITATION DISTRICT

[PROJECT NAME]

PROJECT MANUAL

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• SUPPLEMENTARY CONDITIONS

TECHNICAL SPECIFICATIONS

VOLUME 2 OF 2

DRAWINGS
BIDDING REQUIREMENTS
ADVERTISEMENT FOR BIDS
Solicitation No. [#]

PROJECT: [PROJECT NAME]

LOCATION: [City or County of Project], Virginia

ENGINEER: [Name] 
[Address]

The Hampton Roads Sanitation District (HRSD) will receive electronic Bids for the above referenced project online through HRSD’s Online Oracle ERP system (https://www.hrsd.com) until [#]:00 p.m., local time on [Month] [Day], 20[YY]. Failure to submit a Bid through HRSD’s Online Oracle ERP system prior to the due date and time will be cause for rejected by HRSD.

Procedures for submitting a Bid, claiming an error, withdrawing of Bids and other pertinent information are contained in the Instructions to Bidders. HRSD reserves the right to reject any or all Bids, waive any informalities, or negotiate with the low bidder as described in the Instructions to Bidders.

Bid Documents may be viewed by logging into HRSD’s Online Oracle ERP system. All Bidders must be registered in advance of submitting a Bid. Technical questions should be submitted through HRSD’s Online Oracle ERP system as an online discussion. Questions related to submitting a Bid or using the online system should be directed to the ERP HelpDesk at erphelp@hrsds.com or 757-460-7318 or [CS Name] at [name]@hrsds.com or 757-[Number].

Contractor registration in accordance with Title 2.2, Chapter 43 and Title 54.1, Chapter 11, Code of Virginia is required.

The Project or Work consists of [General Project Description].

[OPTIONAL] A pre-bid conference will be held at [Location] at [Time] on [Date]. Attending the conference shall/shall not be mandatory for those submitting a Bid.

A Bid Bond in the amount of 5 percent of the Bid shall be submitted electronically with each Bid.

[OPTIONAL - VCWRLF] This project is being funded in part under the Virginia Clean Water Revolving Loan Fund (VCWRLF). Bidders shall comply with the President’s Executive Order No. 11246 (Prohibiting discrimination in employment regarding race, color, creed, sex or national origin), No. 12138 and No. 11625 (Regarding MBE/WBE utilization). Bidders shall also comply with the Civil Rights Act of 1964. Bidders must certify that they do not and will not maintain or provide for their employees any facilities that are segregated on basis of race, color, creed or national origin.
# INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

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**PROJECT NAME**

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**DATE**
ARTICLE 1—GENERAL INFORMATION

1.01 Definitions

A. Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

1. Bidder—The corporation, partnership, limited liability company, or combination thereof, acting directly or through an authorized representative, formally submitting a Bid directly to Owner, as distinct from a sub-bidder, who submits a Bid to a Bidder.

2. Bidding Documents—The Advertisement for Bids, Instructions to Bidders, and the proposed Contract Documents (including all Addenda issued prior to the receipt of Bids).

3. Issuing Office—The office from which the Bidding Documents are to be issued.

4. Sub-bidder—An entity to whom the Bidder intends to subcontract any part of the Work.

5. Successful Bidder—The lowest, responsible, and responsive Bidder to whom Owner (on the basis of the Engineers and Owner’s evaluation as hereinafter provided) makes an award.

B. In addition to terms specifically defined, terms with initial capital letters in the Instructions to Bidders include references to identified articles and paragraphs, and the titles of other documents and forms.

1.02 Bidder Registration

A. All Bidders must register on Hampton Roads Sanitation District’s (HRSD) Online Oracle Enterprise Resource Planning (ERP) system prior to submitting a Bid. The following information shall be required:

1. Company (Supplier) Name.

2. Taxpayer Identification Number.

3. Primary Contact.

4. Mailing Address, E-Mail Address, and Telephone Number.


6. Copy of most recent W-9 Form.

7. Other information as required.

1.03 Additional Information

A. Except as amended by the Contract Documents, the procurement activities for HRSD are governed by the HRSD Procurement Policy as adopted by the HRSD Commission (Commission), the HRSD Enabling Act, the Virginia Public Procurement Act (VPPA), and other state and federal statutes and regulations as appropriate. A copy of HRSD’s Procurement Policy is available online at HRSD’s website and is hereby made a part of this RFP; go to https://www.hrsd.com/procurement-manuals-guidelines and select the Procurement Policy (pdf) link.
ARTICLE 2—BIDDING DOCUMENTS

2.01 Bidder shall obtain a complete set of Bidding Documents by logging into HRSD’s Online Oracle ERP system. See the Agreement for a list of the Contract Documents. It is the Bidder’s responsibility to determine that it is using a complete set of documents in the preparation of a Bid. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers. Neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.02 Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use. Authorization to download documents, or other distribution, includes the right for registered users to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers.

ARTICLE 3—QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder’s qualifications to perform the Project or Work, after submitting its Bid and within 48 hours, the apparent low Bidder and other Bidders as requested by the Owner or the Engineer shall submit the following information:

A. Completed copy of attached Questionnaire; [ONLY IF VCWRLF: including the Bidder Compliance Statement/Certification Regarding Equal Employment Opportunity.] Qualifications required from the Bidder shall be based on prior experience of the corporation, partnership, limited liability company, or combination thereof, as identified in the Bid response as described in Paragraph 3.01.B. Prior experience from a Sub-bidder shall not be accepted as experience for the Bidder.

B. The Bidder shall document specific experience in the construction of [Update with Qualifications]. Give project titles, Owner’s and Engineer’s names, addresses, and telephone numbers, and project values. Attach additional pages to the Questionnaire as necessary to provide this information.


E. Additional information may be requested after the Questionnaires are received if, in the opinion of the Owner or the Engineer, the information submitted is insufficient to complete the evaluation of the Bidder.

3.02 Bidder shall meet the on-site work force requirements as defined in the Supplementary Conditions Paragraph 7.07.

3.03 A Bidder’s failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.

3.04 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder’s qualifications.
ARTICLE 4—PRE-BID CONFERENCE

4.01 If a pre-bid conference is to be held, the date, time, and location will be stated in the Advertisement for Bids. The pre-bid conference is [mandatory/non-mandatory] and Bidders are [required/encouraged] to attend and participate. Representatives of Owner and Engineer will be present to discuss the Project.

4.02 Information presented at the pre-bid conference does not alter the Contract Documents. Owner will issue Addenda to make any changes to the Contract Documents that result from discussions at the pre-bid conference. Information presented, and statements made at the pre-bid conference will not be binding or legally effective unless incorporated in an Addendum.

ARTICLE 5—SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER’S SAFETY PROGRAM; OTHER WORK AT THE SITE

5.01 Site and Other Areas

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

5.02 Existing Site Conditions

A. Subsurface and Physical Conditions; Hazardous Environmental Conditions

1. The Supplementary Conditions identify the following regarding existing conditions at or adjacent to the Site:

   a. Those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.

   b. Those drawings known to Owner of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data.

   c. Reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.

   d. Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

a. As set forth in the Supplementary Conditions, the GBR describes certain select subsurface conditions that are anticipated to be encountered by Contractor during construction in specified locations (“Baseline Conditions”). The GBR is a Contract Document.

b. The Baseline Conditions in the GBR are intended to reduce uncertainty and the degree of contingency in submitted Bids. However, Bidders cannot rely solely on the Baseline Conditions. Bids should be based on a comprehensive approach that includes an independent review and analysis of the GBR, all other Contract Documents, Technical Data, other available information, and observable surface conditions. Not all potential subsurface conditions are baselined.

c. Nothing in the GBR is intended to relieve Bidders of the responsibility to make their own determinations regarding construction costs, bidding strategies, and Bid prices, nor of the responsibility to select and be responsible for the means, methods, techniques, sequences, and procedures of construction, and for safety precautions and programs incident thereto.

d. As set forth in the Supplementary Conditions, the GDR is a Contract Document containing data prepared by or for the Owner in support of the GBR.

B. Underground Facilities: Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site are set forth in the Contract Documents and are based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or other.

C. Adequacy of Data: Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to Hazardous Environmental Conditions at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Conditions uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 5.06 of the General Conditions.

5.03 [OPTIONAL] Other Site-related Documents

A. In addition to the documents regarding existing Site conditions referred to in Paragraph 5.02.A, the following other documents relating to conditions at or adjacent to the Site are known to Owner and made available to Bidders for reference:

1. [List of other Site-related documents].

   Owner will make copies of these other Site-related documents available to any Bidder on request.

B. Owner has not verified the contents of these other Site-related documents, and Bidder may not rely on the accuracy of any data or information in such documents. Bidder is responsible for any interpretation or conclusion Bidder draws from the other Site-related documents.
C. The other Site-related documents are not part of the Contract Documents.

D. Bidders are encouraged to review the other Site-related documents, but Bidders will not be held accountable for any data or information in such documents. The requirement to review and take responsibility for documentary Site information is limited to information in (1) the Contract Documents and (2) the Technical Data.

E. No other Site-related documents are available.

5.04 Site Visit and Testing by Bidders

A. Bidder shall conduct the required Site visit during normal working hours and conduct a thorough visual examination of the Site and adjacent sites. During the visit the Bidder must not disturb any ongoing operations at the Site.

B. [OPTIONAL] A Site visit is scheduled following the pre-bid conference.

C. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

D. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder general access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner’s authority regarding the Site.

E. Bidder shall comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

F. Bidder shall restore the property to the equivalent of its original condition upon completion of such explorations, investigations, tests, and studies which shall include but is not limited to filling of all holes and clean-up of Site. Bidder shall indemnify, defend, and hold Owner harmless from and against all claims, costs, losses, damages, and expenses, including reasonable attorney fees, arising from Bidder’s, its agent’s, employee’s, designee’s, representative’s or contractor’s activities upon the Site.

5.05 Owner’s Safety Program

A. Site visits and work at the Site and HRSD property will be governed by an Owner safety program. Requirements of HRSD’s safety program are defined in the General Conditions, Supplementary Conditions, and Technical Specification section on Special Conditions.

5.06 Other Work at the Site

A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware, if any, that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.
ARTICLE 6—BIDDER’S REPRESENTATIONS AND CERTIFICATIONS

6.01 Representations: It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, and any data and reference items identified in the Bidding Documents;

B. visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work;

D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to the Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings;

E. consider the information known to Bidder itself; information commonly known to the contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder’s safety precautions and programs;

F. agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;

G. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

H. promptly submit an online discussion through HRSD’s Online Oracle ERP system as a written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution is acceptable to Bidder;

I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work; and
J. agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

6.02 Bidder certifies that:

A. the Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.

B. the Bidder has not directly and indirectly induced or solicited any other Bidder to submit a false or sham Bid.

C. the Bidder has not solicited or induced any individual or entity to refrain from bidding.

D. the Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 6.02.D.:

1. “corrupt practice” means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;

2. “fraudulent practice” means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish Bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. “collusive practice” means a scheme or arrangement between 2 or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

E. it and its affiliates have only submitted one Bid for any particular Work. Bidder further certifies that it does not share any key personnel with any other Bidder who is submitting a Bid for the same Work as Bidder. For the purposes of this Section 6.02.E.:

1. “key personnel” means any owner, president, vice president, manager, or superintendent of Bidder.

ARTICLE 7—INTERPRETATIONS AND ADDENDA

7.01 Questions

A. Administrative questions shall be addressed to [CS name], Contract Specialist, via email to email@hrsd.com or by phone (757)[number].

B. Bidder shall submit all questions about the meaning or intent of the Bidding Documents through HRSD’s Online Oracle ERP system as an online discussion.

7.02 Addenda

A. Addenda may be issued to clarify, correct, supplement, or change the Bidding Documents.

B. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda via HRSD’s Online Oracle ERP system and sent to all
parties recorded as having received the Bidding Documents. Questions received less than 7 days prior to the date for opening of Bids may not be answered.

C. Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

ARTICLE 8—BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5 percent of Bidder’s maximum Bid price (determined by adding the base bid and all alternates) and in the form of a certified check, bank money order, or a Bid bond issued by a surety meeting the requirements of Paragraph 6.01 and 6.02 of the General Conditions. Such Bid bond will be issued on the form included in the Bidding Documents.

8.02 A scanned copy of the Bid security shall be included with the Bid. If the Bidder chooses to provide a Bid security using a certified check or bank money order, the original check or money order shall be received by the Owner by the date and time of the Bid opening. The certified check or money order shall be mailed to: HRSD, PO Box 5911, Virginia Beach, VA 23471 and shall list the project name for which the security shall apply.

8.03 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract and furnish the required Contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of Owner’s damages in the case of a damages-form bond. Such forfeiture will be Owner’s exclusive remedy if Bidder defaults.

8.04 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

ARTICLE 9—CONTRACT TIMES

9.01 The number of calendar days within which, or the dates by which, the Work is to be substantially completed and completed and ready for final payment (the Contract Times) are set forth in the Agreement.

ARTICLE 10—LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, are set forth in the Agreement.

ARTICLE 11—SUBSTITUTE AND “OR EQUAL” ITEMS

11.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or “or-equal” items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or “or-equal” item of material or equipment, application for such acceptance may not be made to and will not be
considered by Engineer until after the Effective Date of the Contract.

11.02 All prices that Bidder sets forth in its Bid will be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of “or-equal” or substitution requests are made at Bidder’s sole risk.

ARTICLE 12—SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 A Bidder shall be prepared to retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of the Work if required to do so by the Bidding Documents or in the Specifications. If a prospective Bidder objects to retaining any such Subcontractor, Supplier, or other individuals or entities and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.

12.02 Subsequent to the submittal of the Bid, Owner may not require the Successful Bidder or Contractor to retain any Subcontractor, Supplier, or other individual or entity against which Contractor has reasonable objection.

12.03 The apparent Successful Bidder, and any other Bidder so requested, must submit to Owner a list of the Subcontractors, Suppliers, or other individuals or entities proposed for the Work within 48 hours after the Bid opening.

12.04 If requested by Owner, such list must be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, or other individual or entity. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, or other individual or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder will submit a substitute, Bidder’s Bid price will not be increased by such substitution.

12.05 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, other individuals or entities. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, or other individual or entity, so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.07 of the General Conditions.

ARTICLE 13—PREPARATION OF BID

13.01 Electronic Bids shall be submitted through HRSD’s Online Oracle system by an authorized representative. The online submittal certifies that the Bidder is an agent or officer authorized to bind the company to the terms and conditions of the solicitation.

A. All required fields shall be complete. A Bid price shall be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price listed therein.

B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words “No Bid” or “Not Applicable.”
13.02 A Bid by a corporation shall be submitted in the corporate name by a corporate officer or authorized agent. Owner may request evidence of authority to sign. The corporate address and state of incorporation shall be provided.

13.03 A Bid by a partnership shall be submitted in the partnership name by a partner. Owner may request evidence of authority to sign. The official address of the partnership shall be provided.

13.04 A Bid by a limited liability company shall be submitted in the name of the firm by a member or other authorized person. Owner may request evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be provided.

13.05 A Bid by an individual must show the Bidder’s name and official address.

13.06 A Bid by a joint venture shall be submitted by an authorized representative of each joint venturer and the joint venture must have been formally established prior to submittal of a Bid. Owner may request evidence of authority to sign. The official address of the joint venture shall be provided.

13.07 The Bid shall acknowledge receipt of all Addenda.

13.08 The Bid shall contain evidence of Bidder’s authority and qualification to do business in the Commonwealth of Virginia. The Virginia Registered Contractor License Number shall be provided.

13.09 A Bidder organized as a stock or non-stock corporation, limited liability company, business trust, general partnership, limited partnership, or registered as a limited liability partnership must be authorized to transact business in the Commonwealth of Virginia as a domestic or foreign business entity if so required by Title 13.1 or Title 50 of the Code of Virginia or as otherwise required by law. A Bidder organized or authorized to transact business in the Commonwealth of Virginia pursuant to Title 13.1 or Title 50 of the Code of Virginia shall provide the State Corporation Commission (SCC) Identification Number.

13.10 Any Bidder that is not required to be authorized to transact business in the Commonwealth of Virginia as a foreign business entity under Title 13.1 or Title 50 of the Code of Virginia or as otherwise required by law shall include a statement describing why the Bidder is not required to be so authorized. Any Bidder described herein that fails to provide the required information shall not receive an award unless a waiver of this requirement has been granted by the HRSD General Manager.

ARTICLE 14—BASIS OF BID

14.01 Lump Sum
   A. Bidders shall submit a Bid on a lump sum basis as set forth in the Bid Form.

[or]

14.02 Base Bid with Alternates
   A. Bidders shall submit a Bid on a lump sum basis for the base Bid and include a separate price for each alternate described in the Bidding Documents and as provided for in the Bid Form. The price for each alternate will be the amount added to or deleted from the base Bid if Owner selects the alternate.

   B. In the comparison of Bids, alternates will be applied in the same order of priority as listed in the Bid Form.

[or]
14.03 **Unit Price**

A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.

B. The “Bid Price” (sometimes referred to as the extended price) for each unit price Bid item will be the product of the “Estimated Quantity”, which Owner or its representative has set forth in the Bid Form, for the item and the corresponding “Bid Unit Price” offered by the Bidder. The total of all unit price Bid items will be the sum of these “Bid Prices”; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.

14.04 **Allowances**

A. For cash allowances the Bid price shall include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

**ARTICLE 15—SUBMITTAL OF BID**

15.01 A Bid shall be received no later than the date and time prescribed in the Advertisement or invitation to bid. Bids shall only be accepted through HRSD’s Online Oracle ERP system. Failure to submit a response through the ERP website will be cause for rejection by HRSD.

15.02 Bids received after the date and time prescribed for the opening of bids or not submitted in the designated manner will not be accepted. HRSD shall not be responsible for late or lost responses due to an improper online submittal by Bidder.

15.03 If there are difficulties logging into or using HRSD’s Online Oracle ERP system, please contact the ERP Help Desk at (757) 460-7318 or erphelp@hrsd.com for assistance.

**ARTICLE 16—MODIFICATION AND WITHDRAWAL OF BID**

16.01 A Bid may be withdrawn prior to the date and time of the opening of Bids through HRSD’s Online Oracle ERP system.

16.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 15.01 and submit a new Bid prior to the date and time for the opening of Bids.

16.03 A Bidder may withdraw its Bid due to error, in accordance with §2.2-4330 of the Code of Virginia and the Bid security will be returned if Bidder files a duly signed written notice with original working papers within 2 business days after Bids are opened and those documents demonstrate to the reasonable satisfaction of the Owner that there was a material and substantial mistake in the preparation of its Bid. Thereafter, that Bidder will be disqualified from further bidding or providing any material, labor, or subcontract work on the Work to be provided under the Contract Documents.

**ARTICLE 17—OPENING OF BIDS**

17.01 Bids will be opened at the time and place indicated in the Advertisement or invitation to bid. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.
ARTICLE 18—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain subject to acceptance for 60 days after the Bid opening or for such longer period of time that Bidder may agree to in writing upon request of Owner. Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19—EVALUATION OF BIDS

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.

19.02 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.

19.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, whether in the Bid itself or in a separate communication to Owner or Engineer, then Owner will reject the Bid as nonresponsive.

19.04 If Owner awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest responsive Bid.

19.05 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

19.06 Evaluation of Bids

A. In evaluating Bids, Owner will consider whether the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

B. In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors, Suppliers, other individuals and entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, other individuals and entities must be submitted as provided in the Bidding Documents.

19.07 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, safety record, and financial ability of Bidders and any proposed Subcontractors, Suppliers, other individuals and entities.

ARTICLE 20—NEGOTIATION WITH THE LOWEST RESPONSIBLE BIDDER

20.01 Owner may negotiate with the lowest responsible Bidder to obtain a Contract within available funds if the lowest responsive Bid exceeds available funds. Such negotiation may be undertaken if approved in writing by HRSD’s General Manager and must be based on a project cost estimate prepared prior to issuance of the Advertisement for Bids.

ARTICLE 21—BONDS AND INSURANCE

21.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner’s requirements as to performance and payment bonds, other required bonds, if any, and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it must
be accompanied by required bonds and insurance documentation.

21.02 Article 8, Bid Security, of these Instructions, addresses any requirements for providing bid bonds as part of the bidding process.

ARTICLE 22—AWARD OF CONTRACT AND SIGNING OF AGREEMENT

22.01 Award of Contract: The Director of Engineering shall submit the Agreement to the General Manager for approval, and the General Manager shall submit the Agreement to the Commission for approval of award.

22.02 Signing of Agreement: After the Commission approves the award of contract, the Owner will issue a Notice of Award to the Successful Bidder, it will be accompanied by the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 calendar days thereafter, Successful Bidder shall deliver any bonds and insurance documentation required to be delivered by the Contract Documents to Owner. Within 10 calendar days thereafter, Owner shall transmit the Agreement through HRSD’s Online Oracle ERP system. Successful Bidder’s acknowledgment in the ERP system represents signature and acceptance of the terms and conditions of the Agreement.

ARTICLE 23—[OPTIONAL] SALES AND USE TAXES

23.01 Bidders are advised that this is a pollution control project and as such certain materials and equipment will be exempt from Virginia sales tax in accordance with Section 58.1-3660 of the Code of Virginia (1950), as amended, upon a request by the Successful Bidder to the Tidewater Regional Office, Department of Environmental Quality, Water Division, 5636 Southern Blvd., Virginia Beach, Virginia 23462. Information to be submitted in triplicate is:

A. Project Title.
B. Project Owner.
C. Project Location.
D. Anticipated Project Completion Date.
E. Moderately detailed description of the equipment or facilities.

ARTICLE 24—RETAINAGE

24.01 Provisions concerning retainage are set forth in the Agreement.

ARTICLE 25—[OPTIONAL – USE IF HRSD SUPPLIES EQUIPMENT/MATERIALS] CONTRACTS TO BE ASSIGNED

25.01 Owner (Buyer) [has executed/will execute] a contract with [Name] (Seller) for the procurement of goods and special services for [Name]. The materials and equipment provided for in the procurement contract are to be furnished and delivered to the Site [or other location] for installation by Contractor. The said procurement contract will be assigned by Owner to Contractor as set forth in the Agreement. Contractor will accept the assignment and assume responsibility for the Seller, who will become a Subcontractor to Contractor.

25.02 Bidders may examine the Contract Documents for the procurement of goods and special services for [Item] at [Location].
ARTICLE 26—[OPTIONAL] PARTNERING

26.01 Owner intends to participate in a partnering process with Contractor. The process is intended to help develop better and more effective communication and mutual understanding of common goals. The objectives of the process will be to achieve effective and efficient performance of the Work and completion of the Work within the Contract Price and Contract Times, all in accordance with the Contract Documents.

26.02 Participation in the partnering process will be voluntary. To initiate the process, within [number] days after the Notice to Proceed the key personnel of Owner, Engineer, Contractor, and Contractor’s major Subcontractors will be invited to attend a [number] day seminar and team building workshop to develop a partnering statement. The seminar and the workshop will be conducted by a neutral facilitator at a time and location agreed to by Owner and Contractor in the general vicinity of the Site.

26.03 The facilitator will be selected by Owner, subject to approval by Contractor. All facilitator-related and facilities costs will be shared equally by Owner and Contractor with no change in the Contract Price or Contract Time. Each party will pay all costs associated with the participation of its own personnel.

26.04 It is intended that the initial seminar and workshop sessions be followed by periodic [half/one] day evaluation sessions approximately every [number] days as agreed to by Owner and Contractor.

26.05 These provisions express the intent and spirit of the partnering process, and nothing stated herein or in the partnering statement shall change in any way the rights, responsibilities, and obligations of the parties as set forth in the Contract Documents. The partnering statement will not be a part of the Contract Documents and will not modify any defense, claim, obligation, or right that otherwise exists.

ARTICLE 27—[OPTIONAL-VCWRLF] PROJECT FUNDING

27.01 This project is funded in part under the Virginia Clean Water Revolving Loan Fund (VCWRLF). Bidders must be familiar with and in compliance with the additional requirements associated with this funding source and must provide the required documentation.

27.02 Bidders shall comply with the President’s Executive Order No. 11246 (Prohibiting discrimination in employment regarding race, color, creed, sex or national origin), No. 12138 and No. 11625 (Regarding MBE/WBE utilization). Bidders shall also comply with the Civil Rights Act of 1964.

27.03 Bidders must certify that they do not and will not maintain or provide for their employees any facilities that are segregated on basis of race, color, creed, sex or national origin.

A. Affirmative Steps: Activities during preparation of proposals. Bidders shall take affirmative steps in compliance with the regulations, prior to submission of proposals, to encourage participation in projects by MBE/WBE firms. Such efforts include:

1. Establish and maintain a current solicitation list of minority and female recruitment sources and assure MBE/WBE firms are solicited once they are identified.

2. When feasible, segmenting total work requirements to permit maximum MBE/WBE participation and establish delivery schedules to encourage MBE/WBE participation.

3. Assuring that MBE/WBE firms are solicited whenever they are potential sources of goods and services. This step may include:
a. Sending letters or making other personal contact with MBE/WBE firms, private agencies and state associations (e.g. – whose names appear on lists prepared by the United States Environmental Protection Agency (EPA) or the recipient and other MBE/WBE known to the Bidder). MBE/WBE firms should be contacted when other potential subcontractors are contacted, within reasonable time prior to bid submission or closing date for receipt of initial offers. Those letters or other contacts should communicate the following:

1) Specific description of the work to be contracted;
2) How and where to obtain a copy of plans and specifications or other detailed information needed to prepare a detailed price quotation;
3) Date the quotation is due to the Bidder;
4) Name, address, and phone number of the person in the Bidder’s firm whom the prospective MBE/WBE subcontractor should contact for additional information.

b. Using the services and assistance of the Small Business Administration and the Office of Minority Business Enterprise of the United States Department of Commerce.

B. Bidders must demonstrate compliance with MBE/WBE requirements to be deemed responsible. Successful Bidders shall provide documentation on MBE/WBE solicitation efforts as detailed in the VCWRLF – 2016 Contract Inserts and complete the attached “Bidder Compliance Statement/Certification Regarding Equal Employment Opportunity”. Demonstration of compliance may include the following information; however, the recipient may specify other methods of demonstrating compliance:

1. Names, addresses, and phone numbers of MBE/WBE firms expected to perform work;
2. Work to be performed by the MBE/WBE firms;
3. Aggregate dollar amount of work to be performed by MBE/WBE firms, showing aggregate to MBE’s and aggregate to WBE’s separately;
4. Description of contracts to MBE/WBE organizations, agencies, and associations which service MBE/WBE firms, including names of organizations, agencies, and associations and dates of contacts;
5. Description of contacts to MBE/WBE firms, including number of contacts, fields (e.g. – equipment or material supplier, excavators, transport services, electrical subcontractors, plumbers, etc.) and dates of contacts.

C. Successful Bidders should take reasonable affirmative steps to subcontract with MBE/WBE firms whenever additional subcontracting opportunities arise during the performance of the contract.

D. Successful Bidders shall provide a signed copy of Attachment #6 from the VCWRLF – 2016 Contract Inserts titled, “American Iron and Steel (AIS) Certification Statement”.
QUESTIONNAIRE

The undersigned guarantees the accuracy of all statements and answers herein contained. Contractor shall provide answers in order on separate sheet except where fill one blank or yes/no checks suffice.

1. How many years has your firm been in business as a General Contractor?
   ____ years

2. List at least 3 projects similar in nature to this project that you have completed. Provide project information addressing the qualifications identified in Article 4 of the Instructions to Bidders. For each project include:
   a. The original contract date and time.
   b. The final contract time.
   c. The original contract cost.
   d. The final contract cost.
   e. Name, address, phone number, and contact for the Consulting Engineer or Registered Architect and Owner Representative involved with the project.

3. List projects presently under construction by your firm, dollar value of the contract, and the percent of completion.

4. Have you ever performed work for a public body such as the Hampton Roads Sanitation District previously? If yes, list the public body and name of the project for the three most recent projects. (If all such entities are listed under 2, this question need not be completed.)
   Yes ____
   No ____

5. Have you ever failed to complete work awarded to you? If yes, state where and explain why on separate sheet.
   Yes ____
   No ____
6. Do you plan to use subcontractors for any part of this work? If yes, give details.

Yes ________

No ________

7. What equipment do you own that is available for this work?

8. What equipment do you plan to rent or purchase for this work?

9. Give the name, address and telephone number of an individual who represents each of the following and who the Owner or Engineer may contact to investigate your financial responsibility:

a. Surety Name__________________________________________
   
   Contact Name__________________________________________
   
   Address ________________________________________________
   
   ____________________________________________________________
   
   Phone Number __________________________________________

b. Bank Name____________________________________________
   
   Contact Name__________________________________________
   
   Address ________________________________________________
   
   ____________________________________________________________
   
   Phone Number __________________________________________

  c. Material Supplier Name_________________________________
   
   Contact Name__________________________________________
   
   Address ________________________________________________
   
   ____________________________________________________________
   
   Phone Number __________________________________________

10. List all formal claims made, requests for equitable contract adjustments submitted, arbitrations, or legal actions taken by Contractor against any Owner within the last five years. Include Owner, project title, amounts of disputes, and final disposition with explanations, as appropriate.
11. List any projects on which liquidated damages were assessed within the past five years.

12. Has your firm or any of its officers, employees or agents ever been suspended or debarred from any Federal, State or local procurement? If yes, provide details.

   Yes ______

   No ______

13. List your firm's designated safety representative(s) and attach an OSHA 300 form (Log and Summary of Occupational Injuries and Illnesses), as appropriate, covering the past 5 years.

14. Provide a copy of your most recent financial statement.

15. State the true, exact, correct and complete name of the partnership, corporation or trade name under which you do business, and the address of the place of business. (If a corporation, state the name of the President and Secretary. If a partnership, state the names of all partners. If a trade name, state the names of the individuals who do business under the trade name.) It is absolutely necessary that this information be furnished.

   Correct Name of Bidder

   a. The business is a _______________________________________

   b. The address of the principal place of business is:

   _______________________________________

   _______________________________________

   c. The names of the corporate officers, partners, or individuals doing business under a trade name, are as follows:

   _______________________________________

   _______________________________________

a. Provide the names, addresses, and phone numbers of MBE/WBE firms expected to perform work.

b. Describe the type of work to be performed by MBE/WBE firms.

c. Provide the aggregate dollar amount of work to be performed by MBE/WBE firms, showing aggregate to MBEs and aggregate to WBEs separately.

d. Include description of contacts to MBE/WBE organizations, agencies, and associations which serve MBE/WBE firms, including names of organizations, agencies, and associations and dates of contacts.

e. Include descriptions of contacts MBE/WBE firms, including number of contacts, fields (i.e., equipment or material supplier, excavators, transport services, electrical subcontractors, plumbers, etc.) and dates of contacts.

Dated this ______________ day of ______________________ 20 __.

________________________________

________________________________

By______________________________
[OPTIONAL-VCWRLF] BIDDER COMPLIANCE STATEMENT/CERTIFICATION
REGARDING EQUAL EMPLOYMENT OPPORTUNITY

This statement relates to a proposed contract between ______________ (contractor) and Public Body) or (subcontract between ___________________________ (subcontractor) and _____________________________ (contractor)) to be funded under a federally assisted project. Pursuant to Executive Order 11246 and its implementing regulations at 41 CFR 60-1.7(b)(1), as the undersigned bidder, I certify that:

1) Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity Clause.
   _____Yes  _____No

2) Bidder has developed and has on file at each establishment affirmative action programs pursuant to 41 CFR 60-2 (applies only to non-construction contractor).
   _____Yes  _____No

3) Bidder has filed with the Joint Reporting Committee, the Director (Office of Federal Contract Compliance Programs, U.S. Department of Labor), and agency, or the Equal Employment Opportunity Commission, all reports due under the applicable filing requirements.
   _____Yes  _____No

I understand that if I have failed to file any compliance reports which have been required of me, or have failed to develop and have on file at each establishment affirmative action programs pursuant to 41 CFR 60-2, when required, I am not eligible to have my bid or proposal considered, or to enter into the proposed contract.

I further understand that if awarded the proposed contract, and the contract for the FIRST time brings me under the filing requirements of the written affirmative action programs that I will, as applicable: (a) within 30 days file with the Public Body Standard Form 100 (EEO-1); and (b) within 120 days from the commencement of the contract develop and submit to the Director of OFCCP for approval a Written Affirmative Action Plan.

NAME AND ADDRESS OF BIDDER (Include ZIP Code):

NAME AND TITLE OF SIGNER (Please Type):

SIGNATURE:   DATE:
BID BOND

BOND NO. ______________________

AMOUNT: 5% of Bid amount ___

KNOW ALL MEN BY THESE PRESENTS, that ______________________________________ hereinafter called the PRINCIPAL, and ________________________________ a corporation duly organized under the laws of the State of ____________________________ having its principal place of business at ____________________________ in the State of ________________ and authorized to do business in the Commonwealth of Virginia, as Surety, are held and firmly bound unto Hampton Roads Sanitation District, as OWNER, hereinafter called the OBLIGEE, in the sum of 5% of bid amount for the payment for which we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS BOND IS SUCH THAT:

WHEREAS, the PRINCIPAL is herewith submitting his or its Bid for [PROJECT NAME] said Bid, by reference thereto, being hereby made a part hereof.

NOW, THEREFORE, the conditions of this obligation are as follows: This Bid Bond shall guarantee that the Principal will not withdraw the Bid during the period of 60 days following the opening of Bids; that if the Bid is accepted, Principal will enter into a formal Agreement with the Owner in accordance with the Instructions to Bidders; that Principal will submit a properly executed and authorized Performance Bond and Payment Bond on the forms included in the Instructions to Bidders; and that in the event of the withdrawal of said Bid within said period, or failure to enter into said Agreement and give said bonds within 15 days after Principal has received notice of acceptance of the Bid, Principal and Surety shall be jointly and severally liable to the Owner for the difference between the amount specified in said Bid and such larger amount for which the Owner may contract with another party to perform the work covered by said Bid, up to the amount of the Bid guarantee. This amount represents the damage to the Owner on account of the default of the Bidder in any particular thereof. It being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the said amount of this obligation as herein stated. Provided, however, that in addition to the amount of this obligation as herein stated, the Surety shall be liable for all costs and attorney’s fees incurred by the Obligee in enforcing the obligations hereunder.

The Surety, for value received, hereby stipulates and agrees that the obligations of the Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such bid; and the Surety does hereby waive notice of such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year set forth below.
Signed and sealed this ___ day of ____________, 20__ .

PRINCIPAL

By________________________________________

SURETY

By________________________________________
Attorney-In-Fact

IMPORTANT: The Surety executing bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the Commonwealth of Virginia.
CONTRACT FORMS
AGREEMENT BETWEEN OWNER AND CONTRACTOR
FOR CONSTRUCTION CONTRACT

THIS AGREEMENT is by and between Hampton Roads Sanitation District (HRSD) (Owner), and [name] (Contractor).

PROJECT INFORMATION

Construction Contract: [name] [Owner’s identification number] (Contract)

Authorized Representatives: Owner and Contractor each hereby designates a specific individual authorized to act as representative with respect to the performance of responsibilities under this Contract. Such an individual shall have authority to transmit instructions, receive formal notices, receive information, and render decisions relative to this Contract on behalf of the respective party that the individual represents.

1. Owner’s Authorized Representative:

   [Name], [Title – Chief of Design and Construction or Director of Engineering]
   [Address]
   (757) [Number]; [email]@hrsd.com

2. Contractor’s Authorized Representative:

   [Name], [Title]
   [Address]
   [Phone Number]; [Email Address]

Owner and Contractor further agree as follows:

ARTICLE 1 – THE WORK

1.01 General Description of Work

   A. Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: [Add project information].

ARTICLE 2 – ENGINEER

2.01 The Owner has retained [Name] (Engineer) to act as Owner’s representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

2.02 The part of the Project that pertains to the Work has been designed by [Name].

ARTICLE 3 – CONTRACT TIMES

3.01 Time is of the Essence

   A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment, as stated in the Contract Documents, are of the essence of the Contract.

3.02 Contract Times [Dates]

   A. The Work will be substantially complete on or before [date], and completed and ready for
3.02 **Contract Times** [Days]

A. The Work will be substantially complete within [number] calendar days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment, in accordance with Paragraph 15.06 of the General Conditions, within [number] calendar days after the date when the Contract Times commence to run.

3.03 **[OPTIONAL] Milestones**

A. Parts of the Work must be substantially completed on or before the following Milestone[s]:

1. Milestone 1 [event & date/days].
2. Milestone 2 [event & date/days].
3. Milestone 3 [event & date/days].

3.04 **Liquidated Damages**

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 3.01 above, and that Owner will suffer financial and other losses if the Work is not completed and Milestones (if applicable) not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a lawsuit or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. **Substantial Completion**: Contractor shall pay Owner $[number] for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 3.02 above for Substantial Completion, until the Work is substantially complete.

2. **Completion of Remaining Work**: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner $[number] for each day that expires after such time until the Work is completed and ready for final payment.

3. **[OPTIONAL] Milestones**: Contractor shall pay Owner $[amount] for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for achievement of Milestone 1, until Milestone 1 is achieved.

4. Liquidated damages for failing to timely attain Substantial Completion, final completion, and Milestones (if applicable) are not additive, and will not be imposed concurrently. Liquidated damages for failing to attain Substantial Completion shall take precedence.

B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner’s sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

C. **[OPTIONAL] Bonus**: Contractor and Owner further recognize that the Owner will realize
3.05 **Special Damages**

A. In addition to the amount provided for liquidated damages, Contractor shall reimburse Owner (1) for any fines or penalties imposed on Owner as a direct result of the Contractor’s failure to attain Substantial Completion according to the Contract Times, and (2) for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified above in Paragraph 3.02 for Substantial Completion (as duly adjusted pursuant to the Contract), until the Work is substantially complete.

B. After Contractor achieves Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times, Contractor shall reimburse Owner for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified above in Paragraph 3.02 for Work to be completed and ready for final payment (as duly adjusted pursuant to the Contract), until the Work is completed and ready for final payment.

C. The special damages imposed in this paragraph are supplemental to any liquidated damages for delayed completion established in this Agreement.

**ARTICLE 4 – CONTRACT PRICE**

4.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, the amounts that follow, subject to adjustment under the Contract:

A. For all Work other than Unit Price Work, a lump sum of: $\text{[amount]}$ (\text{[words]} dollars).

   All specific cash allowances are included in the above price in accordance with Paragraph 13.02 of the General Conditions.

B. For all Unit Price Work, an amount equal to the sum of the extended prices (established for each separately identified item of Unit Price Work by multiplying the unit price times the actual quantity of that item).

<table>
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<tr>
<th>Unit Price Work</th>
<th>Unit No.</th>
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<th>Estimated Quantity</th>
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<th>Extended Price</th>
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<td>Total of all Extended Prices for Unit Price Work (subject to final adjustment based on actual quantities)</td>
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This document is a MODIFIED version of EJCDC® C-520, Agreement Between Owner and Contractor for Construction Contract (Stipulated Price). Copyright © 2016 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.
The extended prices for Unit Price Work set forth as of the Effective Date of the Contract are based on estimated quantities. As provided in Paragraph 13.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer.

C. Total of Lump Sum Amount and Unit Price Work (subject to final Unit Price adjustment): $[amount] ([words] dollars).

ARTICLE 5 – PAYMENT PROCEDURES

5.01 Submittal and Processing of Payments

A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Owner and Engineer will process Applications for Payment as provided in the General Conditions.

5.02 Progress Payments; Retainage

A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor’s Applications for Payment monthly during performance of the Work as provided in Paragraph 5.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner, have been approved by the Engineer and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.
   a. 95 percent of Work completed (with the balance being retainage); and
   b. 95 percent of cost of materials and equipment not incorporated in the Work but delivered, suitably stored, and accompanied by documentation satisfactory to Owner as provided in Paragraph 15.01.B of the General Conditions (with the balance being retainage).

B. Upon Substantial Completion, the retainage shall be further reduced below 5 percent to that amount necessary to assure completion as determined by the Owner. The determination of any such reduction shall be at the sole discretion of the Owner.

5.03 Diversity Procurement

A. The Contractor and Suppliers are encouraged to provide the participation of small, women-owned, minority-owned or service-disabled veteran-owned businesses in this Contract. With each monthly Application for Payment, the Contractor shall document the following:

1. if the Contractor is designated by the Commonwealth of Virginia as a small, women-owned, minority-owned or service-disabled veteran-owned business, the designation type and the dollar value of work completed by the Design-Builder;
2. dollar value of work completed by Subcontractors designated by the Commonwealth of Virginia as small business;
3. dollar value of work completed by Subcontractors designated by the Commonwealth of Virginia as women-owned business;

4. dollar value of work completed by Subcontractors designated by the Commonwealth of Virginia as minority-owned business; and

5. dollar value of work completed by Subcontractors designated by the Commonwealth of Virginia as service-disabled veteran-owned business.

5.04 Subcontractor Payments

A. Within 7 days of each payment by Owner to Contractor under this Agreement, Contractor shall either: (1) pay the Subcontractor for the proportionate share of the total payment received, attributable to the work performed by the Subcontractor; or (2) notify the Owner in writing of the intention to withhold all or part of the Subcontractor’s payment with the reason for nonpayment.

B. Contractor shall pay interest to its Subcontractors on all amounts owed by the Contractor that remain unpaid 7 days after receipt of the Contractor of payment from Owner for work performed by the Subcontractor, except of amounts withheld as allowed above and unless otherwise provided under the terms of this Agreement. Unless otherwise provided under the terms of this Agreement, interest shall accrue at the rate of 1 percent per month.

C. Contractor shall include in each its subcontracts a provision requiring each Subcontractor to include or otherwise be subject to the same payment and interest requirements set forth in this paragraph. A contract modification or cost reimbursement claim shall not include any amounts for reimbursement of such interest charges.

5.05 Final Payment

A. Upon final completion and acceptance of the Work in accordance with Paragraph 15.06 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by the Engineer as provided in Paragraph 15.06 of the General Conditions.

5.06 Consent of Surety

A. Owner may withhold final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return or release.

ARTICLE 6 – REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

6.01 Contractor’s Representations

A. Contractor makes the following representations for Owner’s reliance:

1. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.

2. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

3. Contractor is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

4. Contractor has carefully studied all: (a) reports of explorations and tests of subsurface
conditions at or adjacent to the Site, and all drawings of physical conditions relating to existing surface or subsurface structures at the Site, if any, that Owner has identified or made available to Contractor, especially with respect to Technical Data in such reports and drawings, and (b) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site, that Owner has identified or made available to Contractor, especially with respect to Technical Data in such reports and drawings.

5. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings, if any, identified in the Contract Documents or otherwise made available to Contractor, with respect to the effect of such information, observations, and documents on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor’s safety precautions and programs.

6. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary prior to entry into the Contract at the Contract Price, subject to the Contract Times.

7. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

8. Contractor has submitted online discussions through HRSD’s Online Oracle Enterprise Resource Planning (ERP) system as written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written response from Owner is acceptable to Contractor.

9. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

10. Contractor’s entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

11. Contractor is organized or authorized to transact business in the Commonwealth of Virginia in accordance with Title 13.1 and Title 50 of the Code of Virginia. Contractor shall not allow its existence to lapse or its certificate of authority or registration to transact business in the Commonwealth of Virginia, if so, required under Title 13.1 and Title 50 of the Code of Virginia, to be revoked or cancelled at any time during the term of this Contract. If the Contractor fails to remain in compliance with the provisions of this section, Owner reverse the right to cancel this Agreement.


6.02 Contractor’s Certifications

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph
6.02:
1. “corrupt practice” means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;
2. “fraudulent practice” means an intentional misrepresentation of facts made (a) to influence the bidding process or in the Contract execution to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
3. “collusive practice” means a scheme or arrangement between 2 or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid or Contract prices at artificial, non-competitive levels; and
4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or in the Contract execution.

6.03  Anti-Discrimination Requirements
A. For all contracts over $10,000 the Contractor must agree not to discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability or other basis prohibited by state law relating to discrimination in employment. During the performance of this contract, the Contractor agrees to:
   1. post in conspicuous place, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause;
   2. in all solicitations or advertisements for employees placed by or on behalf of the Contractor, will state that such Contractor is an equal opportunity employer. Notices, advertisements and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section; and
   3. include the provisions of the foregoing clauses in every construction subcontract or purchase order over $10,000, so that the provisions will be binding upon each construction subcontractor or vendor, all in accordance with §2.2-4311 of the Code of Virginia.
   B. Further, in accordance with §2.2-4343.1 of the Code of Virginia, the Contractor shall not discriminate against a faith-based organization on the basis of the organization’s religious character or impose conditions that restrict the religious character of the faith-based organization, except in accord with §2.2-4343.1.F of the Code of Virginia, that no funds shall be expended on contracts for religious worship, instruction, or proselytizing, or impair, diminish, or discourage the exercise of religious freedom by the recipients of such goods, services, or disbursements.

6.04  Drug Free Workplace Requirements
A. For all contracts over $10,000 the Contractor must maintain a drug-free workplace. During the performance of this Contract, the Contractor agrees to:
   1. provide a drug-free workplace for the Contractor’s employees;
   2. post in conspicuous places, available to employees and applicants for employment, a
statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the Contractor’s workplace and specifying the actions that will be taken against employees for violations of such prohibition;

3. state in all solicitations or advertisements for employees placed by or on behalf of the Contractor that the Contractor maintains a drug-free workplace; and

4. include the provisions of the foregoing clauses in every subcontract or purchase order over $10,000, so that the provisions will be binding upon each subcontractor or vendor, all in accordance with §2.2-4312 of the Code of Virginia.

**ARTICLE 7 – CONTRACT DOCUMENTS**

7.01 **Contents**

A. The Contract Documents consist of the following:

1. This Agreement (pages 1 to [#], inclusive).

2. General Conditions (pages 1 to 70, inclusive; not attached but incorporated by reference).

3. Supplementary Conditions (pages 1 to [#], inclusive; not attached but incorporated by reference).

4. Specifications (pages 1 to [#], inclusive; not attached but incorporated by reference).

5. Drawings (not attached but incorporated by reference) consisting of [#] sheets with each sheet bearing the following general title: [tile of Drawings]. [OR] Drawings listed on the attached sheet index.

6. Addenda (numbers 1 to [#], inclusive; not attached but incorporated by reference).

7. Exhibits to this Agreement (enumerated as follows):

   a. Contractor’s Bid submitted in HRSD’s Online Oracle ERP system (Solicitation [#]: Response [#]; not attached but incorporated by reference).

8. The following will be delivered or issued after the Effective Date of this Agreement and are not attached hereto:

   a. Notice to Proceed.

   b. Performance Bond (together with power of attorney).

   c. Payment Bond (together with power of attorney).

   d. Insurance Certificates.

   e. Work Change Directives (if applicable).

   f. Change Orders (if applicable).

   g. Warranty Bond (if applicable).

9. **[OPTIONAL]** Other Exhibits to this Agreement (enumerated as follows):

   a. [List].

B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except
as expressly noted otherwise above).
C. There are no Contract Documents other than those listed above in this Article 7.
D. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

ARTICLE 8 – MISCELLANEOUS

8.01 Terms
A. Terms used in this Agreement will have the meanings stated in the General Conditions and Supplementary Conditions.

8.02 Assignment of Contract
A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party hereto of any rights under or interests in the Contract will be binding on the other party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

8.03 Successors and Assigns
A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, and its successors, assigns, and legal representatives, in respect to all covenants, agreements, and obligations contained in the Contract.

8.04 Severability
A. Any provision or part of the Contract held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

8.05 Permission to Use HRSD Name and Social Media Release
A. The Contractor or any of its employees or agents shall not use HRSD’s name, logo, proprietary information, or site photographs in any format for any personal or professional marketing or public relations material or social media use without prior review and approval from HRSD. These materials include, but are not limited to, advertisements, news releases, published articles, customer lists, social media posts, advertorials or any other promotional purposes. HRSD’s Director of Communications shall be provided with any material to be shared with the public at least 7 business days prior to the planned release of the information.

This Agreement will be effective on [date] (which is the Effective Date of the Contract).

The agreement and all subsequent changes to the agreement will be approved and executed using HRSD’s Online Oracle ERP system. Physical signatures (on the agreement and future change orders) will not be required if acknowledged by Design-Builder through the ERP system.
PERFORMANCE BOND

BOND NO.____________

AMOUNT: $«Contract_Value»

KNOW ALL MEN BY THESE PRESENTS, that «Contractor» of «Address_Line_1», «Address_Line_2», hereinafter called the Contractor (Principal), and «Surety», a corporation duly organized and existing under and by virtue of the laws of the State of «Surety_State», hereinafter called the Surety, and authorized to transact business within the Commonwealth of Virginia, as Surety, are held and firmly bound unto Hampton Roads Sanitation District (HRSD) as Owner (Obligee), in the sum of «Value_words» Dollars ($«Contract_Value») for payment of which, well and truly be made to the Owner, the Contractor and the Surety bind themselves and each of their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents as follows:

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT:

WHEREAS, the Contractor has executed and entered into a certain Contract hereto attached, with the Owner, dated «Contract_Date» for [PROJECT_NAME].

NOW, THEREFORE, if the Contractor shall at all times duly, promptly, and faithfully perform the Contract and any alteration in or addition to the obligations of the Contractor arising thereunder, including the matter of infringement, if any, of patents or other proprietary rights, and shall assure all guarantees against defective workmanship and materials, including the guarantee period following final completion by the Contractor and final acceptance by the Owner and comply with all the covenants therein contained in the Specifications, Drawings, and other Documents constituting a part of the Contract required to be performed by the Contractor, in the manner and within the times provided in the Contract, and shall fully indemnify and save harmless the Owner from all costs and damage which it may suffer by reason or failure so to do, and shall fully reimburse and repay it all outlay and expenses which it may incur in making good any default, and reasonable counsel fees incurred in the prosecution of or defense of any action arising out of or in connection with any such default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that the Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration, or addition to the terms of the Contract Documents or to the work to be performed thereunder, shall in any way affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration, or addition to the terms of the Contract Documents.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, the above parties bounded together have executed this instrument this ____ day of ______________, 20__, the name and corporate seal of each corporate party being hereto affixed and those presents duly signed by its undersigned representative, pursuant to authority of its governing body.
«CONTRACTOR»

By ____________________________
(Seal)

Attest

«SURETY»

By ____________________________
(Seal)

Attest

NOTE: Date of bond must not be prior to date of Contract. If Contractor is a partnership, all partners should execute bond.

IMPORTANT: The Surety named on this bond shall be one who is licensed to conduct business in the state where the project is located, and named in the current list of Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies, as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U.S. Treasury Department. All bonds signed by an agent must be accompanied by a certified copy of the authority to act for the Surety at the time of the signing of this bond.
PAYMENT BOND

BOND NO.__________

AMOUNT: »Contract_Value«

KNOW ALL MEN BY THESE PRESENTS, that »Contractor« of »Address_Line_1«, »Address_Line_2«, hereinafter called the Contractor (Principal), and »Surety«, a corporation duly organized and existing under and by virtue of the laws of the State of »Surety_State«, hereinafter called the Surety, and authorized to transact business within the Commonwealth of Virginia, as Surety, are held and firmly bound unto Hampton Roads Sanitation District (HRSD) as Owner (Obligee), in the sum of »Value_words« Dollars ($»Contract_Value«) for payment of which, well and truly be made to the Owner, the Contractor and the Surety bind themselves and each of their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents as follows:

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT:

WHEREAS, the Contractor has executed and entered into a certain Contract hereto attached, with the Owner, dated »Contract_Date« for [PROJECT NAME].

NOW, THEREFORE, if the Contractor shall promptly make payment to all persons, firms, subcontractors, and corporations furnishing materials for or performing labor in the prosecution of the work provided for in the Contract, and any authorized extension or modification thereof, including but not limited to, all amounts due for materials, lubricants, oil, gasoline, repairs on machinery, equipment, and tools consumed or used in connection with the construction of the work, and all insurance premiums on the work, and for all labor performed in the work, whether by subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration, or addition to the terms of the Contract, or to work to be performed thereunder, or the Specifications accompanying the same, shall in any way affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration, or addition to the terms of the Contract, or to the work, or to the Specifications.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, the above parties bounded together have executed this instrument this _____ day of ____________, 20___, the name and corporate seal of each corporate party being hereto affixed and those presents duly signed by its undersigned representative, pursuant to authority of its governing body.
NOTE: Date of bond must not be prior to date of Contract. If Contractor is a partnership, all partners should execute bond.

IMPORTANT: The Surety named on this bond shall be one who is licensed to conduct business in the Commonwealth of Virginia, and named in the current list of Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies, as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U.S. Treasury Department. All bonds signed by an agent must be accompanied by a certified copy of the authority to act for the Surety at the time of the signing of this bond.
ESCROW AGREEMENT

THIS ESCROW AGREEMENT, made and entered into this ___ day of ____________, 20__, by, between and among Hampton Roads Sanitation District (HRSD) and «Contractor» (Contractor), _______________ (Bank), a trust company, bank, or savings and loan institution with its principal office located in the Commonwealth and «Surety» (Surety), provides:

I.

HRSD and the Contractor have entered into an agreement with respect to HRSD Agreement titled [PROJECT NAME] (Agreement). This Escrow Agreement is pursuant to, but in no way amends or modifies the contract. Payments made hereunder or the release of funds from escrow shall not be deemed approval or acceptance of performance by the Contractor.

II.

In order to assure full and satisfactory performance by the Contractor of its obligations under the agreement, HRSD is entitled to retain certain amounts otherwise due the Contractor, known as retainage. The Contractor has, with the approval of HRSD, elected to have such retainage held in escrow by the Bank. This document sets forth the terms of the escrow. The Bank shall not be deemed a party to, bound by, or required to inquire into the terms of the agreement or any other instrument or agreement between HRSD and the Contractor.

III.

HRSD shall from time to time pursuant to its contract pay to the Bank amounts retained by it under the agreement. Except as to amounts actually withdrawn from escrow by HRSD, the Contractor shall look solely to the Bank for the payment of funds retained under the agreement and paid by HRSD to the Bank.

The risk of loss by diminution of the principal of any funds invested under the terms of this Escrow Agreement shall be solely upon the Contractor.

Funds and securities held by the Bank pursuant to this Escrow Agreement shall not be subject to levy, garnishment, attachment, lien or other process whatsoever. Contractor agrees not to assign, pledge, discount, sell or otherwise transfer or dispose of his interest in the escrow account or any part thereof, except to the Surety.

IV.

Upon receipt of checks or warrants drawn by HRSD and made payable to it as escrow agent, the Bank shall promptly notify the Contractor, negotiate the same and deposit or invest and reinvest the proceeds in approved securities in accordance with the written instructions of the Contractor. In no event shall the Bank invest the escrow funds in any security not approved.

V.

The following securities, and none other, are approved securities for all purposes of this Escrow
Agreement:

1. United States Treasury Bonds, United States Treasury Notes, United States Treasury Certificates of Indebtedness or United States Treasury Bills.

2. Bonds, notes and other evidences of indebtedness unconditionally guaranteed as to the payment of principal and interest by the United States.

3. Bonds or notes of the Commonwealth of Virginia.

4. Bonds of any political subdivision of the Commonwealth of Virginia, if such bonds carried, at the time of purchase by the Bank or deposit by the Contractor, a Standard and Poor’s or Moody’s Investors Service rating of at least “A”.

5. Certificates of deposit or other financial accounts issued or held by commercial banks located within the Commonwealth, including, but not limited to, those insured by the Bank and its affiliates.

6. Any bonds, notes, or other evidences of indebtedness listed in Paragraphs 1 through 3 may be purchased pursuant to a repurchase agreement with a bank, within or without the Commonwealth of Virginia having a combined capital, surplus and undivided profit of not less than $25,000,000, provided the obligation of the Bank to repurchase is within the time limitations established for investments as set forth herein. The repurchase agreement shall be considered a purchase of such securities even if title, and/or possession of such securities is not transferred to the Escrow Agent, so long as the repurchase obligation of the bank is collateralized by the securities themselves, and the securities have on the date of the repurchase agreement a fair market value equal to at least 100% of the amount of the repurchase obligation of the Bank and the securities are held by a third party, and segregated from other securities owned by the Bank.

No security is approved hereunder which matures more than five years after the date of its purchase by the Bank or deposit by the Contractor.

VI.

The Contractor may from time to time withdraw the whole or any portion of the escrowed funds by depositing with the Bank approved securities in an amount equal to, or in excess of, the amount so withdrawn. Any securities so deposited or withdrawn shall be valued at such time of deposit or withdrawal at the lower par or market value, the latter as determined by the Bank. Any securities so deposited shall thereupon become a part of the escrowed fund.

Upon receipt of a direction signed by the HRSD General Manager, Director of Finance or Chief of Accounting & Finance, the Bank shall pay the principal of the fund, or any specified amount thereof, to HRSD. Such payment shall be made as soon as is practicable after receipt of the direction.

Upon receipt of a direction signed by either the General Manager, Director of Finance or Chief of Accounting & Finance on behalf of HRSD, the Bank shall pay and deliver the principal of the fund, or any specified portion thereof, to the Contractor, in cash or in kind, as may be specified by the Contractor. Such payment and delivery shall be made as soon as is practicable after receipt of the direction.
VII.

For its services hereunder the Bank shall be entitled to a reasonable fee in accordance with its published schedule of fees or as may be agreed upon by the Bank and the Contractor. Such fee and any other costs of administration of this Agreement shall be paid from the income earned upon the escrow fund and, if such income is not sufficient to pay the same, by the Contractor.

Under no circumstances shall HRSD be responsible to the Bank for any fee or costs of administering this agreement, account, or escrow fund.

VIII.

The net income earned and received upon the principal of the escrow fund shall be paid over to the Contractor in quarterly or more frequent installments. Until so paid or applied to pay the Bank's fee or any other costs of administration such income shall be deemed a part of the principal of the fund. All income earned shall be reported by the Bank to the Internal Revenue Service and other taxing authorities on the Contractor's Tax Identification Number.

IX.

The Surety undertakes no obligation hereby but joins in the Agreement for the sole purpose of acknowledging that its obligations as surety for the Contractor's performance of the contract are not affected hereby.

WITNESS the following signatures, all as of the day and year first above written.

HAMPTON ROADS SANITATION DISTRICT

By____________________________________

Director of Finance or
Chief of Accounting & Finance

«Contractor»

_______________________________

Contractor's Tax Identification Number or
Owner's Social Security Number

By __________________________________________

Officer, Partner or Owner

BANK:

__________________________________________

Mailing Address to which
Payments are to be Mailed

__________________________________________

Account Number

By __________________________________________

President/Vice President

«Surety»

By __________________________________________

Attorney-in-Fact
CONDITIONS OF THE CONTRACT
# STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT

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ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term’s singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. Addenda—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. Agreement—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. Application for Payment—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. Bid—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. Bidder—An individual or entity that submits a Bid to Owner.

6. Bidding Documents—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. Bidding Requirements—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. Change Order—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. Change Proposal—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. Claim

   a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the
requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer’s decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer’s decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. Constituent of Concern—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. Contract—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. Contract Documents—Those items so designated in the Agreement, and which together comprise the Contract.

14. Contract Price—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. Contract Times—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. Contractor—The individual or entity with which Owner has contracted for performance of the Work.

17. Cost of the Work—See Paragraph 13.01 for definition.

18. Drawings—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. Effective Date of the Contract—The date, indicated in the Agreement, on which the Contract becomes effective.

20. Electronic Document—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. Electronic Means—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the recipient; (d) the storage and archiving of the Electronic Document by sender and...
recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. **Engineer**—The individual or entity named as such in the Agreement.

23. **Field Order**—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. **Hazardous Environmental Condition**—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.
   
a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.
   
b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.
   
c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. **Laws and Regulations; Laws or Regulations**—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. **Liens**—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. **Milestone**—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. **Notice of Award**—The written notice by Owner to a Bidder of Owner’s acceptance of the Bid.

29. **Notice to Proceed**—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. **Owner**—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. **Progress Schedule**—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor’s plan to accomplish the Work within the Contract Times.

32. **Project**—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
33. **Resident Project Representative**—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. **Samples**—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

35. **Schedule of Submittals**—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals.

36. **Schedule of Values**—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.

37. **Shop Drawings**—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. **Site**—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

39. **Specifications**—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. **Subcontractor**—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. **Submittal**—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers’ instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. **Substantial Completion**—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion of such Work.
43. **Successful Bidder**—The Bidder to which the Owner makes an award of contract.

44. **Supplementary Conditions**—The part of the Contract that amends or supplements these General Conditions.

45. **Supplier**—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

46. **Technical Data**

   a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

   b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

   c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. **Underground Facilities**—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

48. **Unit Price Work**—Work to be paid for on the basis of unit prices.

49. **Work**—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

50. **Work Change Directive**—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.
1.02 Terminology

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. Intent of Certain Terms or Adjectives: The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. Day: The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.

D. Defective: The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
   1. does not conform to the Contract Documents;
   2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
   3. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. Furnish, Install, Perform, Provide
   1. The word “furnish,” when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
   2. The word “install,” when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
   3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.
   4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.
F. **Contract Price or Contract Times**: References to a change in “Contract Price or Contract Times” or “Contract Times or Contract Price” or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term “or both” is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

**ARTICLE 2—PRELIMINARY MATTERS**

2.01 **Delivery of Performance and Payment Bonds; Evidence of Insurance**

A. **Performance and Payment Bonds**: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. **Evidence of Contractor’s Insurance**: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. **Evidence of Owner’s Insurance**: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 **Copies of Documents**

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 **Before Starting Construction**

A. **Preliminary Schedules**: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

   1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

   2. a preliminary Schedule of Submittals; and

   3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments
during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 ***Preconstruction Conference; Designation of Authorized Representatives***

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 ***Acceptance of Schedules***

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor’s full responsibility therefor.

2. Contractor’s Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor’s Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 ***Electronic Transmittals***

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient’s use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.
ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 Intent

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 Reference Standards

A. Standards Specifications, Codes, Laws and Regulations

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for
3.03 Reporting and Resolving Discrepancies

A. Reporting Discrepancies

1. **Contractor’s Verification of Figures and Field Measurements**: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. **Contractor’s Review of Contract Documents**: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. Resolving Discrepancies

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
   a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or
   b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 Requirements of the Contract Documents

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.
B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer’s written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 Reuse of Documents

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner’s express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 Commencement of Contract Times; Notice to Proceed

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 Starting the Work

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 Reference Points

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer’s judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the
established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 **Progress Schedule**

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 **Delays in Contractor’s Progress**

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor’s performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor’s sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions;

3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.
D. Contractor’s entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor’s entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;

2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

4. The number of days’ increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 Availability of Lands

A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.
B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner’s interest therein as necessary for giving notice of or filing a mechanic’s or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 Use of Site and Other Areas

A. Limitation on Use of Site and Other Areas

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor’s operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor’s performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. Removal of Debris During Performance of the Work: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. Cleaning: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not
5.03 Subsurface and Physical Conditions

A. Reports and Drawings: The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;
2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and
3. Technical Data contained in such reports and drawings.

B. Underground Facilities: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. Reliance by Contractor on Technical Data: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. Limitations of Other Data and Documents: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor’s purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;
2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;
3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner’s archival documents concerning the Site; or
4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 Differing Subsurface or Physical Conditions

A. Notice by Contractor: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;
2. is of such a nature as to require a change in the Drawings or Specifications;
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and
   generally recognized as inherent in work of the character provided for in the Contract
   Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing
the subsurface or physical conditions or performing any Work in connection therewith (except
in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about
such condition. Contractor shall not further disturb such condition or perform any Work in
connection therewith (except with respect to an emergency) until receipt of a written
statement permitting Contractor to do so.

B. **Engineer’s Review:** After receipt of written notice as required by the preceding paragraph,
Engineer will promptly review the subsurface or physical condition in question; determine
whether it is necessary for Owner to obtain additional exploration or tests with respect to the
condition; conclude whether the condition falls within any one or more of the differing site
condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information
from Contractor; prepare recommendations to Owner regarding the Contractor’s resumption
of Work in connection with the subsurface or physical condition in question and the need for
any change in the Drawings or Specifications; and advise Owner in writing of Engineer’s
findings, conclusions, and recommendations.

C. **Owner’s Statement to Contractor Regarding Site Condition:** After receipt of Engineer’s written
findings, conclusions, and recommendations, Owner shall issue a written statement to
Contractor (with a copy to Engineer) regarding the subsurface or physical condition in
question, addressing the resumption of Work in connection with such condition, indicating
whether any change in the Drawings or Specifications will be made, and adopting or rejecting
Engineer’s written findings, conclusions, and recommendations, in whole or in part.

D. **Early Resumption of Work:** If at any time Engineer determines that Work in connection with
the subsurface or physical condition in question may resume prior to completion of Engineer’s
review or Owner’s issuance of its statement to Contractor, because the condition in question
has been adequately documented, and analyzed on a preliminary basis, then the Engineer
may at its discretion instruct Contractor to resume such Work.

E. **Possible Price and Times Adjustments**

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract
   Times, to the extent that the existence of a differing subsurface or physical condition, or
   any related delay, disruption, or interference, causes an increase or decrease in
   Contractor’s cost of, or time required for, performance of the Work; subject, however, to
   the following:

   a. Such condition must fall within any one or more of the categories described in
      Paragraph 5.04.A;

   b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract
      Price will be subject to the provisions of Paragraph 13.03; and,

   c. Contractor’s entitlement to an adjustment of the Contract Times is subject to the
      provisions of Paragraphs 4.05.D and 4.05.E.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
   a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;
   b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor’s making such commitment; or
   c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor’s entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner’s issuance of the Owner’s written statement to Contractor regarding the subsurface or physical condition in question.

F. Underground Facilities; Hazardous Environmental Conditions: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 Underground Facilities

A. Contractor’s Responsibilities: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:
   1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
   2. complying with applicable state and local utility damage prevention Laws and Regulations;
   3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;
   4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
   5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. Notice by Contractor: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or
performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. **Engineer’s Review**: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor’s resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer’s findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. **Owner’s Statement to Contractor Regarding Underground Facility**: After receipt of Engineer’s written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer’s written findings, conclusions, and recommendations in whole or in part.

E. **Early Resumption of Work**: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer’s review or Owner’s issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. **Possible Price and Times Adjustments**

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor’s cost of, or time required for, performance of the Work; subject, however, to the following:
   a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;
   b. Contractor’s entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and
   c. Contractor gave the notice required in Paragraph 5.05.B.
2. If Owner and Contractor agree regarding Contractor’s entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner’s issuance of the Owner’s written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor’s remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 Hazardous Environmental Conditions at Site

A. Reports and Drawings: The Supplementary Conditions identify:
   1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;
   2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
   3. Technical Data contained in such reports and drawings.

B. Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
   1. the completeness of such reports and drawings for Contractor’s purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;
   2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
   3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner’s written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner’s own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as
Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual’s or entity’s own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual’s or entity’s own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 Performance, Payment, and Other Bonds

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor’s obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or Regulations, and must be issued and signed by a surety named in “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual’s authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify
Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner’s termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 Insurance—General Provisions

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and “Occupational Accident and Excess Employer’s Indemnity Policies,” are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.
F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party’s full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party’s obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner’s option, may purchase and maintain Owner’s own liability insurance. Owner’s liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner’s liability policies for any of Contractor’s obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:
   1. Subcontractors to purchase and maintain worker’s compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor’s liability policies) on each Subcontractor’s commercial general liability insurance policy; and
   2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor’s entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner’s termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party’s interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor’s interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor’s liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.
6.03 Contractor’s Insurance

A. Required Insurance: Contractor shall purchase and maintain Worker’s Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. General Provisions: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;
2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;
3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;
4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and
5. include all necessary endorsements to support the stated requirements.

C. Additional Insureds: The Contractor’s commercial general liability, automobile liability, employer’s liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;
2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;
3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);
4. not seek contribution from insurance maintained by the additional insured; and
5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor’s acts or omissions, or the acts and omissions of those working on Contractor’s behalf, in the performance of Contractor’s operations.

6.04 Builder’s Risk and Other Property Insurance

A. Builder’s Risk: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder’s risk insurance upon the Work on a completed value basis, in the amount of the Work’s full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder’s risk insurance are set forth in the Supplementary Conditions.
B. **Property Insurance for Facilities of Owner Where Work Will Occur:** Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder’s risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. **Property Insurance for Substantially Complete Facilities:** Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder’s risk insurance. The builder’s risk insurance may terminate upon written confirmation of Owner’s procurement of such property insurance.

D. **Partial Occupancy or Use by Owner:** If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder’s risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder’s risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. **Insurance of Other Property; Additional Insurance:** If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder’s risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor’s expense.

### 6.05 Property Losses; Subrogation

A. The builder’s risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder’s risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.

2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner’s existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer’s rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner’s property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder’s risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 Receipt and Application of Property Insurance Proceeds

A. Any insured loss under the builder’s risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder’s risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.
ARTICLE 7—CONTRACTOR’S RESPONSIBILITIES

7.01 Contractor’s Means and Methods of Construction
   A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
   B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor’s responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor’s expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor’s determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 Supervision and Superintendence
   A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.
   B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 Labor; Working Hours
   A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.
   B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor’s employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor’s own acts and omissions.
   C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 Services, Materials, and Equipment
   A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.
B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 “Or Equals”

A. Contractor’s Request; Governing Criteria: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or “or equal” item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an “or equal” item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

   a. in the exercise of reasonable judgment Engineer determines that the proposed item:

      1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

      2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

      3) has a proven record of performance and availability of responsive service; and

      4) is not objectionable to Owner.

   b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

      1) there will be no increase in cost to the Owner or increase in Contract Times; and

      2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. Contractor’s Expense: Contractor shall provide all data in support of any proposed “or equal” item at Contractor’s expense.

C. Engineer’s Evaluation and Determination: Engineer will be allowed a reasonable time to evaluate each “or-equal” request. Engineer may require Contractor to furnish additional data about the proposed “or-equal” item. Engineer will be the sole judge of acceptability. No “or-equal” item will be ordered, furnished, installed, or utilized until Engineer’s review is complete and Engineer determines that the proposed item is an “or-equal,” which will be evidenced by
an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. **Effect of Engineer’s Determination:** Neither approval nor denial of an “or-equal” request will result in any change in Contract Price. The Engineer’s denial of an “or-equal” request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. **Treatment as a Substitution Request:** If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an “or-equal” item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 **Substitutes**

A. **Contractor’s Request; Governing Criteria:** Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:

   a. will certify that the proposed substitute item will:

      1) perform adequately the functions and achieve the results called for by the general design;

      2) be similar in substance to the item specified; and

      3) be suited to the same use as the item specified.

   b. will state:

      1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

      2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

      3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
c. will identify:
   1) all variations of the proposed substitute item from the item specified; and
   2) available engineering, sales, maintenance, repair, and replacement services.

d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. **Engineer's Evaluation and Determination:** Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. **Special Guarantee:** Owner may require Contractor to furnish at Contractor’s expense a special performance guarantee or other surety with respect to any substitute.

D. **Reimbursement of Engineer’s Cost:** Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. **Contractor’s Expense:** Contractor shall provide all data in support of any proposed substitute at Contractor’s expense.

F. **Effect of Engineer’s Determination:** If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer’s denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 **Concerning Subcontractors and Suppliers**

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor’s retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor’s obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.
C. Subsequent to the submittal of Contractor’s Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner’s requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.
7.08  *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09  *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor’s Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10  *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11  *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor’s compliance with any Laws or Regulations.
B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor’s responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor’s Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 Record Documents

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.13 Safety and Protection

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;
2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of
construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner’s safety programs, if any. Any Owner’s safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor’s safety program with which Owner’s and Engineer’s employees and representatives must comply while at the Site.

I. Contractor’s duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor’s duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 Hazard Communication Programs

A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 Emergencies

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor’s response to an emergency. If Engineer
determines that a change in the Contract Documents is required because of an emergency or Contractor’s response, a Work Change Directive or Change Order will be issued.

7.16 Submittals

A. Shop Drawing and Sample Requirements

1. Before submitting a Shop Drawing or Sample, Contractor shall:
   a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
   b. determine and verify:
      1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;
      2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
      3) all information relative to Contractor’s responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;
   c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor’s obligations under the Contract Documents with respect to Contractor’s review of that Submittal, and that Contractor approves the Submittal.

3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. Submittal Procedures for Shop Drawings and Samples: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. Shop Drawings
   a. Contractor shall submit the number of copies required in the Specifications.
   b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. Samples
   a. Contractor shall submit the number of Samples required in the Specifications.
b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer’s review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. **Engineer’s Review of Shop Drawings and Samples**

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer’s review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer’s review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer’s review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer’s review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer’s review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer’s review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer’s receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. **Resubmittal Procedures for Shop Drawings and Samples**

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.
2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer’s time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer’s charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer’s charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:
   a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.
   b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.
   c. Engineer’s review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.
   d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03, 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 Contractor’s General Warranty and Guarantee

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor’s warranty and guarantee.

B. Owner’s rights under this warranty and guarantee are in addition to, and are not limited by, Owner’s rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and
2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor’s warranty and guarantee hereunder excludes defects or damage caused by:
    1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
    2. normal wear and tear under normal usage.

D. Contractor’s obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor’s obligation to perform the Work in accordance with the Contract Documents, or a release of Owner’s warranty and guarantee rights under this Paragraph 7.17:
    1. Observations by Engineer;
    2. Recommendation by Engineer or payment by Owner of any progress or final payment;
    3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
    4. Use or occupancy of the Work or any part thereof by Owner;
    5. Any review and approval of a Shop Drawing or Sample submittal;
    6. The issuance of a notice of acceptability by Engineer;
    7. The end of the correction period established in Paragraph 15.08;
    8. Any inspection, test, or approval by others; or
    9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor’s performance obligations to Owner for the Work described in the assigned contract.

7.18 Indemnification

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly
employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers’ compensation acts, disability benefit acts, or other employee benefit acts.

7.19 Delegation of Professional Design Services

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor’s design professional when submitted by Contractor to Engineer.

D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer’s review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.
G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 Other Work

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner’s employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner’s employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner’s employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others’ work with the written consent of Engineer and the others whose work will be affected.

E. If the proper execution or results of any part of Contractor’s Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor’s Work. Contractor’s failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor’s Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 Coordination

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner’s employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any
such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 Legal Relationships

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner’s employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor’s rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor’s entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner’s contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner’s employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor’s failure to take reasonable and customary measures with respect to Owner’s other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor’s failure to take reasonable and customary measures to avoid such impacts, or if any claim
arising out of Contractor’s actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER’S RESPONSIBILITIES

9.01 Communications to Contractor
   A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 Replacement of Engineer
   A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer’s status under the Contract Documents will be that of the former Engineer.

9.03 Furnish Data
   A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 Pay When Due
   A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 Lands and Easements; Reports, Tests, and Drawings
   A. Owner’s duties with respect to providing lands and easements are set forth in Paragraph 5.01.
   B. Owner’s duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
   C. Article 5 refers to Owner’s identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 Insurance
   A. Owner’s responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 Change Orders
   A. Owner’s responsibilities with respect to Change Orders are set forth in Article 11.

9.08 Inspections, Tests, and Approvals
   A. Owner’s responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.
9.09 **Limitations on Owner’s Responsibilities**

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor’s failure to perform the Work in accordance with the Contract Documents.

9.10 **Undisclosed Hazardous Environmental Condition**

A. Owner’s responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 **Evidence of Financial Arrangements**

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner’s obligations under the Contract (including obligations under proposed changes in the Work).

9.12 **Safety Programs**

A. While at the Site, Owner’s employees and representatives shall comply with the specific applicable requirements of Contractor’s safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

**ARTICLE 10—ENGINEER’S STATUS DURING CONSTRUCTION**

10.01 **Owner’s Representative**

A. Engineer will be Owner’s representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner’s representative during construction are set forth in the Contract.

10.02 **Visits to Site**

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor’s executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer’s efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer’s visits and observations are subject to all the limitations on Engineer’s authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer’s visits or observations of Contractor’s Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and
Regulations applicable to the performance of the Work.

10.03 Resident Project Representative

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer’s consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 Engineer’s Authority

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer’s authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer’s authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner’s delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer’s authority as to changes in the Work is set forth in Article 11.

E. Engineer’s authority as to Applications for Payment is set forth in Article 15.

10.05 Determinations for Unit Price Work

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 Decisions on Requirements of Contract Documents and Acceptability of Work

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 Limitations on Engineer’s Authority and Responsibilities

A. Neither Engineer’s authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor’s failure to perform the Work in accordance with the Contract
Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer’s review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 Compliance with Safety Program

A. While at the Site, Engineer’s employees and representatives will comply with the specific applicable requirements of Owner’s and Contractor’s safety programs of which Engineer has been informed.

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 Amending and Supplementing the Contract

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer’s recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 Change Orders

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner’s acceptance of defective Work under Paragraph 14.04 or Owner’s correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer’s recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and
4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 Work Change Directives

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive’s effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 Field Orders

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 Owner-Authorized Changes in the Work

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer’s recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be
performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor’s safety obligations under the Contract Documents or Laws and Regulations.

11.06 Unauthorized Changes in the Work

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 Change of Contract Price

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor’s fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. Contractor’s Fee: When applicable, the Contractor’s fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or

2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

   a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor’s fee will be 15 percent;

   b. For costs incurred under Paragraph 13.01.B.3, the Contractor’s fee will be 5 percent;

   c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor’s fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that
for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor’s fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 Change of Contract Times

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 Change Proposals

A. Purpose and Content: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. Change Proposal Procedures

1. Submittal: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. Supporting Data: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.
b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. **Engineer’s Initial Review**: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. **Engineer’s Full Review and Action on the Change Proposal**: Upon receipt of Contractor’s supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor’s supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer’s inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. **Binding Decision**: Engineer’s decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. **Resolution of Certain Change Proposals**: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. **Post-Completion**: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 **Notification to Surety**

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor’s responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.
ARTICLE 12—CLAIMS

12.01 Claims

A. Claims Process: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer’s decisions regarding Change Proposals;
2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;
3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and
4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. Submittal of Claim: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor’s knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. Review and Resolution: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. Mediation

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.
2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.
3. Owner and Contractor shall each pay one-half of the mediator’s fees and costs.

E. Partial Approval: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
F. Denial of Claim: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. Final and Binding Results: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 Cost of the Work

A. Purposes for Determination of Cost of the Work: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. Costs Included: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers’ compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers’ field services required in
connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor’s Cost of the Work and fee will be determined in the same manner as Contractor’s Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:
   a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor’s employees incurred in discharge of duties connected with the Work.
   b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
      1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.
   c. Construction Equipment Rental
      1)Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.
      2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.
3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder’s risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor’s fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. Costs Excluded: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor’s officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor’s principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor’s fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor’s principal and branch offices other than Contractor’s office at the Site.

4. Any part of Contractor’s capital expenses, including interest on Contractor’s capital employed for the Work and charges against Contractor for delinquent payments.
5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. **Contractor’s Fee**

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:
   a. Contractor’s fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.
   b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor’s fee will be determined as follows:
      1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.
      2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor’s fee for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. **Documentation and Audit:** Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor’s accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor’s fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 **Allowances**

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. **Cash Allowances:** Contractor agrees that:

   1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
   2. Contractor’s costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in
the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. **Owner’s Contingency Allowance:** Contractor agrees that an Owner’s contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 **Unit Price Work**

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor’s overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer’s preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer’s written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. **Adjustments in Unit Price**

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
   a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
   b. Contractor’s unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor’s costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.
ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 Access to Work

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor’s safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 Tests, Inspections, and Approvals

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
   1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
   2. to attain Owner’s and Engineer’s acceptance of materials or equipment to be incorporated in the Work;
   3. by manufacturers of equipment furnished under the Contract Documents;
   4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
   5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor’s purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor’s expense
unless Contractor had given Engineer timely notice of Contractor’s intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 Defective Work

A. Contractor’s Obligation: It is Contractor’s obligation to assure that the Work is not defective.

B. Engineer’s Authority: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. Notice of Defects: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. Correction, or Removal and Replacement: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. Preservation of Warranties: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner’s special warranty and guarantee, if any, on said Work.

F. Costs and Damages: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 Acceptance of Defective Work

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer’s confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner’s evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 Uncovering Work

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer’s observation, and then replace the covering, all at Contractor’s expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer’s request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor’s full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 Owner May Stop the Work

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 Owner May Correct Defective Work

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days’ written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor’s services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner’s representatives, agents and employees, Owner’s other contractors, and Engineer and Engineer’s consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or
ARTICLE 14—TIME FOR PERFORMANCE; DELAYS; EXTENSIONS OF CONTRACT TIMES

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner’s rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 Progress Payments

A. Basis for Progress Payments: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. Applications for Payments

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation establishing full payment by Contractor for the materials and equipment; (b) at Owner’s request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner’s interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor’s legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. Review of Applications

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer’s reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer’s recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer’s observations of
the executed Work as an experienced and qualified design professional, and on Engineer’s review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer’s knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor’s being entitled to such payment appear to have been fulfilled in so far as it is Engineer’s responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer’s review of Contractor’s Work for the purposes of recommending payments nor Engineer’s recommendation of any payment, including final payment, will impose responsibility on Engineer:

a. to supervise, direct, or control the Work;

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

c. for Contractor’s failure to comply with Laws and Regulations applicable to Contractor’s performance of the Work;

d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer’s opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer’s opinion to protect Owner from loss because:

a. the Work is defective, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;
c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. Payment Becomes Due

1. Ten days after presentation of the Application for Payment to Owner with Engineer’s recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. Reductions in Payment by Owner

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

   a. Claims have been made against Owner based on Contractor’s conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor’s conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

   b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

   c. Contractor has failed to provide and maintain required bonds or insurance;

   d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

   e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

   f. The Work is defective, requiring correction or replacement;

   g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

   h. The Contract Price has been reduced by Change Orders;

   i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

   j. Liquidated or other damages have accrued as a result of Contractor’s failure to achieve Milestones, Substantial Completion, or final completion of the Work;

   k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

   l. Other items entitle Owner to a set-off against the amount recommended.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner’s refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 Contractor’s Warranty of Title

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 Substantial Completion

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor’s notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner’s objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner’s use or occupancy of the Work following Substantial Completion, review the builder’s risk insurance policy with respect to the end of the builder’s
risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner’s use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 Partial Use or Occupancy

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor’s performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder’s risk or other property insurance.

15.05 Final Inspection

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.
15.06 Final Payment

A. Application for Payment

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:
   a. all documentation called for in the Contract Documents;
   b. consent of the surety, if any, to final payment;
   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
   d. a list of all duly pending Change Proposals and Claims; and
   e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner’s property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. Engineer’s Review of Final Application and Recommendation of Payment: If, on the basis of Engineer’s observation of the Work during construction and final inspection, and Engineer’s review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor’s other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer’s recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer’s opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. Notice of Acceptability: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is
acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. **Completion of Work**: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer’s written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. **Final Payment Becomes Due**: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner’s receipt of the final Application for Payment from Engineer.

15.07 **Waiver of Claims**

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim, appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 **Correction Period**

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor’s repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner’s written instructions:

1. correct the defective repairs to the Site or such adjacent areas;
2. correct such defective Work;
3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner’s written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced.
Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

F. Contractor’s obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 Owner May Suspend Work

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 Owner May Terminate for Cause

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor’s persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor’s disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor’s repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days’ written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:
1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor’s services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 Owner May Terminate for Convenience

A. Upon 7 days’ written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 Contractor May Stop Work or Terminate

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor’s stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 Methods and Procedures

A. Disputes Subject to Final Resolution: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. Final Resolution of Disputes: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.
ARTICLE 18—MISCELLANEOUS

18.01 Giving Notice

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient’s place of business;
2. by registered or certified mail, postage prepaid, to the recipient’s place of business; or
3. by e-mail to the recipient, with the words “Formal Notice” or similar in the e-mail’s subject line.

18.02 Computation of Times

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 Cumulative Remedies

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 Limitation of Damages

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 No Waiver

A. A party’s non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 Survival of Obligations

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 Controlling Law

A. This Contract is to be governed by the law of the state in which the Project is located.
18.08 **Assignment of Contract**

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 **Successors and Assigns**

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 **Headings**

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.
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These Supplementary Conditions amend or supplement EJCDC® C-700, Standard General Conditions of the Construction Contract (2018). The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix “SC” added – for example, “Paragraph SC-4.05.”

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

SC-1.01 Amend Paragraph 1.01.A.22 by adding the following new sentence:

In the event the Owner should not require the services of the Engineer, then the powers, duties, and responsibilities conferred in the Contract Documents to the Engineer shall be construed to be those of the Owner.

SC-1.01 Amend Paragraph 1.01.A.42 by adding the following subparagraphs:

Substantial Completion is further defined as (a) that degree of completion of the Project's operating facilities or systems sufficient to provide the Owner the full time, uninterrupted, continuous beneficial operation of the Work; and (b) all required functional, performance and acceptance or startup testing has been successfully demonstrated for all components, devices, equipment, and instrumentation and control to the satisfaction of the Owner in accordance with the requirements of the Specifications; and (c) all inspections required have been completed and identified conditions corrected. Specific items of Work which shall be completed prior to declaration of Substantial Completion date include, but are not limited to, the following:

1. Conformance with all training services requirements, unless specified for post startup period.

2. Correction of all state, local, and other regulatory agencies defective Work lists.

3. Submittals have been received and approved by the Owner including, but not necessarily limited to, the following:
   a. Draft record documents.
   b. Operation and maintenance manuals, including service and maintenance agreements.
   c. Equipment data forms.
   d. Manufacturers' certificates of proper installation.
   e. Factory test reports.

4. All special accessories have been provided that are required to place each item of equipment in full operation. These special accessory items include, but are not limited to, specified spare parts, test equipment, adequate oil and grease or other lubrication, air filters, light bulbs, fuses, special tools, valve operators, and other expendable items required for startup and operation of the operating facilities or
systems as a whole.

5. All additional warranty or insurance coverage requirements have been provided.

SC-1.01 Amend Paragraph 1.01.A.49 by adding the following new sentence:

Work excludes the equipment, machinery, tools, vehicles, supplies, etc. used by the Contractor to complete the project.

SC-1.01 Add the following to the list of items in Paragraph 1.01.A, as numbered items:

51. Bonds: Performance and payment bonds and other instruments of security.

52. Final Completion: The time at which the Work is complete, the Engineer has issued the Notice of Acceptability of Work and all deficient items are resolved to the satisfaction of the Owner.

53. Request for Proposal: A document which is signed by Engineer and Contractor, which requests a change or changes to the Work.

ARTICLE 2 – PRELIMINARY MATTERS

2.02 Copies of Documents

SC-2.02 Delete Paragraph 2.02.A and replace it with the following:

A. Owner shall furnish to Contractor 4 copies of conformed Contract Documents incorporating and integrating all Addenda and any amendments negotiated prior to the Effective Date of the Contract and 1 electronic copy in Adobe Acrobat portable document format (PDF). Additional printed copies of the conformed Contract Documents will be furnished upon request at the cost of reproduction.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.05 Delays in Contractor’s Progress

SC-4.05 Add new subparagraph immediately after Paragraph 4.05.C.4:

5. Time Extensions for Abnormal Weather Conditions

a. Procedure: The procedure for the determination of time extensions for abnormal weather shall be in accordance with the following:

1) The weather experienced at the project site during the contract period must be found to be abnormal, that is, severe weather that occurs beyond the adverse weather anticipated for the project location during any given month.

2) The abnormal weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

3) Abnormal weather delay days must prevent work on critical activities for 50 percent or more of the contractor’s scheduled work day.

b. Schedule:

1) The following schedule of monthly adverse weather anticipated by the Hampton Roads Planning District Commission (HRPDC) Regional
Construction Standards will constitute the baseline for evaluating extensions in time due to abnormal weather. Delays will only be allowed for the amount of lost work days in excess of the following:

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2) The Contractor shall anticipate the potential loss of the number of workdays listed above for each calendar month due to weather, and shall schedule the Work accordingly. Any schedules submitted shall include the above number of days each month as lost days. The Owner shall determine, upon examination of submitted evidence, whether or not weather prevented the Contractor from performing Work on the days claimed by the Contractor. The Owner’s determination shall be final and binding upon the parties.

c. Records: Upon acknowledgment of the Notice to Proceed and continuing throughout the execution of the Work, the Contractor will record the occurrence of adverse weather and resultant impact to normally scheduled work.

d. Determination of Time Extensions for Abnormal Weather Conditions: Abnormal weather conditions will be determined by taking the total number of documented adverse weather days that actually occurred in a given month, minus the anticipated adverse weather days (from the Schedule provided above). The Contractor will convert any Abnormal Weather delays into calendar days and may request a time extension in accordance with the Contract Documents.

SC-4.05 Delete the last Paragraph in 4.05.E and replace it with the following:

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work within 30 days of the commencement of the delaying, disrupting, or interfering event. Delays not notified will not be considered.

ARTICLE 5 – SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.02 Use of Site and Other Areas

SC-5.02 Delete subparagraph 5.02.A.2 and replace it with the following:

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) inform the Owner in writing of any and all claims within 7 days of notification by third party; (c) promptly attempt to settle the claim within 60 days through negotiations with such owner or occupant, or otherwise resolve the
claim by arbitration or other dispute resolution proceeding, or at law; and (d) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor’s performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

5.03 Subsurface and Physical Conditions

SC-5.03 Add new paragraph immediately after Paragraph 5.03.D:

E. No reports of explorations or tests of subsurface conditions at or adjacent to the Site, or drawings of physical conditions relating to existing surface or subsurface structures at the Site, are known to Owner.

[or]

SC-5.03 Add new paragraph[s] immediately after Paragraph 5.03.D:

E. The following report[s] of explorations and tests of subsurface conditions at or adjacent to the Site are known to Owner:

1. Report dated [date], prepared by [Engineer Name, City, State], entitled: “[Title]”, consisting of [#] pages. The Technical Data contained in such report upon whose accuracy Contractor may rely are [indicate Technical data, or state none]. [or] [those indicated in the definition of Technical Date in the General Conditions].

F. The following drawing[s] of physical conditions relating to existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities) are known to owner:

1. Drawings dated [date], prepared by [Engineer Name, City, State], entitled: “[Title]”, consisting of [#] sheets numbered [#] to [#], inclusive.

[Use one of the following two subparagraphs for each set of drawings]

1) All of the information in such drawings constitutes of Technical Data on whose accuracy Contractor may rely, except for [explain] appearing on Drawing No. [#] and [explain] appearing on Drawing No. [#].

[or]

a) None of the contents of such drawings is Technical Data on whose accuracy Contractor may rely.

5.04 Differing Subsurface or Physical Conditions

SC-5.04 Delete Paragraph 5.04.D and replace it with the following:

D. Intentionally Omitted.
5.05 Underground Facilities

SC-5.05 Delete Paragraph 5.05.E and replace it with the following:

E. Intentionally Omitted.

SC-5.05 Delete subparagraph 5.05.F.4.c and replace it with the following:

(c) gathered in an investigation conducted by the Engineer. If such information or data is incorrect or incomplete, Contractor’s remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 Hazardous Environmental Conditions at Site

SC-5.06 Delete in its entirety Paragraph 5.06.A and replace it with the following:

A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.

[or]

SC-5.06 Add new subparagraph[s] immediately after Paragraph 5.06.A.3:

4. The following report[s] regarding Hazardous Environmental Conditions at the Site are known to Owner:

   a. Report dated [date], prepared by [Engineer Name, City, State], entitled: “[Title]”, consisting of [#] pages. The Technical Data contained in such report upon whose accuracy Contractor may rely are [indicate Technical data, or state none].

5. The following drawing[s] regarding Hazardous Environmental Conditions at the Site are known to owner:

   a. Drawings dated [date], prepared by [Engineer Name, City, State], entitled: “[Title]”, consisting of [#] sheets numbered [#] to [#], inclusive.

   [Use one of the following two subparagraphs for each set of drawings]

   1) All of the information in such drawings constitutes of Technical Data on whose accuracy Contractor may rely, expect for [explain] appearing on Drawing No. [#] and [explain] appearing on Drawing No. [#].

   [or]

   1) None of the contents of such drawings is Technical Data on whose accuracy Contractor may rely.

SC-5.06 Add new paragraph immediately after Paragraph 5.06.K:

L. HRSD is required in accordance with 29 CFR 1910.1200, to inform Contractor personnel that work centers within HRSD have hazardous chemicals on site. HRSD and Contractor personnel may be exposed to these hazardous chemicals while working at HRSD work centers. A written Hazard Communication Program has been developed to inform personnel of the specific hazardous chemicals at the work center and the related safety information including protective measures, special precautions and emergency procedures to be observed. The Hazard Communication Program including Safety Data Sheets for each hazardous chemical at the work
center will be reviewed with the Contractor after the Notice to Proceed is issued. It is the responsibility of the Contractor to request a meeting with representatives of HRSD’s Safety Division and/or work center staff to review this program prior to beginning any on-site efforts at the work center or centers impacted by this Project. The Contractor is responsible for communicating the information contained in the Hazard Communication Program to their personnel and subcontractors working at the work center.

ARTICLE 6 – BONDS AND INSURANCE

6.02 Insurance – General Provisions

SC-6.02 Add new subparagraph immediately after Paragraph 6.02.B:

1. Contractor may obtain workers’ compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the Project is located, (b) is certified or authorized as a workers’ compensation insurance provider by the appropriate state agency having jurisdiction, and (c) has been accepted to provide workers’ compensation insurance for similar projects by the state within the last 12 months.

6.03 Contractor’s Insurance

SC-6.03 Delete in its entirety Paragraph 6.03 and replace it with the following:

A. Workers’ Compensation: Contractor shall purchase and maintain workers’ compensation and employer’s liability insurance for:

1. claims under worker’s compensation, disability benefits, and other similar employees benefit acts.

2. United States Longshoreman and Harbor Workers’ Compensation Act and Jones Act coverage (if applicable).

3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor’s employees (by stop-gap endorsement in monopolistic worker’s compensation states).

4. Foreign voluntary worker compensation (if applicable).

5. Owner shall be named as an Alternate Employer by endorsement.

B. Commercial General Liability – Claims Covered: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:

1. Claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor’s employees.

2. Claims for damages insured by reasonably available personal or advertising injury liability coverage.

3. Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

C. Commercial General Liability – Form and Content: Contractor’s commercial liability policy shall be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability occurrence form (or equivalent) and include the following coverages and endorsements:

1. Products and completed operations coverage:
   a. Such insurance shall be maintained for 3 years after final payment.
   b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and 3 years thereafter.

2. Blanket contractual liability coverage, to the extent permitted by Law, including but not limited to coverage of Contractor’s contractual indemnity obligations in Paragraph 7.18.

3. Broad form property damage coverage.

4. Severability of interests and no insured-versus-insured or cross-liability exclusions.

5. Personal injury coverage.

6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 and CG 20 37; or their equivalent.

7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, “Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured” or its equivalent.

8. Aggregate Limits will apply per project.

D. Commercial General Liability – Excluded Content: The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

1. Any modification of the standard definition of “insured contract” (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).

2. Any exclusion for water intrusion or water damage.

3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.

4. Any exclusion of coverage relating to earth subsidence or movement.

5. Any exclusion for the insured’s vicarious liability, strict liability, or statutory liability (other than worker’s compensation).

6. Any limitation or exclusion based on the nature of Contractor’s work.

7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79 04 13.
E. **Automobile liability**: Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an accident basis.

F. **Umbrella or Excess Liability**: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer’s liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.

G. **Contractor’s Pollution Liability Insurance**: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from Contractor’s operations and completed operations. This insurance shall be maintained for no less than 3 years after final completion. If written on a claims made basis the retroactive date will pre-date the commencement of work.

H. **Additional Insureds Ongoing and Completed Operations, and Waiver of Subrogation**: The Contractor’s commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner, Engineer, and any individuals or entities identified as required additional insureds: include coverage for their respective officers, directors, members, partners, employees, agents, consultants, and construction subcontractors or each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. The Contractor’s commercial general liability, automobile liability, umbrella or excess, and workers compensation policies shall include a waiver of subrogation endorsement in favor of the Owner, Engineer, and any individuals or entities identified herein. Contractor shall obtain all necessary endorsement to support these requirements. The additional insureds shall include the following:

1. **Owner:**
   Hampton Roads Sanitation District
   1434 Air Rail Avenue
   Virginia Beach, Virginia 23455

2. **Engineer:**
   [NAME]
   [ADDRESS LINE 1]
   [ADDRESS LINE 2]

3. **[ADDITIONAL]**
   [NAME]
   [ADDRESS LINE 1]
   [ADDRESS LINE 2]

I. **Contractor’s Professional Liability Insurance**: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall
provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of 3 years after Substantial Completion. If written on a claims made basis the retroactive date will pre-date the commencement of services.

J. *Unmanned Aerial Vehicle Liability Insurance*: If Contractor uses unmanned aerial vehicles (UAV – commonly referred to as drones) at the Site or in support of any aspect of the Work, Contractor shall obtain UAV liability insurance in the amounts stated; name Owner, Engineer, and all individuals and entities identified in the Supplementary Conditions as additional insureds; and provide a certificate to Owner confirming Contractor’s compliance with this requirement. Such insurance will provide coverage for property damage, bodily injury or death, and invasion of privacy. Contractor shall ensure any subcontractors using UAV’s carry the required liability insurance and provide the same additional insured protections.

K. *General provisions*: The policies of insurance required by this Paragraph 6.03 shall:

1. Include at least the specific coverages provided in this Article.
2. Be written for not less than limits of liability provided in this Article or required by Laws or Regulations, whichever is greater.
3. Contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 30 days prior written notice has been given to Contractor (10 days Non-Payment). Within 3 days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.
4. Remain in effect at least 3 years after final payment and Contractor’s departure from the Site (and longer if expressly required elsewhere in this Contract), and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.
5. Be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor’s performance of the Work and Contractor’s other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.

L. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

M. The limits of liability for the insurance required by Paragraph 6.03 for the Contractor, all subcontractors, and all subconsultants shall provide coverage for not less than the following amounts, or greater where required by Laws and Regulations:

1. Workers’ Compensation and Employer’s Liability under Paragraph 6.03.A:
State: Virginia  
Federal, if applicable (e.g., Longshoreman’s):  
Jones Act coverage, if applicable:  
   Bodily injury by accident, each accident: $1,000,000  
   Bodily injury by disease, aggregate: N/A  
Employer’s Liability:  
   Bodily injury, each accident: $100,000  
   Bodily injury by disease, each employee: $100,000  
   Bodily injury/disease aggregate: $500,000  
Voluntary Worker Compensation: Statutory

2. Commercial General Liability under Paragraphs 6.03.B, 6.03.C, and 6.03D:  
   General Aggregate: $2,000,000  
   Products – Completed Operations Aggregate: $1,000,000  
   Personal and Advertising Injury: $1,000,000  
   Each Occurrence (Bodily Injury and Property Damage): $1,000,000  
   Damage to Rented Premises (Fire Damage): $100,000  
   Medical Expenses (Any one person): $5,000

3. Automobile Liability under Paragraph 6.03.E:  
   Combined Single Limit of: $1,000,000

4. Umbrella or Excess Liability under Paragraph 6.03.F:  
   Per Occurrence: $5,000,000  
   General Aggregate: $5,000,000

5. Contractor’s Pollution Liability insurance under Paragraph 6.03.G:  
   Each Claim: $1,000,000  
   General Aggregate: $1,000,000

6. Contractor’s Professional Liability insurance under Paragraph 6.03.I:  
   Each Claim: $1,000,000  
   General Aggregate: $1,000,000

7. Unmanned Aerial Vehicle Liability insurance under Paragraph 6.03.J:  
   Each Claim: $1,000,000  
   General Aggregate: $1,000,000
8. **Additional Coverages**: In the event the Contractor utilizes a vessel or barge in execution of the contract, all owned and non-owned vessels or barges shall be insured; including crew coverage and contractual liability. Hull insurance shall be carried for the full value of replacement. Owner shall be named as additional insured on all watercraft insurance coverage:

<table>
<thead>
<tr>
<th>Protection and Indemnity</th>
<th>$ 1,000,000</th>
</tr>
</thead>
</table>

If operations involve the use of owned or non-owned aircraft of watercraft, coverage must be provided for bodily injury and property damage arising out of ownership, maintenance, use, or entrustment, thereof as follows:

<table>
<thead>
<tr>
<th>General Aggregate</th>
<th>$ 2,000,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each Occurrence (Bodily Injury and Property Damage)</td>
<td>$ 1,000,000</td>
</tr>
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**6.04 Builder’s Risk and Other Property Insurance**

Delete in its entirety Paragraph 6.04 and replace it with the following:

A. [NOTE: Review with Director and Insurance Consultant if project over $10 million]
   [NOTE: If HRSD supplies equipment/materials and cost is over $100,000 update Builder’s Risk to include by a comparable amount] **Builder’s Risk**: Contractor shall purchase and maintain builder’s risk insurance upon the Work on a completed value basis for the full contract amount and including materials, labor, overhead and profit, subject to such deductible amounts described herein. The Contractor shall be responsible for payment of any and all deductibles. Contractor shall have full property insurance coverage in all situations including “Named Storm” events. This builder’s risk insurance shall:

1. Include the Owner and Contractor as named insureds, and Subcontractors of all tiers, and any individuals or entities required by the Supplementary Conditions to be insured under such builder’s risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.04, Paragraphs 6.05 and 6.06 in the General Conditions, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as “insureds.”

2. Be written on a builder’s risk “all risk” policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; hail; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition and increased cost of construction occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood or windstorm, are not commercially available under builder’s risk policies, by endorsement or otherwise, such insurance may be
provided through other insurance policies acceptable to Owner and Contractor.

3. Cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

4. Cover 12 months of expenses (soft costs) incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers, architects, insurance, interest expense, etc.).

5. Extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).

6. Extend to cover damage or loss to insured property while in transit.

7. Allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder’s risk insurance.

8. Allow for the waiver of the insurer’s subrogation rights, as set forth in this Contract.

9. Provide primary coverage for all losses and damages caused by the perils or causes of loss covered.

10. Not include a co-insurance clause or show coinsurance as ‘nil’.

11. Include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.

12. Include performance/hot testing and start-up.

13. Be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.

14. Provide insurance sublimit coverage of $10,000,000 or the full value of the work, whichever is less, for earth movement (earthquake), flood, and windstorm.

B. Notice of Cancellation or Change: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.04 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice (10 days Non-Payment) has been given to the purchasing policyholder. Within 3 days of receipt of any such written notice, the
purchasing policyholder shall provide a copy of the notice to each other insured.

C. **Deductibles:** The Contractor shall be responsible for all policy deductibles on Builder’s Risk or property insurance. Maximum property deductibles permitted without prior agreement with the Owner shall be $50,000 all other perils, 2 percent of insured value for wind and hail and $50,000 flood and earthquake. The Contractor shall be responsible for any and all deductibles under such insurance.

D. **Partial Occupancy or Use by Owner:** If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder’s risk policy, or through Contractor) will provide notice of such occupancy or use to the builder’s risk insurer. The builder’s risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder’s risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder’s risk insurance.

E. **Additional Insurance:** If Contractor elects to obtain other special insurance to be included in or supplement the builder’s risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor’s expense.

F. **Insurance of Other Property:** If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount. The Contractor shall be responsible for any and all deductibles under such insurance.

6.05 **Property Losses; Subrogation**

SC-6.05 Delete in their entirety Paragraphs 6.05.A, 6.05.B, and 6.05.C and replace it with the following:

A. All policies purchased in accordance with Paragraph 6.04, expressly including the builder’s risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
ARTICLE 7 – CONTRACTOR’S RESPONSIBILITIES

7.03 Labor; Working Hours

SC-7.03 Delete Paragraph 7.03.C and replace it with the following:

C. Regular working hours will be Monday through Friday 7:00 a.m. to 5:00 p.m. Contractor may Work at the Site outside regular working hours or on a legal holiday with a written request, subject to approval by the Owner. Weekend construction activities and any pile driving shall begin no earlier than 8 a.m..

7.07 Concerning Subcontractors and Suppliers

SC-7.07 Amend Paragraph 7.07.A by adding the following new sentence:

Contractor shall perform a minimum of [25 percent for pipeline or other similar project] OR [10 percent for pump station, plant, directional drill or other similar projects] of the on-site labor with its own forces.

SC-7.07 Add new paragraphs immediately after Paragraph 7.07.M:

N. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor’s own acts and omissions.

O. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor

2. shall create any obligation on the part of the Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as many otherwise be required by Laws and Regulations.

7.10 [OPTIONAL] Taxes

SC-7.10 Add new paragraph immediately after Paragraph 7.10.A:

B. Bidders are advised that this is a pollution control project and as such certain materials and equipment will be exempt from Virginia sales tax in accordance with Section 58.1-3660 of the Code of Virginia (1950), as amended, upon a request by the successful bidder to the Tidewater Regional Office, Virginia Department of Environmental Quality, Water Division, 5636 Southern Boulevard, Virginia Beach, Virginia 23462. Information to be submitted in triplicate is: (a) Project Title (b) Project Owner (c) Project Location (d) Anticipated Project Completion Date (e) Brief Description of the equipment and facilities to be purchased.

7.12 Record Documents

SC-7.12 Add new paragraph immediately after Paragraph 7.12.A:
B. Further requirements for the maintenance of record documents and the documentation of as-built data are defined further in the technical specifications. The Contractor’s lack of meeting the record document requirement listed herein and further defined in the technical specifications can be a cause for the delay of progress payment of payments by the Owner to the Contractor until the needed information is properly verified by the Engineer.

7.13 [OPTIONAL] Safety and Protection

SC-7.13 Add new subparagraph immediately after 7.13.G:

1. The following Owner safety programs are applicable to the Work: [Expressly identify by title and/or date, any such Owner safety programs].

7.17 Contractor’s General Warranty and Guarantee

SC-7.17 Amend subparagraph 7.17.C.2 by adding the following new sentence:

Normal wear and tear is defined as unavoidable minor deterioration of the Work resulting from normal use.

SC-7.17 Add new paragraph immediately after Paragraph 7.17.E:

F. Standard of Care: All Work performed pursuant to the Contract Documents shall be consistent with the Contractor’s highest and best work, which shall be at least as good as the standard of care, skill, attention, priority, and judgement provided by first class, experienced Contractors in the greater Hampton Roads area (the “Standard of Care”). The Contractor shall supervise and direct the Work in accordance with the Standard of Care.

7.18 Indemnification

SC-7.18 Delete Paragraph 7.18.A and replace it with the following:

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of the Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs losses, damages and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to, damage to or destruction of tangible property (other than work itself) including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, and Subcontractor, and Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

7.20 Submittals Using Project Management Software

SC-7.20 Add new paragraph immediately after Paragraph 7.19:

7.20 Submittals Using Project Management Software
A. Contractor, shall submit the following information and documentation using the HRSD Project Management Software (Oracle ERP and Unifier):

1. Pay applications.
2. Shop Drawings, Operations and Maintenance (O&M) Manuals, and Material and Spare Parts Turnover forms.
3. Certificate of Substantial Completion.
4. Other forms and submittals as mutually agreed upon.

B. Contractor personnel shall attend HRSD training to implement usage of software.

**ARTICLE 8 – OTHER WORK AT THE SITE**

**8.02 [OPTIONAL] Coordination**

SC-8.02 Delete in its entirety Paragraph 8.02.A and replace it with the following:

A. Owner intends to contract with others for the performance of other work at or adjacent to the Site.

1. [Identify individual or entirety] shall have authority and responsibility for coordination of the various contractors and work forces at the Site;

2. The following specific matters are to be covered by such authority and responsibility: [Itemize such matters].

3. The extent of such authority and responsibilities is: [Provide the extent].

**8.04 Claims Between Contractors**

SC-8.04 Add new paragraph immediately after Paragraph 8.03:

8.04 Claims Between Contractors

A. Should Contractor cause damage to the work or property of any other contractor at the Site, or should any claim arising out of Contractor’s performance of the Work at the Site be made by any other contractor against Contractor, Owner, Engineering, or Resident Project Representative, Contractor shall promptly attempt to settle with such other contractor by agreement, or to otherwise resolve the dispute by arbitration or at law.

B. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner, Engineer, Resident Project Representative (RPR) or Owner’s designee, and the officers, directors, partners, employees, agents and other consultants and subcontractors of each and any of them from and against all claims, costs, losses and damages (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any other contractor against Owner, Engineer, Engineer’s Consultants, or the RPR to the extent said claim is based on or arises out of Contractor’s performance of the Work. Should another contractor cause
damage to the Work or property of Contractor or should the performance of work by any other contractor at the Site give rise to any other Claim, Contractor shall not institute any action, legal or equitable, against Owner, Engineer, RPR, or Owner’s designee or permit any action to be maintained and continued in its name or for its benefit in any court or before any arbiter which seeks to impose liability on or to recover damages from Owner or Engineer, or RPR or designee on account of any such damage or Claim.

C. If Contractor is delayed at any time in performing or furnishing Work by any act or negligence of another contractor, and Owner and Contractor are unable to agree as to the extent of any adjustment in Contract Times attributable thereto, Contractor may make a Claim for an extension of times in accordance with Article 12. An extension of the Contract Times shall be Contractor’s exclusive remedy with respect to Owner, Engineer, and Resident Project Representative for any delay, disruption, interference, or hindrance caused by any other contractor. This paragraph does not prevent recovery from Owner, Engineer, or Resident Project Representative for activities that are their respective responsibilities.

ARTICLE 10 – ENGINEER’S STATUS DURING CONSTRUCTION

10.03 Resident Project Representative

[NOTE: Engineer to review and modify as required based on split of duties between RPR and Contract Administrator]

SC-10.03 Add new paragraph immediately after Paragraph 10.03.B:

C. The Resident Project Representative (RPR) will be Engineer’s representative at the Site. RPR’s dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR’s dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The responsibilities, authority, and limitations of the RPR are limited to those of Engineer in accordance with this Paragraph 10.03 and as set forth elsewhere in the Contract Documents. The authority and responsibilities of RPR follows:

1. Schedules: Review and monitor the Progress Schedule, Schedule of Submittals, and Schedule of Values prepared by Contractor and consult with Engineer concerning acceptability.

2. Conferences and Meetings: Conduct or attend meetings with Contractor, such as preconstruction conferences, progress meetings, Work conferences, and other Project related meetings.

3. Safety Compliance: Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR’s own personal safety while at the Site.

4. Liaison:

   a. Serve as Engineer’s liaison with Contractor. Working principally through Contractor’s authorized representative or designee and assist in providing information regarding the provisions and intent of the Contract Documents.
b. Assist Engineer in serving as Owner’s liaison with Contractor when Contractor’s operations affect Owner’s on-Site operations.

c. Assist in obtaining from Owner additional details or information, when required for Contractor’s proper execution of the Work.

5. **Submittals:**

   a. Record date of receipt of Submittals and samples approved by Contractor.

   b. Receive Submittals and samples furnished at the Site by Contractor, and notify Engineer of availability of samples for examination.

   c. Advise Engineer and Contractor of the commencement of any portion of the Construction requiring a Shop Drawing or sample for which RPR believes that the Submittal has not been accepted by Engineer.

6. **Review of Work, Rejection of Defective Work, Inspections, and Tests:**

   a. Conduct on-site observations of the Work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.

   b. Inform Engineer and Contractor whenever RPR believes that any Work is defective.

   c. Advise Engineer whenever RPR believes that any Work will not produce a completed Project that conforms generally to the Contract Documents or will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or whenever RPR believes Work should be uncovered for observation, or requires special testing, inspection, or approval.

   d. Monitor tests, equipment and systems start-ups, and operating and maintenance training are conducted in the presence of appropriate personnel, and that the Contractor maintains adequate records thereof.

   e. Observe, record and report to Engineer appropriate details relative to the test procedures and startups.

   f. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Project; record the results of these inspections and report to Engineer.

7. **Interpretation of Contract Documents:** Inform Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.

8. **Modifications:** Consider and evaluate Contractor’s suggestions for modifications in Drawings or Specifications and provide recommendations to Engineer; transmit to Contractor the decisions issued by Engineer.

9. **Records:**

   a. Maintain at the Site files for correspondence, conference records, Submittals including Shop Drawings and Samples, reproductions of original Contract Documents including all Addenda, the signed Agreement, Work
Change Directives, Change Orders, Field Orders, additional Drawings issued after the Effective Date of the Agreement, Engineer’s written clarifications and interpretations, progress reports, and other Project related documents.

b. Keep a diary or log book recording pertinent Site conditions, activities, decisions, and events.

10. Reports:
   a. Furnish Engineer periodic reports of progress of the Work and of Contractor’s compliance with the Progress Schedule and Schedule of Submittals submissions.
   b. Consult with Engineer in advance of scheduled major tests, inspections or start of important phases of the Work.
   c. Assist in drafting proposed Change Orders, Work Change Directives, and Field Orders; obtain backup material from Contractor as appropriate.

11. Payment Requests: Review each Application for Payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to: (a) the Schedule of Values, accepted by Engineer, (b) relevant cost of the work provisions, (c) Work completed, and (d) materials and equipment delivered to the Site but not incorporated in the Work.

12. Certificates, Operation and Maintenance Manuals, Record Documents, and Site Records: During the course of the Work, review and monitor that these documents and other data required by the Contract Documents to be assembled, maintained, and furnished by Contractor, noting whether the documentation is applicable to the items actually installed, and deliver to Engineer for its review and acceptance prior to final payment for that part of the Work.

13. Completion:
   a. Conduct an inspection in the company of Engineer, Owner, and Contractor to determine Substantial Completion and prepare a list of items to be completed or corrected; submit to Engineer a list of observed items requiring completion or correction.
   b. Conduct final inspection in the company of Engineer, Owner, and Contractor and notify Contractor and Engineer in writing of all particulars in which this inspection reveals that the Work is incomplete or defective.
   c. Observe that all items on final list have been completed, corrected, or accepted by Owner and make recommendations to Engineer concerning acceptance.

14. Provide Direction During Emergency: Provide direction to Contractor during times of emergency or when imminent risk of death or serious risk of danger to individuals or property is likely.

15. Limitations of Authority: RPR shall not:
   a. Authorize any deviation from the Contract Documents or substitution of
materials or equipment (including “or equal” items), unless authorized by Engineer.

b. Exceed limitations of Engineer’s authority as set forth in the Contract Documents.

c. Undertake any of the responsibilities of Contractor, Contractor’s authorized representative or designee, Subcontractors, or Suppliers.

d. Accept Submittals from anyone other than Contractor.

e. Authorize Owner to occupy the Project in whole or in part; or

f. Participate in specialized field or laboratory tests or inspections conducted by others, except as specifically authorized by Engineer.

ARTICLE 11 – CHANGES TO THE CONTRACT

11.05 Owner- Authorized Changes in the Work

SC-11.05 Add new paragraph immediately after Paragraph 11.05.C:

D. Changes in the Work requested by Owner will be documented by the Engineer through the use of a Request for Proposal. This document will be prepared by the Engineer and shall describe the proposed changes. The document shall be signed by the Engineer and Contractor and provided to the Owner for information.

11.09 Change Proposals

SC-11.09 Delete in its entirety subparagraph 11.09.B.5 and replace it with the following:

5. Intentionally Omitted.

11.11 Claims

SC-11.11 Add new paragraph immediately after Paragraph 11.10:

11.11 Claims

A. Notice: If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or an adjustment of the Contract Times that should be allowed as a result of any order of Owner pursuant to this Article or other occurrence for which the Contract Documents provide that such adjustment(s) may be made, a Claim may be made therefor. Written notice of intent to make such a Claim shall be submitted to the other party promptly and in no event more than 15 days after the start of the occurrence or event giving rise to the Claim.

B. Documentation: Substantiating documentation shall be submitted by the claiming party within 30 days after delivery of the notice required by Paragraph 11.11.A.

C. Decision: The other party shall render a decision on the Claim no more than 30 days after the receipt of the substantiating documentation required by Paragraph 11.11.B. This decision will be final and binding unless the claiming party gives notice of intention to exercise its rights under Article 17 within 30 days of receipt of the decision and exercises such rights within 30 days of giving the notice of intent.
D. **Time Limit Extension:** The time limits of Paragraphs 11.11.B and 11.11.C may be extended by mutual agreement.

**ARTICLE 13 – COST OF THE WORK; ALLOWANCES, UNIT PRICE WORK**

### 13.01 Cost of Work

**SC-13.01** Amend subparagraph 13.01.B.1 by adding the following new paragraph:

Such employees shall also include Contractor’s Project Manager, Project Engineer and other similar positions, if applicable. For these employees to be included in the Cost of Work, documentation shall be provided showing that these individuals have actually been an integral part of the project, at least 10 hours per week, and have consistently charged time to the project. Payroll records for these individuals shall be provided if requested by the Owner.

**SC-13.01** Delete in its entirety subparagraph 13.01.B.5.c and replace it with the following:

**c. Construction Equipment and Machinery:**

1) Rentals of all construction equipment and machinery, and the parts thereof in accordance with rental agreements approved by Owner, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor will be paid at a rate not to exceed that shown for such equipment in the Rental Rate Blue Book for Construction Equipment. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs. Costs will include the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, shall cease to accrue when the use thereof is no longer necessary for the changed Work. Equipment or machinery with a value of less than $1,000 will be considered small tools.

### 13.03 Unit Price Work

**SC-13.03** Delete in its entirety Paragraph 13.03.E and replace it with the following:

**E. Adjustments in Unit Price:** Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

1. If the extended price of a particular item of Unit Price Work amounts to 5 percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Agreement;

2. If there is not corresponding adjustment with respect to any other item of Work; and

3. If Contractor believes that Contractor has incurred additional expense as a...
result thereof, Contractor may submit a Change Proposal, or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, seeking an adjustment in Contract Price.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

15.01  Progress Payments
SC-15.01 Delete subparagraph 15.01.D.1 and replace it with the following:
1. No more than 30 days after presentation of the Application of Payment to Owner with Engineer’s affirmative recommendation, the amount (subject to the provisions of Paragraph 15.01.E) will become due and when due will be paid by owner to the Contractor.

15.03  Substantial Completion
SC-15.03 Add new subparagraph immediately after Paragraph 15.03.B:
1. If some or all of the Work has been determined not to be a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, shall be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

15.06  Final Payment
SC-15.06 Add new subparagraph immediately after subparagraph 15.06.A.2.e:
f. Documentation of resolution of all claims against Contractor or Subcontractors by any third party.

ARTICLE 17 – DISPUTES

17.01  Methods and Procedures
SC-17.01 Delete in its entirety Paragraph 17.01 and replace it with the following:
A. Engineer’s action under Paragraph 11.11.C or a denial pursuant to Paragraphs 11.11.C shall become final and binding 30 days after receipt of written notice of Owner's action or decision unless, within that time period, Owner or Contractor gives to the other party written notice of intent to submit the Claim to a process of bilateral negotiations as set forth below.

B. Within 30 days of the delivery of such notice, Owner, Contractor, and Engineer (if requested) shall meet and confer regarding the Claim. A good-faith effort to negotiate resolution shall be made by both parties.

C. If the negotiations are unsuccessful, management representatives of Owner, Contractor, and Engineer (if requested) at least one tier above the individuals who met initially shall meet, confer, and negotiate within 45 days of the closure of the unsuccessful negotiations.

D. If the claim is not resolved by negotiation, either Owner or Contractor may request within 10 days of termination of negotiations non-binding mediation of any Claim
submitted to Engineer for a decision under Paragraph 11.11 before such decision becomes final and binding. If both parties agree to mediation in writing within 10 days, the mediation will proceed and be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 11.11.

E. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

F. If the Claim is not resolved by negotiation and mediation, Engineer’s action under Paragraph 11.11 or a denial pursuant to Paragraphs 11.11 shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:
   1. gives to the other party written notice of intent to submit the Claim to a court of competent jurisdiction, or
   2. agrees with the other party in writing to submit the Claim to another dispute resolution process.

G. Notwithstanding any applicable statute of limitations, a party giving notice under this Paragraph 17.01 shall commence an action on the Claim within 6 months of said notice. Failure to do so shall result in the Claim being time-barred and Engineer’s action or denial shall become final and binding.

17.02 Attorney’s Fees

SC-17.02 Add new paragraph immediately after Paragraph 17.01:

17.02 Attorney’s Fees

   A. For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorney’s fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration panel, or other arbiter of the matter subject to final resolution, taking into account the parties’ initial demand or defense positions in comparison with the final results.

ARTICLE 18 – MISCELLANEOUS

18.01 Giving Notice

SC-18.01 Delete subparagraph 18.01.A.3 and replace it with the following:

   3. by e-mail, with the words “Formal Notice” or similar in the e-mail’s subject line and follow up within 7 days as listed in subparagraph 18.01.A.1 or 18.01.A.2.

18.07 Controlling Law

SC-18.07 Add new paragraph immediately after Paragraph 18.07.A:

   B. Any formal proceedings shall be instituted in the Circuit Court of the City of Virginia Beach, Virginia, or the United States District Court for the Eastern District of Virginia,
Norfolk Division.
Section 39 - Construction Administration Forms/Formats

A. Introduction – The FIRM is responsible for providing bid ready plans, specifications, addenda, final opinion of probable construction costs to HRSD’s Contract Specialist on Design-Bid-Build project delivery for bidding the appropriate project in HRSD’s Enterprise Resource Planning (ERP) System. During the pre-construction phase the FIRM is to attend the pre-bid meeting (if one is specified), attend the bid opening (if required), evaluate the received bids and qualifications of the bidder, and recommend award of a construction contract to the lowest responsive and responsible bidder. HRSD will then obtain Commission approval, issue the Notice of Award, sign the contracts, and review and approve the bonds and insurance certificates. The FIRM will then be asked to issue the Notice to Proceed and administer and inspect the contract using HRSD’s Unifier Enterprise Project Management System. The following forms/formats shall be used in the administration of the traditional bid construction contracts. Most of these are available in electronic format. The HRSD Contract Specialist and Project Manager will work with the FIRM to customize these forms/formats for each project. The FIRM shall provide any other forms or formats required subject to the Project Manager’s approval.

B. Contract Administration Forms - The below listed forms/formats are included for traditional Design-Bid-Build project delivery at the end of this Section.

1. Sample Bid Recommendation Letter
2. Notice of Award [Issued by HRSD]
3. Notice to Proceed
4. Emergency Contact List
5. Field Order
6. Request for Proposal
7. Work Change Directive
8. Change Order
9. Application for Payment
   a. Summary Sheet
   b. Schedule of Values – Lump Sum
   c. Schedule of Values – Unit Price
   d. Stored Materials Inventory
   e. Diversity Procurement Statement
10. Certificate of Substantial Completion
11. Notice of Acceptability
12. Warranty Memorandum

End of Section
SAMPLE BID RECOMMENDATION LETTER

ENGINEER LETTERHEAD

Date: [ ]

Mr. ________
Chief of Design & Construction
HRSD
P.O. Box 5911
Virginia Beach, Virginia 23471-0911

RE: [Project title as on plans and specifications]

Dear Mr. ______:

We have evaluated the bids received on [ date ] for the [ Project Title ] which consists of [ brief description ].

[ # of bids ] were received as shown below.

[ Full name of each bidder-listed lowest to highest ] [ Amount of bid ]

Engineer’s Estimate [ Amount of estimate ]

*[ Use asterisk to note any discrepancies or corrections ]

[If the difference between low bid and engineer’s estimate is greater than 10%, explain why.]

The low bid was submitted by [ name of low bidder ] in the amount of [ amount of bid ]. Our evaluation of the experience, reputation, and financial condition of [ name of low bidder ] indicates that they are capable of completing the work required. Therefore, we recommend the award of a contract for construction of the [ Project Title ] to [ name of low bidder ] in the amount of [ amount of bid ].

Very truly yours,

[Name], P.E.
[Title]

[If bids are being rejected or further explanation of the evaluation is needed, provide a draft recommendation letter to the HRSD Project Manager for review and comment.]
NOTICE OF AWARD

Date of Contract: «Contract_Date»

<table>
<thead>
<tr>
<th>Owner:</th>
<th>Hampton Roads Sanitation District</th>
<th>Owner’s Contract No.:</th>
<th>«Owner_Contract»</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineer:</td>
<td>«Engineer»</td>
<td>Engineer’s Contract No.:</td>
<td>«Engineer_Contract»</td>
</tr>
<tr>
<td>Contract:</td>
<td>«Contract»</td>
<td>Engineer’s Contract No.:</td>
<td>«Engineer_Contract»</td>
</tr>
<tr>
<td>Bidder:</td>
<td>«Contractor»</td>
<td>Engineer’s Contract No.:</td>
<td>«Engineer_Contract»</td>
</tr>
<tr>
<td>Bidder’s Address:</td>
<td>«Address_Line_1», «Address_Line_2»</td>
<td>Engineer’s Contract No.:</td>
<td>«Engineer_Contract»</td>
</tr>
</tbody>
</table>

You are notified that Owner has accepted your Bid dated, «Bid_Date», for the above Contract, and that you are the Successful Bidder and are awarded a Contract for «Contract».

The Contract Price of the awarded Contract is «Value_words» dollars ($«Contract_Value»). Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

One copy of the proposed Contract Documents (except Specifications and Drawings) accompanies this Notice of Award.

Four copies of Specifications and Drawings will be provided by the Engineer after the Notice to Proceed, if requested by Contractor.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Acknowledge acceptance of the Agreement via HRSD’s Online Project Management system.
2. Deliver the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders (Article 21) and in the General and Supplementary Conditions (Article 6).

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General and Supplementary Conditions.
NOTICE TO PROCEED

Owner: ____________
Owner’s Contract No.: ____________

Engineer: ____________
Engineer’s Contract No.: ____________

Contractor: ____________
Date of Contract: ____________

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on ____________, pursuant to Paragraph 4.01 of the General Conditions.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work will be done at the Site prior to such date.

In accordance with the Agreement:

The date by which Substantial Completion must be achieved is ____________ («Substantial_Completion» days) and the date by which readiness for final payment must be achieved is ____________ («Final_Completion» days).

Before starting any Work at the Site, Contractor must comply with the following: ____________

[Note any access limitations, security procedures, or other restrictions]

Engineer: ____________
By (signature): ____________
Name (printed): ____________
Title: ____________
Date Issued: ____________

Copy: Owner
# [PROJECT NAME]

EMERGENCY CONTACT LIST

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Office</th>
<th>Cell</th>
<th>E-mail</th>
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</thead>
<tbody>
<tr>
<td></td>
<td><strong>ENGINEER</strong></td>
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<td></td>
<td>Project Manager</td>
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<td>Project Engineer</td>
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<td>Inspector</td>
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<td>Resident Project Rep</td>
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<td><strong>HRSD</strong></td>
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<td>Project Manager</td>
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<td>Chief of IS Ops</td>
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<td>IS Rep</td>
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<td>Chief of Treatment</td>
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<td></td>
<td>Plant Superintendent</td>
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<td>Electrical</td>
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<td></td>
<td><strong>CONTRACTOR</strong></td>
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<td></td>
<td>President</td>
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<td>Project Manager</td>
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<td>Safety representative</td>
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<td><strong>KEY SUBCONTRACTOR</strong></td>
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<td></td>
<td><strong>CITY OR OTHER KEY CONTACTS</strong></td>
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</tbody>
</table>
FIELD ORDER NO.: ________

Date Issued: ___________  Effective Date of Field Order: ___________

Owner: Hampton Roads Sanitation District  Owner’s Contract No.: «Owner_Contract»
Engineer: «Engineer»  Engineer’s Contract No.: «Engineer_Contract»
Contractor: «Contractor»
Contract: «Contract»
Date of Contract: «Contract_Date»  Notice to Proceed Date: ___________

Contractor is hereby directed to promptly perform the Work described in this Field Order, issued in accordance with Paragraph 11.04 of the General Conditions, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference:

Specification Section(s): ____________________________________________________________

Drawing(s) / Details (s): ____________________________________________________________

Description:

Attachments:

Engineer by: ___________________________________________ Date: ___________
Contractor by: ___________________________________________ Date: ___________
Copy: Owner
REQUEST FOR PROPOSAL NO.: __________

Date Issued: __________

Owner: Hampton Roads Sanitation District    Owner’s Contract No.: «Owner_Contract»
Engineer: «Engineer»    Engineer’s Contract No.: «Engineer_Contract»
Contractor: «Contractor»
Contract: «Contract»
Date of Contract: «Contract_Date»    Notice to Proceed Date: ________________

The proposed changes are being considered in the Work on the above project as described below. Please advise us promptly of your proposed change in contract price and time to accomplish this work. Note that this is not an order to proceed with the proposed change. Notice to Proceed with the proposed change will be issued later in the form of a Change Order or Work Change Directive if it is decided to proceed with this change.

Proposed Changes:

Engineer by: ___________________________ Date: __________
Contractor by: ___________________________ Date: __________
Copy: HRSD, Chief of Design & Construction
**WORK CHANGE DIRECTIVE NO.: __________**

Date Issued: __________  
Effective Date of Work Change Directive: __________

<table>
<thead>
<tr>
<th>Owner: Hampton Roads Sanitation District</th>
<th>Owner's Contract No.: «Owner_Contract»</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineer: «Engineer»</td>
<td>Engineer's Contract No.: «Engineer_Contract»</td>
</tr>
<tr>
<td>Contractor: «Contractor»</td>
<td></td>
</tr>
<tr>
<td>Contract: «Contract»</td>
<td></td>
</tr>
<tr>
<td>Date of Contract: «Contract_Date»</td>
<td>Notice to Proceed Date:</td>
</tr>
</tbody>
</table>

Contractor is directed to proceed promptly with the following change(s):

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
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</tbody>
</table>

Attachments: (list documents related to the change to the Work)

**Purpose for the Work Change Directive:**

- ☐ Authorization for Work described herein to proceed on the basis of Cost of the Work due to:
  - ☐ Non-agreement on pricing of proposed change.
  - ☐ Necessity to expedite Work described herein prior to agreeing to changes on Contract Price and Contract Time.
- ☐ Authorization for Work described herein to proceed based on negotiated price – Estimated/Agreed (circle one) change in Contract Price and Contract Times:
  - Contract Price $ ____________ (increase/decrease)  
  - Contract Time _____ days (increase/decrease)

If the change involves an increase, the estimated amounts are not to be exceeded without further authorization.

Approval for Engineer by: ____________________________ Date: __________

Authorized for Owner by: ____________________________ Date: __________

Authorized for Contractor by: ____________________________ Date: __________
CHANGE ORDER NO.: ________

Date Issued: __________ Effective Date of Change Order: __________

Owner: Hampton Roads Sanitation District          Owner’s Contract No.: «Owner_Contract»
Engineer: «Engineer»          Engineer’s Contract No.: «Engineer_Contract»
Contractor: «Contractor»
Contract: «Contract»
Date of Contract: «Contract_Date» Notice to Proceed Date: __________

The Contract is modified as follows upon execution of this Change Order:

Description:

Attachments: (List documents related to the change)

<table>
<thead>
<tr>
<th>Change in Contract Price</th>
<th>Change in Contract Times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Contract Price:</td>
<td>Original Contract Times:</td>
</tr>
<tr>
<td>$ «Contract_Value»</td>
<td>Substantial Completion (days/date): «Substantial_Completion»</td>
</tr>
<tr>
<td></td>
<td>Ready for final payment (days/date): «Final_Completion»</td>
</tr>
<tr>
<td>[Increase] [Decrease] from previously approved Change Orders No. 1 to No. _____:</td>
<td>[Increase] [Decrease] from previously approved Change Orders No.1 to No. _____:</td>
</tr>
<tr>
<td>$ _______________________</td>
<td>Substantial Completion (days): _______________________</td>
</tr>
<tr>
<td></td>
<td>Ready for final payment (days): _______________________</td>
</tr>
<tr>
<td>Contract Price prior to this Change Order:</td>
<td>Contract Times prior to this Change Order:</td>
</tr>
<tr>
<td>$ _______________________</td>
<td>Substantial Completion (days): _______________________</td>
</tr>
<tr>
<td></td>
<td>Ready for final payment (days): _______________________</td>
</tr>
<tr>
<td>[Increase] [Decrease] this Change Order:</td>
<td>[Increase] [Decrease] this Change Order:</td>
</tr>
<tr>
<td>$ _______________________</td>
<td>Substantial Completion (days): _______________________</td>
</tr>
<tr>
<td></td>
<td>Ready for final payment (days): _______________________</td>
</tr>
<tr>
<td>Contract Price incorporating this Change Order:</td>
<td>Contract Times with all approved Change Orders:</td>
</tr>
<tr>
<td>$ _______________________</td>
<td>Substantial Completion (days): _______________________</td>
</tr>
<tr>
<td></td>
<td>Ready for final payment (days): _______________________</td>
</tr>
</tbody>
</table>

By acceptance of this contract modification, parties hereby agree that the modification represents an equitable adjustment to the Contract and the Contractor further agrees to waive all rights to file further claims arising out of, or as a result of, this change.

The agreement and all subsequent changes to the agreement will be approved and executed using HRSD’s Project Management system. Physical signatures will not be required if acknowledged by Contractor through the Online system.

This document is a MODIFIED version of EJCDC® C-941, Change Order.
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APPLICATION FOR PAYMENT

1. Original Contract Amount

2. Approved Change Order Amount
   Change Order Through
   Original Completion Date
   Approved Time Extensions
   Revised Completion Date

3. Revised Contract Amount (Line 1 + Line 2)

4. Total Work Completed To Date (See attached Schedule of Values)
   Percent Complete (Line 4/Line 3) #DIV/0!

5. Total Stored Materials (See Attached)

6. Total Earned To Date (Line 4 + Line 5)

7. Total Retainage Held (Line 6 x 5%)

8. Total Earned To Date Less Total Retainage Held (Line 6 - Line 7)

9. Total Previously Paid To Date (Line 8 from prior application)

10. Amount Due This Application (Line 8 - Line 9)

11. Balance to Finish (Line 3 - Line 8)

CONTRACTOR’S Certification:

CONTRACTOR certifies that: (1) all previous progress payments received from OWNER on account of Work done under the Contract referred to above have been applied to discharge in full all obligations of CONTRACTOR incurred in connection with Work covered by prior Applications for Payment; (2) title to all Work, materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to OWNER at time of payment free and clear of all liens, claims, security interest and encumbrances (except such as are covered by Bond Acceptable to OWNER against any such lien, claim, security interest or encumbrance); and (3) all Work covered by this Application for Payment is in accordance with the Contract Documents and not defective as that term is defined in the Contract Documents.

Application for Payment
December 1, 2004
### Application For Payment
**Schedule Of Values - Lump Sum Contract**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Total Value</th>
<th>Previous Completed to Date</th>
<th>Total Completed To Date</th>
<th>Balance Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>%</td>
<td>Value</td>
<td>%</td>
</tr>
</tbody>
</table>

| Total Original Contract | #DIV/0! | #DIV/0! |

#### Approved Change Orders

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

| Total Change Orders | #DIV/0! | #DIV/0! |

| Grand Total | #DIV/0! | #DIV/0! |

---

Application for Payment
December 1, 2004
<table>
<thead>
<tr>
<th><strong>1. Original Contract Amount</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2. Approved Change Order Amount</strong></td>
<td></td>
</tr>
<tr>
<td>Change Order Through</td>
<td></td>
</tr>
<tr>
<td>Original Completion Date</td>
<td></td>
</tr>
<tr>
<td>Approved Time Extensions</td>
<td></td>
</tr>
<tr>
<td>Revised Completion Date</td>
<td></td>
</tr>
<tr>
<td><strong>3. Revised Contract Amount (Line 1 + Line 2)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>4. Total Work Completed To Date (See attached Schedule of Values)</strong></td>
<td></td>
</tr>
<tr>
<td>Percent Complete (Line 4/Line 3)</td>
<td>#DIV/0!</td>
</tr>
<tr>
<td><strong>5. Total Stored Materials (See Attached)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>6. Total Earned To Date (Line 4 + Line 5)</strong></td>
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</tr>
<tr>
<td><strong>7. Total Retainage Held (Line 6 x 5%)</strong></td>
<td></td>
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<tr>
<td><strong>8. Total Earned To Date Less Total Retainage Held (Line 6 - Line 7)</strong></td>
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<tr>
<td><strong>9. Total Previously Paid To Date (Line 8 from prior application)</strong></td>
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<tr>
<td><strong>10. Amount Due This Application (Line 8 - Line 9)</strong></td>
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</tr>
<tr>
<td><strong>11. Balance to Finish (Line 3 - Line 8)</strong></td>
<td></td>
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</tbody>
</table>

**CONTRACTOR’S Certification:**

CONTRACTOR certifies that: (1) all previous progress payments received from OWNER on account of Work done under the Contract referred to above have been applied to discharge in full all obligations of CONTRACTOR incurred in connection with Work covered by prior Applications for Payment; (2) title to all Work, materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to OWNER at time of payment free and clear of all liens, claims, security interest and encumbrances (except such as are covered by Bond Acceptable to OWNER against any such lien, claim, security interest or encumbrance); and (3) all Work covered by this Application for Payment is in accordance with the Contract Documents and not defective as that term is defined in the Contract Documents.
## Application For Payment
**Schedule Of Values - Unit Price Contract**

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION OF ITEM</th>
<th>SCHEDULE QUANTITY</th>
<th>TOTAL QUANTITIES</th>
<th>TOTAL AMOUNT DUE TO DATE</th>
<th>BALANCE TO FINISH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>BID QUANT</td>
<td>UNIT</td>
<td>UNIT PRICE</td>
<td>BID VALUE</td>
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**CHANGE ORDERS**

|            |           |           |           |           |           |                  |            |                |                           |   |
|------------|-----------|-----------|-----------|-----------|-----------|------------------|            |                |                           |   |

**TOTAL CONTRACT**

|            |           |           |           |           |           |                  |            |                |                           |   |
|------------|-----------|-----------|-----------|-----------|-----------|------------------|            |                |                           |   |

Application for Payment  
December 1, 2004
<table>
<thead>
<tr>
<th>Item No.*</th>
<th>Vendor</th>
<th>Invoice No.</th>
<th>Material</th>
<th>Original Value</th>
<th>Installed Value</th>
<th>%</th>
<th>Stored Value</th>
<th>Invoice ** Submitted</th>
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Totals

*Should match line item on Application For Payment Schedule of Values
**Represents the Application For Payment number when first submitted

Application for Payment
December 1, 2004
DIVERSITY PROCUREMENT STATEMENT

Contractor, subcontractors, and suppliers are encouraged to provide for the participation of small, women-owned and minority owned businesses (SWAM) in this contract.

Project
0

Contractor
0

Application No.
0

1 For this month, list the total value of work in place.

2 Is Contractor
   a. Small business? YES NO
   b. Women-owned business? YES NO
   c. Minority-owned business? YES NO
   d. Service disabled veteran-owned business? YES NO

3 If Contractor is SWAM, list the total value of work invoiced by Contractor.

4 List all SWAM subcontractors, amounts due them on this invoice, and what type business they are.

<table>
<thead>
<tr>
<th>Subcontractor</th>
<th>Amount due</th>
<th>Small Business</th>
<th>Women Owned</th>
<th>Minority Owned</th>
<th>Veteran Owned</th>
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</table>

CERTIFICATE OF SUBSTANTIAL COMPLETION

Date Issued: ____________

Owner: Hampton Roads Sanitation District  
Owner’s Contract No.: «Owner_Contract»

Engineer: «Engineer»  
Engineer’s Contract No.: «Engineer_Contract»

Contractor: «Contractor»  
Date of Contract: «Contract_Date»

This (tentative) (definitive) Certificate of Substantial Completion applies to:

☐ All Work under the Contract Documents  ☐ The following specified portions of the Work:

Date of Substantial Completion: ____________________________

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A list of items to be completed or corrected is attached to this Certificate; if applicable. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner’s use or occupancy of the Work must be as provided in the Contract, except as amended as follows:

Amendments to Owner’s Responsibilities: ☐ None  ☐ As follows:

Amendments to Contractor’s Responsibilities: ☐ None  ☐ As follows:

The following documents are attached to and made a part of this Certificate:

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor’s obligation to complete the Work in accordance with the Contract Documents.

Executed by Engineer: ___________________________________________  Date: ____________

Accepted by Contractor: ___________________________________________  Date: ____________

Accepted by Owner: ___________________________________________  Date: ____________
NOTICE OF ACCEPTABILITY OF WORK

Date Issued: ____________

Owner: Hampton Roads Sanitation District Owner’s Contract No.: «Owner_Contract»
Engineer: «Engineer» Engineer’s Contract No.: «Engineer_Contract»
Contractor: «Contractor»
Contract: «Contract»
Date of Contract: «Contract_Date» Notice to Proceed Date: __________________

The Engineer hereby gives notice to the Owner and Contractor that the Engineer recommends final payment to Contractor, and that the Work furnished and performed by Contractor under the Construction Contract is acceptable, expressly subject to the provisions of the Construction Contract’s Contract Documents (“Contract Documents”). This Notice of Acceptability of Work (Notice) is made expressly subject to the following terms and conditions to which all who receive and rely on said Notice agree:

1. This Notice has been prepared with the skill and care ordinarily used by members of the engineering profession practicing under similar conditions at the same time and in the same locality.
2. This Notice reflects and is an expression of the Engineer’s professional opinion.
3. This Notice has been prepared to the best of Engineer’s knowledge, information, and belief as of the Notice Date.
4. This Notice is based entirely on and expressly limited by the scope of services Engineer has been employed by Owner to perform or furnish during construction of the Project (including observation of the Contractor’s Work) under the Owner-Engineer Agreement, and applies only to facts that are within Engineer’s knowledge or could reasonably have been ascertained by Engineer as a result of carrying out the responsibilities specifically assigned to Engineer under such Owner-Engineer Agreement.
5. This Notice is not a guarantee or warranty of Contractor’s performance under the Construction Contract, an acceptance of Work that is not in accordance with the Contract Documents, including but not limited to defective Work discovered after final inspection, nor an assumption of responsibility for any failure of Contractor to furnish and perform the Work thereunder in accordance with the Contract Documents, or to otherwise comply with the Contract Documents or the terms of any special guarantees specified therein.
6. This Notice does not relieve Contractor of any surviving obligations under the Construction Contract, and is subject to Owner’s reservations of rights with respect to completion and final payment.

Engineer

By (signature): ____________________________
Name (printed): ____________________________
Title: ____________________________
WARRANTY MEMORANDUM NO.: _________

Date Issued: __________

Project Name: «Contract»

To: Company: «Contractor»

Attention: «Contact»

Address: «Address_Line_1»

«Address_Line_2»

Date Deficiency Discovered: __________

Description, Location, and Impact of Deficiency:

Contractor personnel aware or notified of the deficiency:

Name, Title: ____________________________________________________________

Date Notified: __________

CONTRACTOR: PLEASE RETURN A COPY OF THIS ENTIRE FORM WITH THE INFORMATION REQUESTED TO:

HRSD
DESIGN & CONSTRUCTION DIVISION
P.O. BOX 5911
VIRGINIA BEACH, VA 23471-0911

Date of Resolution: __________

Description of Remedy:
Section 40 - Master Specification Sections Overview

A. Introduction – Included in this publication are the below listed master specifications. These are to be used by the FIRM for Bid Document preparation for HRSD Design-Bid-Build project delivery along with other technical specification sections as developed by the FIRM. These sections are intended to be used primarily for HRSD interceptor system projects. The original versions of the HRSD provided specification sections are available in Microsoft Word format with Tracked Changes enabled on HRSD’s homepage under HRSD Design and Construction Standards. The FIRM is to keep the Tracked Changes mode enabled when making suggested edits for the HRSD Project Manager’s approval.

B. Listing of Master Specifications Sections.

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>01010</td>
<td>Summary of Work</td>
</tr>
<tr>
<td>01040</td>
<td>Coordination</td>
</tr>
<tr>
<td>01060</td>
<td>Special Conditions</td>
</tr>
<tr>
<td>01270</td>
<td>Measurement and Payment</td>
</tr>
<tr>
<td>01323</td>
<td>Record Documents</td>
</tr>
<tr>
<td>01340</td>
<td>Submittals</td>
</tr>
<tr>
<td>01520</td>
<td>Maintenance of Pipeline and Pumping Operations</td>
</tr>
<tr>
<td>01560</td>
<td>Environmental Protection and Special Controls</td>
</tr>
<tr>
<td>01650</td>
<td>Facility and System Start-Up</td>
</tr>
<tr>
<td>02510</td>
<td>Ductile Iron Pipe</td>
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<tr>
<td>02520</td>
<td>Polyvinyl Chloride Pipe</td>
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<tr>
<td>02531</td>
<td>Line Stops on Sanitary Sewer Force Main Systems</td>
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<tr>
<td>02610</td>
<td>Valves</td>
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<td>02710</td>
<td>Contaminated Groundwater Management</td>
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<tr>
<td>02761</td>
<td>Television Inspection of Pipelines</td>
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<tr>
<td>02773</td>
<td>Ultrasonic Pipeline Inspection</td>
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<tr>
<td>02774</td>
<td>Condition Assessment Data Collection for Pipelines Being Repaired or to be Abandoned</td>
</tr>
<tr>
<td>03700</td>
<td>Concrete Rebuild</td>
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<tr>
<td>03800</td>
<td>Embedded Galvanic Anodes for Concrete Rebuild</td>
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<tr>
<td>07160</td>
<td>Reactive Waterproofing</td>
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<tr>
<td>07900</td>
<td>Joint Sealants and Expansion Joint Systems</td>
</tr>
<tr>
<td>09900</td>
<td>Protective Coatings</td>
</tr>
<tr>
<td>13110</td>
<td>Cathodic Protection</td>
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</tbody>
</table>
SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.1 LOCATION AND SCOPE OF WORK:
   A. The Work consists of, but is not limited to the following:
      1. Furnishing and installing pipelines, utilities, associated appurtenances, and all associated
         work to accomplish this project.
      2. [Insert project specific scope of work]
   B. The Project is located at the following sites:
      1. [Insert specific location of where work is to be performed].
   C. The summary of the Work described in this Section is an overall summary of the responsibilities
      of the Contractor. It does not supersede the specific requirements of the other Contract
      Documents.

1.2 CONTRACT
   A. The Work shall be constructed under one prime contract.

1.3 WORK BY OTHERS:
   A. Work by Owner:
      1. Operation of all HRSD owned existing valves, air vents, and pump stations. Only HRSD
         personnel shall operate HRSD owned infrastructure.
   B. Work by Municipal Utility Owners:
      1. Operation of all municipally owned existing valves, air vents, and pump stations shall be
         done by [Insert responsible party].
   C. Work by Private Utility Owners:
      1. Operation of all privately owned existing valves, air vents, and pump stations shall be done
         by [Insert responsible party].

1.4 OWNER-FURNISHED PRODUCTS
   A. [Insert as applicable].

1.5 WORK SEQUENCE
   A. The Contractor is responsible for the sequencing of activities as necessary to satisfactorily
      complete all project work within the Contract period. The Contractor’s sequencing shall be
      presented in the Progress Schedule as specified in Article 2.05 of Section 00700 – General
      Conditions.
   B. [Insert additional info regarding work sequence].
   C. Refer to Section 01520 - Maintenance of Pipeline and Pumping Operations for guidelines and
      requirements on the sequencing of Work for the connection of the new or relocated pipeline to
      the existing pipeline. [modify accordingly based upon type of facility construction]

1.6 CONTRACTOR’S USE OF PREMISES
   A. Contractor shall abide by all provisions and requirements outlined in the [insert applicable
      right-of-way permits for municipality] pertaining to work within the public right-of-way.
   B. Contractor is responsible for coordinating access and obtaining written authorization from all
      property owners to enter their sites.
C. Contractor shall assume full responsibility for the protection and safekeeping of materials furnished under this Contract and for materials stored on or off-site.

1. Housekeeping – The Contractor is responsible for the overall housekeeping within their work areas.
   a. All exit doors, electrical panels, fire extinguishers; emergency eyewash/showers must have clear access maintained for emergencies.
   b. Trash and debris must not accumulate nor impede travel on designated walkways.
   c. Weeds and grass must be maintained during the project by the contractor in their designated areas so as not to create fire hazard or harborage of vermin.

D. Contractor shall immediately move any stored materials or equipment under Contractor’s control that interfere with operations of the Owner, Locality, or property owner or are of public nuisance or potential harm to the public.

E. The Contractor shall not park, stage, or engage in any construction related activities on private property or outside of locality rights of way or HRSD easements without obtaining signed authorization from the property owner. The Contractor is responsible for securing all additional staging areas as required for the duration of the Contract. All costs, contingencies, permits, and agreements related to the acquisition and use of any proposed staging area shall be the Contractor’s responsibility. Contractor is responsible for preparation and restoration of areas used to the satisfaction of the property owner. Parking facilities for Contractor’s personnel shall also be the Contractor’s responsibility.

1. The Contractor shall provide HRSD a listing of all property owners and locations the Contractor negotiated staging areas with and copies of such signed authorizations by the property owner. The referenced authorization shall include a detailed description of work to occur on the private property and an expectation of restoration of the property and photos of the conditions prior to entry. The Contractor shall provide this information to HRSD prior to entering the site.

F. HRSD facilities locker rooms, toilets, and lunchrooms are off limits to the Contractor, subcontractors, and suppliers.

G. {HRSD plant sites operate under a closed gate policy. The following general requirements shall apply. Contact the project manager for specific requirements at each plant site.}

1. Security guards shall be provided if Treatment Plant gates are to be left open during normal work hours. The following are requirements and expectations of a security guard:
   a. The Security Guard is expected to be alert and awake while guarding the open gate.
   b. The Security Guard is expected to check cars and trucks in and out of the plant site.
   c. If the Security Guard is not on duty the plant gate will be closed and secured.
   d. The Security Guard must turn unwanted site visitors away.

1.7 REGULATORY REQUIREMENTS

A. Comply with all Federal, State, and local laws, regulations, codes, and ordinances applicable to the Work.

B. Obtain all required permits, post required bonds and pay all required fees. These may include, but are not limited to:

1. Right-of-Way Permit (for excavation within the {insert Locality’s right-of-way}: {insert insert Locality’s applicable Ordinance regarding Right-of-Way permits} as an example: City of Ordinance No. _______ requires a permit for excavation within the public right-of-way. The Contractor shall obtain a permit in accordance with the policies and standards set forth in the “City of _______ Right-of-Way Excavation and Restoration Manual” dated _______. Downloadable PDF copies of the manual and application form is available at ____________________________ .

2. {Jurisdictional) Land Disturbing Permit, if applicable}.
3. {VDOT Land Use Permit, if applicable. HRSD to pay for VDOT inspection costs if applicable}.
4. {Insert additional permits required}.
5. Highlight any permits requiring bonds or for which plan approval has been received. Identify what fees and who is responsible for. Include copies of VDOT, Railroad, Corps of Engineers or other permits which have been obtained for the project. Advise Contractor of existing HRSD permits and requirements. Contractor required to obtain storm water permit for construction activities. If fees cannot be reasonably determined prior to bid, consider direct reimbursement by change order.

1.8 ACCESS BY GOVERNMENT OFFICIALS

A. Authorized representatives of governmental agencies shall at all times have access to the Work where it is in preparation or progress. Contractor shall provide proper facilities for access and inspection.

1.9 NO UNAUTHORIZED WORK

A. The Contractor shall not undertake additional or ‘side work’ not defined within the Contract Documents for residents or businesses as part of or during the active HRSD project, without explicit written authorization from HRSD’s Project Manager.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION
SECTION 01040
COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Contractor shall be solely responsible for coordination of all of the Work. He shall supervise, direct and cooperate fully with all subcontractors, manufacturers, fabricators, suppliers, distributors, installers, testing agencies and all others whose services, materials or equipment are required to ensure completion of the Work within the Contract Time and in accordance with the Contract Documents.

B. Contractor shall cooperate with and coordinate his Work with the work of any other contractors, subcontractors, utility service companies or Owner’s employees performing additional work related to the Project at the site.

C. Contractor shall maintain sufficient competent personnel, drafting equipment and supplies at the site for the purpose of preparing layout and coordination drawings. These drawings shall supplement the Contract Documents, and the working and Shop Drawings as necessary to correlate the work of various trades. Where such drawings are to be prepared by Subcontractors, Contractor will ensure that each Subcontractor maintains the required personnel and facilities at the site.

D. Contractor shall also coordinate his Work with the work of others under separate contract with HRSD or others parties to assure compliance with schedules.

E. Contractor shall attend and participate in all project coordination or progress meetings and report on the progress of all Work and compliance with schedules.

F. Contractor shall provide to HRSD’s Project Manager a copy of any and all temporary land lease or easement negotiated between the Contractor and a property owner.

1.2 PUBLIC NOTIFICATION

A. The Contractor shall attend a coordination meeting with Owner, Engineer, and property owners personnel to discuss notification of property owners prior to the commencement of work. This meeting will be scheduled by the Engineer following issuance of the Notice to Proceed. Include parties affected by the work including jurisdictional representatives. A separate meeting may be required with adjacent property owners and impacted parties.

B. The Contractor shall coordinate with the Engineer and HRSD’s Project Manager regarding HRSD notifications by letter or door hangers within the designated distribution areas for all easement owners, property owners, residents, businesses, and facilities that may be affected by the construction operations.

1. Contractor is responsible for coordinating schedule and shall provide a firm start schedule 45 calendar days prior to staging or entering the work site to allow for HRSD’s Public Information Specialist (or other designated individual) to design all project notifications for the public.

2. Contractor to assist or distribute the HRSD, designed and approved, Project Introductory Notifications. Distribution of these notifications shall occur 30 calendar days in advance of any staging or commencement of work, to all easement owners, property owners, residents, businesses, and facilities that may be affected by the construction activities as within the project limits. The Contractor shall not be permitted to commence work until these distributions have been completed and confirmed by the Engineer or HRSD Project Manager.
3. Contractor shall for the entire duration of this project distribute project update notices (as designed and approved by HRSD) to all business, residence or facility within the upcoming work zone, 7 calendar days in advance of commencing work. The Contractor shall not be permitted to commence work until these distributions have been completed and confirmed by the Engineer or HRSD Project Manager.

4. Contractor will distribute Additional Notices (as designed and approved by HRSD) for work such as but not limited to: detours or street closures, service interruptions or shut offs, and night work a minimum of 48 hours prior to the scheduled work or as defined by the HRSD Public Information Specialist (or other designated individual). The Contractor shall not be permitted to commence work until these distributions have been completed and confirmed by the Engineer or HRSD Project Manager.

5. Contractor shall distribute project closeout notices to all easement owners, property owners, residents and businesses that may be affected by the construction operations by letter or door hangers within the project limits.

6. Contractor shall notify the HRSD Project Manager and HRSD Public Information Specialist (or other designated individual) of the scheduled dates for distributing each notice such that HRSD can perform timely website updates.

7. The Contractor shall keep a copy of each notice on site to provide or review with the public as needed.

1.3 OTHER PROJECTS {if applicable}
A. The {insert specific project name} are being constructed concurrently with the following projects:
   1. {Insert other project name};
      a. {Insert applicable resident project engineer, contact information, or projected schedule date for other projects}.

1.4 OTHER UTILITY OWNERS
A. The Contractor shall coordinate with any private and public utility owners with facilities within the limits of the project and abide by all Miss Utility laws and notification requirements.

1.5 HRSD UNIFIER ENTERPRISE PROJECT MANAGEMENT SYSTEM
A. The Contractor will be required to utilize HRSD’s Unifier Enterprise Project Management System for the duration of this project. This includes but is not limited to taking part in the required software training (generally a half day course at HRSD) and using the web based software as intended to facilitate the management of the project. The project management software will be used to track and manage information such as meeting action items, shop drawing submittals, Request for Information (RFI), and Work Change Directives. Contractor will be obligated to initiate required work flow actions in a timely manner such that workflow and schedule are not adversely impacted.

1.6 ENTERPRISE RESOURCE PLANNING SYSTEM (ERP)
A. The Contractor will be required to utilize HRSD’s Enterprise Resource Planning (ERP) System for the duration of this project. This includes but is not limited to taking part in the required software training (generally a half day course at HRSD). Contractor will be obligated to initiate required work flow actions in a timely manner such that workflow and schedule are not adversely impacted. HRSD’s ERP system will be used for submitting Contractor payment requests, Change Orders, specific documents as directed in the Contract Documents, and for all other financial related matters.
PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION
PART 1 - GENERAL

1.1 DRAWINGS AND CONTRACT DOCUMENTS FOR CONTRACTOR USE

A. Refer to General Conditions.

B. Additional documents after "no-charge" documents will be furnished to Contractor at cost.

1.2 PRECONSTRUCTION CONFERENCE

A. Date, Time and Location: Conference will be held after execution of the Contract and before construction is started at the site. Owner will fix the date, time and location of the meeting.

B. Contractor shall provide data required, contribute appropriate items for discussions and be prepared to discuss all items on agenda.

C. Required Attendance, as a minimum:
   1. Owner’s representatives.
   2. Contractor’s project manager and superintendent.
   3. Contractor’s Safety Officer
   4. Subcontractor representatives whom Contractor may desire or Engineer may request to attend.
   5. Engineer’s representative.
   6. Representative of [jurisdictional and/or private utility owners].
   7. Representatives of government agencies having a degree of control or responsibility, if available.

D. Engineer shall prepare agenda, preside at meeting, and prepare and distribute a transcript of proceedings to all parties.

E. Agenda
   1. Agenda will include, but will not necessarily be limited to, the following:
      a. Designation of responsible personnel.
      b. Subcontractors.
      c. Coordination with other Contractors.
      d. Contractor's preliminary Construction Schedule. Note – the preliminary construction schedule to be used for initial project information on HRSD’s construction web page.
      f. Preconstruction assessments and surveys
      g. Public Notifications: coordination of schedule, planning and confirmation of distributions (30 and 7 day notices, additional specialty notices- 48 hours, and project closeout notice).
      h. Personal/ Private Property Claims Process: notification and tracking; insurance update; and items discussed directly with the Contractor or Engineer’s Resident Project Representative. Note – Contractor must notify Engineer, HRSD Project Manager and HRSD Real Estate Manager (or other designated individual) within 24 hours of knowledge of any incident. All claims are to be resolved by the Contractor within 60 days of the Contractor’s notification of the incident.
      i. Processing of Shop Drawings and distribution of Submittals.
      j. Processing of Requests for Information (RFI), Field Orders, Work Change Directives, and Change Orders.
      k. Requirements for copies of Contract Documents.
      l. Processing and Schedule of Payments, Materials and Supplies.
      m. Use of premises.
      n. Land use agreements / signed authorizations obtained by Contractor
o. Contractor’s safety responsibilities.
p. Security
q. Housekeeping.
r. Field Offices.
s. Record Drawings.
t. Critical work sequencing.
u. Develop emergency contact list for key individuals involved with project
v. HRSD Operational Support Requirements
w. Other project related items.

1.3 TEMPORARY FACILITIES
A. Construction Offices:
   1. All temporary construction offices and trailers (including contractor provided Engineer field offices) shall be sufficiently anchored to withstand 100 mile per hour wind. Review location and size of Engineer and Contractor office trailers with the Engineer.

B. Temporary Water:
   1. The Contractor is responsible for obtaining at his own expense all water required for completion of the work.
   2. Coordinate with the [jurisdictional utility owner] or other source for obtaining water.
   3. The Contractor shall not operate any fire hydrants or spigots without coordinating with and obtaining the approval of its owner. Approved or provided backflow preventers or Reduced Pressure Zone (RPZ) devices with security deposits may be required by various jurisdictions.

C. Temporary Sanitary Facilities:
   1. Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation -type properly vented and fully enclosed in a fiberglass or other approved non-absorbent shell at each site.
   2. Contractor responsible for coordination and all costs associated with waste disposal and upkeep of temporary sanitary facilities.

D. Telephone:
   1. Provide a local area (757 area code) mobile phone number with both text and email capability for Superintendent throughout construction period.
   2. Provide fax service for field office.
   3. [Two-way radios may be requested on certain projects to be on the same frequency as HRSD radios]

E. Power:
   1. The Contractor is responsible for obtaining at his own expense all temporary power necessary for completion of the work.
   2. The Contractor shall coordinate with [insert utility owner and/or other applicable source] for obtaining temporary power.

F. Internet Service:
   1. The Contractor is responsible for obtaining at his own expense sufficient internet capabilities to enable daily and necessary email and electronic submittals or transmittals throughout the duration of this construction phase.

1.4 DOCUMENTATION OF SITE CONDITIONS [Engineer to specify requirements in the Contract Documents for Contractor based upon their determination of project zone of construction activity influence and direction from HRSD’s Project Manager and HRSD Real Estate Manager (or other designated individual)].

A. Documentation of Site Conditions as detailed in this section shall be completed and submitted to the Engineer for upload to HRSD’s Unifier System for review 30 calendar days prior to mobilizing to the work site.
B. Contractor shall coordinate preconstruction photographing and video recording schedules with Owner, Engineer and {insert jurisdictional owner as needed}.

C. Contractor shall coordinate with the Engineer the documentation, through photographs and video recording, the existing conditions of the project site and structures along the project route to include but not limited to: roadways, curb and gutter, medians, sidewalks, driveways and aprons, other utilities and structures within the construction activities zone.

D. Photographs:
   1. Digital preconstruction photographs of the project site. At a minimum, photographs are to be taken at each roadway intersection, all driveways, and a minimum of two pictures at the front of each property. Digital photos are to be labeled with the location, time and date that the photograph was taken.
   2. Furnish jump or external drive copy of digital photographs to the Engineer and Owner.

E. Video Recording:
   1. [Specify format on jump or external drive if applicable]

F. Property / Structure preconstruction assessments and surveys. {Engineer, HRSD Project Manager and HRSD Real Estate Manager (or other designated individual) to determine if detailed structural assessment and documentation of visible defects to be required on certain projects or certain properties}
   1. Examination of Adjacent Facilities and Properties: {Engineer to specify requirements for Contractor based upon direction from HRSD’s Project Manager and HRSD Real Estate Manager (or other designated individual)}
      a. Before start of Work at the site, Contractor shall make a thorough examination of the existing conditions including buildings, structures and other improvements in the vicinity of the Work which could be damaged by construction activities. The Engineer or Engineer’s Resident Project Representative shall accompany the Contractor during this examination.
      b. Periodic reexamination shall be performed to include cracks in structures, settlement, leakage and similar conditions.
      c. Record and submit documentation of observations made during examination inspections to the Engineer.

G. Vibration Monitoring Program. {Engineer, HRSD Project Manager and HRSD Real Estate Manager (or other designated individual) to determine if a detailed vibration monitoring program baseline is required for certain properties and active monitoring as construction is ongoing in the vicinity.}

1.5 PROGRESS MEETINGS

A. Date and Time:
   1. Regular monthly meetings or as designated by Owner.
   2. Other meetings are on call with 48 hours’ notice of meeting.

B. Place:
   1. Contractor’s field office or other predesignated place.

C. Engineer shall prepare agenda, preside at meetings, and prepare and distribute typed summary of proceedings.

D. Contractor shall provide data required and be prepared to discuss all items on agenda.

E. Minimum Attendance: Contractor’s Project Manager and Superintendent shall attend. Contractor and subcontractor’s representatives present for each party shall be authorized to act on their behalf.

F. Agenda:
   1. Agenda will include but not necessarily be limited to the following:
      a. Revisions and/or corrections to previous meeting summaries.
b. Administrative Items.
c. New agenda items to be discussed.
d. Public notifications coordination, planning and confirmation of distributions (30 and 7
calendar day notices, additional specialty notices- 48 hours, and project closeout notice).
e. Land use agreements / signed authorizations obtained by Contractor.
f. Public Relations Items: Property owner, jurisdictional or other lodged complaints
consults or issues, discussed directly with the Contractor or Engineer’s Resident Project
Representative.
g. Status of project related damage claims
h. Updated overall construction schedule to completion for each progress meeting available
for viewing and discussion.
i. 30-day look ahead construction schedule.
j. Progress since last meeting.
k. Planned progress for next meeting and milestone work.
l. Schedule assessment (delay or float).
m. Discussion of potential obstacles or hindrances.

1.6 PROTECTION OF PUBLIC PROPERTY

A. Contractor shall coordinate with the Engineer and HRSD’s Project Manager and make satisfactory
and acceptable arrangements with the owner of, or the agency or authority having jurisdiction
over, any damaged property concerning its repair, replacement, or payment of costs incurred in
connection with any damage.

B. Contractor shall keep fire hydrants and water control valves free from obstruction and available
for use at all times.

C. Contractor shall keep HRSD and jurisdiction owned sewer facilities free from obstruction and
available for use at all times.

D. Contractor shall coordinate with the Engineer to notify all utility owners who may be affected by
the construction operation at least seven (7) calendar days in advance of such work. Before
exposing any utility, the utility having jurisdiction shall grant permission and may oversee the
operation. Should service of any utility be interrupted due to the Contractor's operation, the proper
authority shall be notified immediately. Contractor shall cooperate with the said authority or
utility owner in restoring the service as promptly as possible and shall bear any costs incurred.

E. In areas where the Contractor's operations are adjacent to or near a utility and such operations may
cause damage which might result in considerable expense, loss, and inconvenience, the operation
shall be suspended until all arrangements necessary for the protection thereof have been made by
the Contractor and verified by the Engineer or Engineer’s Resident Project Representative.

1.7 HISTORICAL AND ARCHAEOLOGICAL CONDITIONS

A. If during the course of construction, evidence of deposits of historical or archaelogical interest is
found, the Contractor shall cease operations affecting the find and shall immediately notify the
Engineer and HRSD’s Project Manager.

1. No further disturbance of the deposits shall ensue until the Contractor has been notified by
Owner that Contractor may proceed.
2. Owner will issue a notice to proceed after appropriate authorities have surveyed the find and
made a determination to Owner.
3. Compensation to the Contractor, if any, for lost time or changes in construction resulting from the find, shall be determined in accordance with changed or extra work provisions of the Contract Documents.

1.8 SOIL CONTAMINATION

A. If during the course of construction, evidence of hydrocarbon or other soil contamination is found, the Contractor shall cease operations affecting the find and shall immediately notify the Engineer and HRSD’s Project Manager.
1. No further disturbance of the affected area shall ensue until the Contractor has been notified by Owner that Contractor may proceed.
2. Owner will issue a notice to proceed after appropriate authorities have surveyed the find and made a determination to Owner.
3. Compensation to the Contractor, if any, for lost time or changes in construction resulting from the find, shall be determined in accordance with changed or extra work provisions of the Contract Documents.

1.9 LINES AND GRADES

A. Construct all Work to the lines, grades, and elevations indicated on the Drawings. Remove and reconstruct improperly constructed Work.

B. Provide all additional survey, layout, and measurement work required.
1. Work to be performed by a qualified professional engineer or registered land surveyor.
2. Locate, verify and protect control points prior to starting site Work, and preserve all permanent reference points during construction.
   a. Make no changes or relocations without prior written notice to Engineer.
   b. Report immediately to Engineer when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations. The costs for any and all reestablishment of control work damaged by the Contractor shall be Contractor’s responsibility.
3. Establish lines and levels, locate and lay out by instrumentation and similar appropriate means.
4. Maintain a complete, accurate log of all control and survey work as it progresses.
5. On request of Engineer, submit documentation to verify accuracy of field engineering work.

1.10 WORK HOURS

A. Comply with General Conditions. In addition to the General Condition requirements, no work outside of the hours of 7 a.m. to 5 p.m., Monday through Friday, or on legal holidays will be permitted without Owner’s written consent. The Contractor shall have a supervisor present whenever work is taking place, including when only sub-contractor work is being performed.
1. The following are legal holidays for the Owner: [review each calendar year]
   a. New Year’s Day (January 1st)
   b. Lee-Jackson Day (2nd Friday in January)
   e. Memorial Day (Last Monday in May).
   f. Independence Day (July 4th).
   g. Labor Day (1st Monday in September).
   h. Columbus Day (2nd Monday in October).
   i. Veteran’s Day (November 11th).
   j. Thanksgiving Day (4th Thursday in November).
   k. Friday after Thanksgiving Day.
   l. Christmas Day (December 25th).

B. The Contractor shall obey the work hour provisions of any [jurisdictional permits] obtained for the Work.
C. The Contractor shall refer to the Traffic Control Plans / Maintenance of Traffic in the Drawings for work hour restrictions related to construction at specific locations.

D. [Insert any planned or known work or special events occurring within the project limits that may affect Contractor scheduling, at no additional cost to HRSD.]

E. [Insert any time or date restrictions from any school on which work will occur on school property. When possible, this work shall occur while school is not in session, during overnight hours, weekends or school closures and holidays.]

1.11 HRSD REGULATORY REPORTING REQUIREMENTS FOR SPILLS

A. During the course of construction, project spills from force mains, manholes, etc. may occur. These events must be reported to HRSD personnel and the Engineer’s Resident Project Representative immediately. The Contractor shall also contact the appropriate Operations Center Coordinator. The following telephone numbers are staffed as listed below:

1. [Insert appropriate HRSD contacts and phone numbers]
   a. North Shore Operations: (757) 833-1720 [6:00 AM to 4:30 PM Monday through Friday]
   b. South Shore Operations: (757) 460-7072 [5:45 AM to 4:30 PM Monday through Friday]

B. If the Contractor has a problem outside of these business hours, then one of the following personnel should be notified:

1. [Insert and/or delete to list appropriate HRSD contacts and phone numbers]
   a. North Shore Duty Supervisor (757) 613-6600
   b. North Shore Duty Foreman (757) 613-6601
   c. South Shore Duty Supervisor (757) 248-8118
   d. South Shore Duty Technician (757) 248-8120

C. This procedure shall be followed for all spills. Failure to report a spill can lead to enforcement action by the Virginia Department of Environmental Quality (VDEQ).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. The items listed in Part 1.3 below refer to and are the same pay items listed in the Bid Form. They constitute all of the pay items for the completion of the Work.

B. The unit bid prices will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit.

C. Refer to the General Conditions for provisions for Payments to Contractor and Changes in Contract Price.

1.2 INCIDENTAL ITEMS

A. There are numerous incidental items of work that are required to complete the Project. While these items may not be specifically mentioned or illustrated by the Contract Documents and there may be no specific pay items listed for them, the Contractor will be required to perform those incidental tasks that can be anticipated through inspection of the Contract Documents, inspection of the construction areas, and experience in this class of construction.

B. Items considered incidental work shall not be measured for payment or paid for as such unless specified as unit price by items on the Bid Form. These items and their costs shall be included in the unit prices or lump sum bid for the pay items unless bid separately. Incidental items include but are not limited to the following:

1. Permits.
2. Material royalties.
3. Temporary utility connections.
5. Clearing and grubbing.
7. Traffic control / Maintenance of Traffic (Engineer to determine if incidental or separate pay item for each project).
8. Site security.
10. Temporary erosion and sediment control.
11. Locating existing utilities (excluding locations designated on the plans).
12. Sheetin and shoring (Engineer to determine if incidental or separate pay item for each project).
13. Excavation.
14. Dewatering of trenches, including use of well point system if required. (Engineer to determine if dewatering permitting, discharge, treatment, monitoring and reporting are incidental. If determined to not be incidental, Engineer to include measurement and payment item separately for the work).
15. Bedding materials as detailed (excluding materials required to replace trench undercutting).
16. Handling, placing, manipulating, and compacting excavated material suitable as backfill material.
17. Pipe linings and coatings.
18. Temporary pipe thrust restraint (This item is for temporary pipe restraint / blocking at tie-in connections while pipe is exposed and under operating pressure).
19. Polyethylene encasement.
20. Maintenance of pipeline operations during pipe shutdowns, including pumping, hauling, and disposing of sewage. [Engineer to determine if item is incidental to the project. If determined not to be incidental, Engineer to include measurement and payment item separately for the work.]

21. Tracer wire, marking tape, and/or marker balls.

22. Testing materials, equipment, media, and execution.

23. Offsite disposal of surplus and unsuitable excavated material.

24. Offsite disposal of pipe and appurtenances removed to accommodate the proposed pipe.

25. Daily site cleanup.

26. Allaying of dust.

27. Relocating or modifying existing miscellaneous items.

28. Temporary pavement.

29. Site restoration, including sidewalk and curb and gutter replacement (excluding permanent pavement restoration, milling, and overlay).

30. Site cleanup.

31. Topsoil and seeding.

32. Recordkeeping.

33. All other items required to complete the project, for which pay items are not provided, will not be measured nor paid for as such, but their cost shall be included in the price for other items of work.

1.3 BID ITEMS [Engineer to review HRPDC Regional Construction Standards measurement and payment items and use appropriate items]

A. Item 1 – Mobilization, complete [Delete if not applicable].
   1. Measurement: Item will not be measured separately but paid for on a lump sum basis. The lump sum bid amount for mobilization shall not exceed 6% of the Total Bid amount. Demobilization shall not be paid as a separate item.

   2. Basis of Payment: Payment shall be made at the Contract Lump Sum Price.

B. Item 2 – Horizontal Directional Drill (HDD), Bore & Jacked Casing, or Microtunneling [insert description].
   1. Measurement: Item will not be measured separately but paid for on a lump sum basis [insert description].

   2. Incidental Items: [insert description].
      a. [List any unique work items].
      b. [List any unique work items].

   3. Basis of Payment: Payment shall be made at the Contract Lump Sum Price for each successfully completed crossing. [insert description].

C. Item 3 – [insert description].
   1. Measurement: [insert description].

   2. Incidental Items: [insert description].
      a. [List any unique work items].
      b. [List any unique work items].

   3. Basis of Payment: [insert description].

D. Item 4 – [insert description].
   1. Measurement: [insert description].

   2. Incidental Items: [insert description].
      a. [List any unique work items].
      b. [List any unique work items].

   3. Basis of Payment: [insert description].
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01323
RECORD DOCUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Contractor shall maintain and provide the Owner with project record documents as specified below.

B. Maintenance of Documents:
   1. Maintain on site in clean, dry, legible condition complete sets of the following:
      b. Specifications.
      c. Addenda.
      d. Approved Shop Drawings.
      e. Photographs.
      g. Test Records.
      h. Survey Data.
      i. Approved permits
      j. All other documents pertinent to Contractor's Work.

2. Make documents available at all times for inspection by Engineer.

3. Record documents shall not be used for any other purpose and shall not be removed from the office without Owner's approval.

C. Marking:
   1. Use the following color code unless otherwise approved by the Engineer:
      a. Deletions: Green.
      b. Additions: Red.
      c. Notes and Comments: Blue.

D. Recording:
   1. Label each document "PROJECT RECORD" in 2-inch high printed letters.
   2. Keep record documents current and updated at least weekly.
   3. Do not permanently conceal any Work until required information has been recorded.
   4. Contract Drawings - Legibly mark to record actual construction including:
      a. A written record of actual ground and top of pipe elevations at each joint and at all fittings, valves, air vents and connection points and at all horizontal and vertical deviations from the construction plan set.
      b. Records kept in a digital spreadsheet containing X,Y,Z coordinates for top of pipe elevations at each joint and at all fittings, valves, air vents and connection points. Accuracy must be sub-foot for horizontal (X, Y) and 0.1-ft for vertical (Z). An updated spreadsheet must be provided with each Contractor pay application. The Digital spreadsheet shall be directly compatible with ArcGIS software without requiring any additional re-formatting, such as a Shapefile, Personal Geodatabase, File Geodatabase, or properly formatted Excel or CSV files.
      c. [For Horizontal Directional Drilling (HDD) project, digital records of X, Y, Z coordinates for the center of the installed pipeline collected via a tethered instrument (SmartProbe or equivalent) shall be pulled through the new HDD pipe unless otherwise approved by HRSD's Project Manager].
      d. The number of turns required to fully open or close all installed valves. The number of turns shall be determined in the presence of an Owner’s representative prior to installation.
      e. Horizontal and vertical location of underground utilities and appurtenances encountered referenced to permanent surface improvements.
f. Field changes of dimensions and details.

g. Changes made by Change Order or Field Order.

h. Details not on original Contract Drawings.

i. Changes of different method of construction.

j. Use of different products not specified

5. Specifications and Addenda - Legibly mark up each Section to record:

a. Changes made by Change Order or Field Order.

b. Other matters not originally specified.

6. Shop Drawings - Maintain as record documents and legibly annotate drawings to record changes made after review.

7. Record Documents will be reviewed by the Engineer and the Contractor on a monthly basis and failure to keep documents accurate and current will be basis for the Owner to withhold the Contractor's monthly payment in partial or full.

8. Valve Guides for in-line isolation valves, air vents, cathodic protection test boxes, tracer wire test boxes, and other vaults, boxes, or manholes shall be documented with swing ties, reviewed by the Engineer, and delivered to HRSD prior to HRSD operating any of these newly installed facilities.

E. Record Drawings:

1. Record Drawings shall reflect completion of the installation of all materials, piping, and other work by the Contractor. The drawings shall show the Work in plan and sections as required for clarity with reference dimensions and elevations for complete record drawings.

   a. Interim Record Drawings in the form of redlined plan and profile sheets shall be provided to the Engineer a minimum of 1 business week prior to a planned tie-in. No tie-ins with active systems will be allowed unless these drawings are submitted.

      1) The pre-substantial completion version digital spreadsheet containing X,Y,Z coordinates of the installed pipe and all appurtenances as detailed in Paragraph 1.1.D.4.b of this Section to be submitted as part of the Interim Record Drawings submittal requirements.

   b. Final Record Drawings in the form of redlined plans shall be provided to the Engineer at the time a request for Final Inspection is made.

      1) The final completion version digital spreadsheet containing X,Y,Z coordinates of the installed pipe and all appurtenances as detailed in Paragraph 1.1.D.4.b of this Section to be submitted as part of the Final Record Drawings submittal requirements.

2. The Contract Drawings may be used as a starting point in developing these drawings. Subcontractor drawings may be included in this drawing package. The drawing package must be fully integrated and include the necessary cross references between drawings.

3. The Contractor shall record and provide to the Engineer a written record of the following:

   a. Virginia State Plane coordinates for all valves, air vents, manholes, vaults, and horizontal pipeline bends.

   b. Actual ground and top of pipe elevations at each pipe joint and at all fittings, valves, air vents, manholes, vaults, pressure sensor assemblies, and connection points. All vertical elevations shall utilize the NAVD 88 datum.

   c. The recording of this information shall be performed at the time of installation of the associated pipeline and appurtenances.

F. Valve Guides:

1. Valve Guides shall include swing ties to physical features, valve manufacturer, number of valve turns open/close, HRSD infrastructure ID. A sample Valve Guide is included as Exhibit A to this Section. [Engineer to include an example from the HRSD Design and Construction Standards, Section 6 – Drawings, Record Drawings, and Valve Guides]

   a. Interim Valve Guides shall be developed by the Contractor and delivered to the Engineer for review a minimum of 5 business days prior to a planned tie-in. No tie-ins with active systems will be allowed unless these drawings are submitted and complete.

   b. Final Valve Guides shall be updated and delivered to the Engineer prior to the Final Inspection.
G. Submittal:

1. At the completion of the Project, deliver final documents to the Engineer. (Engineer to coordinate with HRSD Project Manager the submittal of either paper or digital form.) Place all letter-sized material in a three ring binder. Bind Contract drawings and shop drawings in rolls of convenient size for ease of handling.

2. Accompany the submittal with a transmittal letter (in duplicate) containing the following:
   a. Date.
   b. Project title and number.
   c. Contractor's name and address.
   d. Title and number of each record document.
   e. Certification that each document as submitted is complete and accurate.
   f. Signature of Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Mechanics and administration of the submittal process for:
      a. Shop Drawings.
      b. Copies of Contractor acquired work permits (locality, State, Federal)
      c. Miscellaneous submittals.
   2. General content requirements for Shop Drawings.

1.2 DEFINITIONS

A. Shop Drawings:
   1. See General Conditions.
   2. Product data are Shop Drawing information.

B. Copies of Contractor acquired work permits
   1. Provide a copy to HRSD for all permits obtained granting permission by the locality, State, and/or Federal to perform the work identified in the Bid Documents.

C. Miscellaneous Submittals:
   1. Submittals other than Shop Drawings.
   2. Representative types of miscellaneous submittal items include but are not limited to:
      a. Utility test hole reports.
      b. Construction schedule.
      c. Soil compaction and pressure test reports.
      d. Manufacturer's installation certification letters.
      e. Warranties.
      f. Construction photographs \[and video if applicable\].
      g. Survey data.
      h. Schedule of values.
      i. Subcontractor’s qualifications.
      j. Sketches and drawings of equipment.
      k. Interim and Final Valve Guides (refer to Section 01323)
      l. Interim and Final Record Drawings (refer to Section 01323)
      m. Written procedures for implementing portions of the work.
      n. X,Y,Z Table for buried pipe installation (submitted monthly with Contractor’s payment request).

D. Unifier Enterprise Project Management System
   1. See Unifier Management System User Manual
   2. \[Engineer to specify and provide details on any collaboration and document management system other than Oracle Unifier (Unifier) Enterprise Project Management System to be used. These alternative systems must be pre-approved by HRSD’s Project Manager before developing the Bid Document]\.

1.3 SUBMITTAL SCHEDULE

A. Schedule of Shop Drawings:
   1. Submitted within \[insert number of days\] days of receipt of Notice to Proceed.
   2. Account for multiple transmittals under any specification section where partial submittals will be transmitted.
B. Shop Drawings: Submit well in advance of the need for the material or equipment for construction and with ample allowance for the time required to make delivery of material or equipment after data covering such is approved. [Engineer to specify time durations needed for each type of approval so no confusion on what is meant by "well in advance" and "ample allowance"]; Contractor shall assume the risk for all materials or equipment which is fabricated or delivered prior to the approval of Shop Drawings. Materials or equipment will not be included in periodic progress payments until approval thereof has been obtained in the specified manner.

C. Copies of Contractor acquired permits: Copies of all construction related permits to be furnished to HRSD within 14 calendar days of obtaining a permit.

1.4 PREPARATION OF SUBMITTALS

A. General:
1. All submittals shall be either created in Portable Document Format (PDF) or scanned from paper copies into PDF files.
2. All submittals and all pages of all copies of a submittal shall be completely legible.
3. Submittals which, in the Engineer’s sole opinion, are illegible will be returned without review.

B. Shop Drawings:
1. Limit scope of any submittal and letter of transmittal to one specification section.
2. Numbering letter of transmittal:
   a. Include as prefix the specification section number followed by a series number, "-xx", beginning with "01" and increasing sequentially with each additional transmittal.
   b. If more than one submittal under any specification section, assign consecutive series numbers to subsequent transmittal letters.
3. Describing transmittal contents:
   a. Provide listing of each component or item in submittal capable of receiving an independent review action.
   b. Identify for each item:
      1) Manufacturer and Manufacturer's drawing or data number.
      2) Unique page numbers for each page of each separate item.
   c. When submitting "or-equal" items that are not the products of named manufacturers, include the words "or-equal" in the item description.
4. Contractor stamping:
   a. General:
      1) Contractor's review and approval stamp shall be applied either to the letter of transmittal or a separate sheet preceding each independent item in the submittal.
         a) Contractor's signature and date shall be required. [Engineer to coordinate with HRSD’s Contract Specialist regarding requirements for hand signatures versus digital signatures].
         b) Shop Drawing submittal stamp shall read "(Contractor's Name) has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval as stipulated under General Conditions."
      c) Letters of transmittal may be stamped only when the scope of the submittal is one item.
   2) Submittals containing multiple independent items shall be prepared with an index sheet for each item listing the discrete page numbers for each page of that item, which shall be stamped with the Contractor's review and approval stamp.
      a) Individual pages or sheets of independent items shall be numbered in a manner that permits Contractor's review and approval stamp to be associated with the entire contents of a particular item.
      b) Electronic stamps:
1) Contractor may electronically embed Contractor's review and approval stamp to either the letter of transmittal or a separate index sheet preceding each independent item in the submittal.

2) Contractor's signature and date on electronically applied stamps shall be original ink signature. [Engineer to coordinate with HRSD’s Contract Specialist regarding requirements for hand signatures verses digital signatures]

5. Resubmittals:
   a. Number with original root number and a suffix letter starting with "A" on a (new) transmittal form.
   b. Do not increase the scope of any prior transmittal.
   c. Account for all components of prior transmittal.
      1) If items in prior transmittal received "A" or "B" Action code, list them and indicate "A" or "B" as appropriate.
         a) Do not include submittal information for items listed with prior "A" or "B" Action in resubmittal.
      2) Indicate "Outstanding-To Be Resubmitted at a Later Date" for any prior "C" or "D" Action item not included in resubmittal.
         a) Obtain Engineer's approval to exclude items.

6. All submittals shall be submitted through the Unifier System. Please refer to the Unifier User Guide to see the Business Process from start to finish. [Engineer to specify if an alternate collaboration and document management system is requested to be used. Advanced approval to use a system other than or in addition to Unifier shall be pre-approved by HRSD’s Project Manager before development of Bid Document].

7. Provide clear space (3 IN SQ) for Engineer stamping of each component defined in PREPARATION OF SUBMITTALS – Contractor Stamping.

8. Contractor shall not use red color for marks on transmittals.

9. Transmittal contents:
   a. Coordinate and identify Shop Drawing contents so that all items can be easily verified by the Engineer.
   b. Identify equipment or material use, tag number, drawing detail reference, weight, and other project specific information.
   c. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
   d. Submit items such as equipment brochures, cuts of fixtures, product data sheets or catalog sheets.
      1) Indicate exact item or model and all options proposed.
   e. When a Shop Drawing submittal is called for in any specification section, include as appropriate, scaled details, sizes, dimensions, performance characteristics, test data, installation instructions, storage and handling instructions, controls, weights and other pertinent data in addition to information specifically stipulated in the specification section.
      1) Arrange data and performance information in format similar to that provided in Contract Documents.
      2) Provide, at minimum, the detail specified in the Contract Documents.
   f. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify the said deviation in detail in a separate letter immediately following transmittal sheet.

C. Operation and Maintenance Manuals: [delete this part if it does not apply]
   1. Owner's use of manufacturer's Operation and Maintenance materials:
      a. Materials are provided for Owner's use, reproduction and distribution as training and reference materials within Owner's organization.
      1) Applicable to hard copy [Engineer to coordinate with HRSD Project Manager if paper copies are needed] or electronic media.
Applicable to materials containing copyright notice as well as those with no copyright notice.

b. Notify manufacturer of this intended use of materials provided under the Contract.

2. Number each Operation and Maintenance Manual transmittal with the original number of the associated Shop Drawing.
   a. Identify resubmittals with the original number plus a suffix letter starting with "A."

3. Submittal format:
   a. Interim submittals: Submit PDF format through the Unifier Enterprise Project Management system until manual is approved. [Engineer to specify if an alternate collaboration and document management system is requested to be used. Advanced approval to use a system other than or in addition to Unifier shall be pre-approved by HRSD’s Project Manager before development of Bid Document]
   b. Final submittals:
      1) Within 30 days of receipt of approval, submit two (2) electronic copies on Compact Disc (CD-ROM) in Portable Document Format (PDF). [verify with HRSD if submittals are to be submitted electronically via Unifier or other preapproved collaboration and document management system in addition to transmitted CDs]
         a) Compact discs to be secured in jewel cases.
      2) Electronic copies will be reviewed for conformance with the approved electronic copy (PDF) requirements of this Specification.
         a) Non-conforming CDs will be returned with comments.
            i. Provide final CDs within 30 days of receipt of comments.
      3) Non-conforming CDs will be returned with comments.
   b. Electronic copy submittals:
      a. Electronic copies of the approved paper copy Operation and Maintenance Manuals are to be produced in Adobe Acrobat's Portable Document Format (PDF) Version 5.0 or higher.
      b. Do not password protect and/or lock the PDF document.
      c. Create one (1) PDF document (PDF file) for each equipment O&M Manual.
      d. Drawings or other graphics must be converted to PDF format and made part of the one (1) PDF document.
         1) Scanning to be used only where actual file conversion is not possible.
      e. Rotate pages that must be viewed in landscape to the appropriate position for easy reading.
      f. Images only shall be scanned at a resolution of 300 dpi or greater.
         1) Perform Optical Character Recognition (OCR) capture on all images.
         2) Achieve OCR with the "original image with hidden text" option.
         3) Word searches of the PDF document must operate successfully to demonstrate OCR compliance.
      g. Create bookmarks in the navigation frame, for each entry in the Table of Contents/Index.
         1) Normally three (3) levels deep (i.e., "Chapter," "Section," "Sub-section").
      h. Thumbnails must be generated for each PDF file.
      i. Set the opening view for PDF files as follows:
         1) Initial view: Bookmarks and Page.
         2) Magnification: Fit in Window.
         4) Set the file to open to the cover page of the manual with bookmarks to the left, and the first bookmark linked to the cover page.
      j. All PDF documents shall be set with the option "Fast Web View" to open the first pages of the document for the viewer while the rest of the document continues to load.
      k. File naming conventions:
         1) File names shall use a "ten dot three" convention (XXXXX-YY-Z.PDF) where XXXXX is the Specification Section number, YY is the Shop Drawing Root number and Z is an ID number used to designate the associated volume.
            a) Example 1:
(1) Two (2) pumps submitted as separate Shop Drawings under the same Specification Section:
   (a) Pump 1 = 11061-01-1.pdf.
   (b) Pump 2 = 11061-02-1.pdf.

b) Example 2:
   (1) Control system submitted as one (1) Shop Drawing but separated into two (2) O&M volumes:
      (a) Volume 1 = 13440-01-1.pdf.
      (b) Volume 2 = 13440-01-2.pdf.

l. Labeling:
   1) As a minimum, include the following labeling on all CD-ROM discs and jewel cases:
      a) Project Name.
      b) Equipment Name and Project Tag Number.
      c) Project Specification Section.
      d) Manufacturer Name.
      e) Vendor Name.

m. Binding:
   1) Include labeled CD(s) in labeled jewel case(s).
      a) Bind jewel cases in standard three-ring binder Jewel Case Page(s), inserted at the front of the Final paper copy submittal.
      b) Jewel Case Page(s) to have means for securing Jewel Case(s) to prevent loss (e.g., flap and strap).

5. Operation and Maintenance Manuals for Materials and Finishes:
   a. Building Products, Applied Materials and Finishes:
      1) Include product data, with catalog number, size, composition and color and texture designations.
      2) Provide information for re-ordering custom manufactured products.
   b. Instructions for Care and Maintenance:
      1) Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods and recommended schedule for cleaning and maintenance.
   c. Moisture Protection and Weather Exposed Products:
      1) Include product data listing, applicable reference standards, chemical composition, and details of installation.
      2) Provide recommendations for inspections, maintenance and repair.
   d. Additional requirements as specified in individual product specifications.

6. Operation and Maintenance Manuals for Equipment and Systems:
   a. Submission of Operation and Maintenance Manuals for equipment and systems is applicable but not necessarily limited to:
      1) Major equipment.
      2) Equipment powered by electrical, pneumatic or hydraulic systems.
      3) Specialized equipment and systems including instrumentation and control systems and system components for HVAC process system control.
      4) Valves and water control gates.
   b. Equipment and Systems Operation and Maintenance Manuals shall include, but not necessarily be limited to, the following completed forms and detailed information, as applicable:
      1) Fully completed copies (in Excel format) of the associated Equipment Record(s), Exhibits C1, C2 and C3. Equipment Record(s) shall be included under the first tab following the Table of Contents of each Operation and Maintenance Manual.
         a) Each section of the Equipment Record must be completed in detail.
            (1) Simply referencing the related manual for nameplate, maintenance, spare parts or lubricant information is not acceptable.
b) For equipment items involving components or subunits, a fully completed Equipment Record Form is required for each operating component or subunit.

c) Submittals that do not include the associated Equipment Record(s) will be rejected without further content review.

d) Utilize digital copies (in Excel format) of Exhibits C1, C2, and C3 to transmit the Equipment Record(s). [Engineer to verify these referenced exhibits are included and appended to this section].

2) Equipment function, normal operating characteristics, limiting operations.

3) Assembly, disassembly, installation, alignment, adjustment, and checking instructions.

4) Operating instructions for start-up, normal operation, control, shutdown, and emergency conditions.

5) Lubrication and maintenance instructions.

6) Troubleshooting guide.

7) Parts lists:
   a) Comprehensive parts and parts price lists.
   b) A list of recommended spare parts.
   c) List of spare parts provided as specified in the associated Specification Section.

8) Outline, cross-section, and assembly Drawings; engineering data; and electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, word description of wiring diagrams and interconnection diagrams.

9) Test data and performance curves.

10) As-constructed fabrication or layout Drawings and wiring diagrams.

11) Instrumentation or tag numbers assigned to the equipment by the Contract Documents are to be used to identify equipment and system components.

12) Additional information as specified in the associated equipment or system Specification Section.

D. Copies of Contractor acquired permits:
   1. Provide a single PDF version of each permit acquired granting construction rights. Each permit to be transmitted to the Engineer for uploading into the HRSD’s Unifier system.

E. Miscellaneous Submittals:
   1. Prepare in the format and detail specified in specification requiring the miscellaneous submittal.

1.5 TRANSMITTAL OF SUBMITTALS

A. Shop Drawings:
   1. Transmit all submittals through HRSD’s Unifier System.
   2. Utilize digital copies of attached Exhibit "A" to transmit all Shop Drawings to [insert Engineer’s name] {Engineer to verify referenced Exhibit A is included and appended to this section}.

   3. All submittals must be from Contractor.
      a. Submittals will not be received from or returned to subcontractors.

   4. Provide submittal information defining specific equipment or materials utilized on the project.
      a. Generalized product information, not clearly defining specific equipment or materials to be provided, will be rejected.

B. Calculations required in the individual specifications are required for For-Information Only.

C. Miscellaneous Submittals:
   1. Transmit under Contractor's standard letter of transmittal or letterhead.
   2. Submit as specified in individual specification section.
D. Expedited Return Delivery: [delete this paragraph or revise as necessary if exclusively electronic submittals]
   1. Include prepaid express envelope or air bill in submittal transmittal package for any submittals Contractor expects or requires express return mail.
   2. Inclusion of prepaid express envelope or air bill does not obligate Engineer to conduct expedited review of submittal.

E. Fax transmittals are not acceptable.

1.6 ENGINEER'S REVIEW ACTION

A. Shop Drawings:
   1. Items within transmittals will be reviewed for overall design intent and will receive one of the following actions:
      a. A - FURNISH AS SUBMITTED.
      b. B - FURNISH AS NOTED [By Engineer].
      c. C - REVISE AND RESUBMIT.
      d. D - REJECTED.
      e. E - ENGINEER'S REVIEW NOT REQUIRED.
   2. Submittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp.
      a. Submittals not stamped by the Contractor or stamped with a stamp containing language other than that specified herein will not be reviewed for technical content and will be returned without any action.
   3. In relying on the representation on the Contractor's review and approval stamp, Owner and Engineer reserve the right to review and process poorly organized and poorly described submittals as follows:
      a. Submittals transmitted with a description identifying a single item and found to contain multiple independent items:
         1) Review and approval will be limited to the single item described on the transmittal letter.
         2) Other items identified in the submittal will:
            a) Not be logged as received by the Engineer.
            b) Be removed from the submittal package and returned without review and comment to the Contractor for coordination, description and stamping.
            c) Be submitted by the Contractor as a new series number, not as a re-submittal number.
      b. Engineer, at Engineer's discretion, may revise the transmittal letter item list and descriptions, and conduct review.
         1) Unless Contractor notifies Engineer in writing that the Engineer's revision of the transmittal letter item list and descriptions was in error, Contractor's review and approval stamp will be deemed to have applied to the entire contents of the submittal package.
   4. Submittals returned with Action "A" or "B" are considered ready for fabrication and installation.
      a. If for any reason a submittal that has an "A" or "B" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal.
      b. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "A" or "B" Action that are superseded by a resubmittal.
   5. Submittals with Action "A" or "B" combined with Action "C" (Revise and Resubmit) or "D" (Rejected) will be individually analyzed giving consideration as follows:
      a. The portion of the submittal given "C" or "D" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference).
1) One copy or the one transparency of the "C" or "D" drawings will be marked up and returned to the Contractor. (Engineer to verify with Contractor the desire for paper verses digital media)
   a) Correct and resubmit items so marked.
   b) Items marked "A" or "B" will be fully distributed.
   c) If a portion of the items or system proposed is acceptable, however, the major part of the individual drawings or documents are incomplete or require revision, the entire submittal may be given "C" or "D" Action.
      1) This is at the sole discretion of the Engineer.
      2) In this case, some drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package."
      3) Distribution to the Owner and field will not be made (unless previously agreed to otherwise).

6. Failure to include any specific information specified under the submittal paragraphs of the Specifications will result in the submittal being returned to the Contractor with "C" or "D" Action.

7. Calculations required in individual specification sections will be received for information purposes only, as evidence calculations have been performed by individuals meeting specified qualifications, and will be returned stamped "E. Engineer's Review Not Required" to acknowledge receipt.

8. Transmittals of submittals which the Engineer considers as "Not Required" submittal information, which is supplemental to but not essential to prior submitted information, or items of information in a transmittal which have been reviewed and received "A" or "B" Action in a prior submittal, will be returned with Action "E. Engineer's Review Not Required."

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 01520
MAINTENANCE OF PIPELINE AND PUMPING OPERATIONS

PART 1 - GENERAL

1.1 SUMMARY
   A. The intent of this specification is to have the Contractor schedule and perform the force main tie-in work, sanitary manhole or gravity sewer rehabilitation, and pump station shutdowns, bypasses, and startups in a manner such that the Owner can maintain service in continuous dependable operation and meet all regulatory requirements. The Contractor shall adhere to the constraints listed in this Section. [Engineer to modify this Specification section in collaboration with HRSD’s Project Manager to the specific situations to be encountered for each project]

1.2 GENERAL CONSTRAINTS
   A. All shutdown operations shall be approved by the Owner. All shutdown operations shall be coordinated with and scheduled at times suitable to the Owner.
   1. HRSD Operations field support is limited to Tuesdays, Wednesdays, and Thursdays (excluding HRSD observed holidays) only.
   2. Flow diversions and pump station / pressure reducing station shutdowns will be between the hours of 10 PM and 4 AM unless otherwise noted or approved.
   B. Bypass pumping systems or temporary emergency generators required for work on force mains, gravity mains, pump stations, or pressure reducing stations to be tested and alarmed as follows:
      1. Pumps and generators to be successfully tested for 24 hours continuously.
      2. Alarms to be installed to insure adequate response time for operational issues.
      3. Contractor to be the first responder to alarms throughout the bypass / shutdown event.
      4. Contractor responsible for fuel and required maintenance and documentation
   C. HRSD does not guarantee complete system valve closures. The Contractor’s Plan of Operation shall account for this situation in the developed plan.
   D. Shop drawing submittals for all pipe and appurtenance materials required for the tie-in work shall be reviewed and approved by the Engineer prior to scheduling of the tie-in.
   E. Shutdowns shall not begin until all required materials are on-hand and ready for installation and a written Plan of Operation has been submitted and approved by the Owner.
      At a time approved by the Owner, the shutdown period will commence and the Contractor shall proceed with the Work continuously, start to finish, unless otherwise noted, until the Work is completed and the system is tested and ready for operation. If the Contractor completes all required Work before the specified shutdown period has ended, the Owner may immediately place the existing system back in service.
      1. If problems occur, Contractor along with appropriate staff and equipment to remain on site to be an extension of HRSD operational response until all operational issues have been resolved to the satisfaction of HRSD.
      2. Labor crews involved with a tie-in must be switched out after a maximum of 12-hour shifts.
      3. Consideration shall be given to extreme weather conditions as to whether or not reductions in crew shift time periods will be required at Owner’s discretion
   F. The Owner reserves the right to cancel scheduled shutdowns if conditions warrant.
   G. Both Interim Record Drawings and Interim Valve Guides must be submitted and approved by HRSD in accordance with “Section 01323 – Record Documents” prior to a tie-in, shutdown, or system bypass.

1.3 GENERAL WORK SEQUENCE
   A. Notification and Meetings:
1. The Contractor to submit a tentative schedule to the Engineer at least 30 calendar days prior to any work on or work affecting active HRSD force mains, pump stations, and gravity sewer mains for Owner to evaluate resources and prepare to support the Contractor’s work efforts.

2. The Contractor shall provide written notice in the form of Contractor’s Plan of Operation and tie-in checklist to the Owner and Engineer 10 business days prior to his anticipated tie-in date.

3. The Contractor shall develop and submit Interim Valve Guides and Interim Record Drawings to the Engineer for review a minimum of 5 business days in advance of the scheduled tie-in, shutdown, or startup. No tie-ins or shutdowns of an active HRSD system will be allowed until the referenced Interim Valve Guides and Interim Record Drawing are submitted and approved.

4. The Contractor shall schedule a Pre-tie-in and/or Pre-Startup Coordination Meeting 5 business days prior to the scheduled tie-in to review the previously submitted and approved Plan of Operation with the Owner, the Engineer, and representatives from affected jurisdictional and private utility owners. This meeting will not be held until the Plan of Operation has been approved by the Engineer and the Owner. The following will be discussed at this meeting:
   a. Review of tie-in checklist
   b. Review of site conditions to include rodding of air vents, operation of valves, access to all appurtenances, etc.
   c. Review of weather forecast/weather impacts to include freezing temperatures for pump & haul operations.
   d. Review contact information

5. The Contractor is required to schedule a meeting on site on the morning of a planned nighttime tie-in [or one business day prior to a daytime allowable tie-in] and shall notify the Owner, Engineer, and representatives from affected jurisdictional and private utility owners. At the time of the meeting, the Contractor shall have all materials and equipment necessary for the tie-in on site, operable and assembled for inspection by the Owner and Engineer. The following will be discussed at this meeting:
   a. Review of site conditions
   b. Review weather forecasts / weather impacts
   c. Review work and contingency plans
   d. Review contact information
   e. Review of emergency equipment

6. The Owner reserves the right to postpone the scheduled tie-in if:
   a. The site or Contractor is not prepared as required in the plan notes and as agreed upon at the pre-tie-in meeting.
   b. The Owner or the [insert name of Jurisdiction where work is being performed] has an emergency in another part of their system.
   c. A rain event has occurred in the 3 calendar days before the scheduled tie-in date or is forecasted in the 24 to 48 hours after the scheduled tie-in date in a portion of the sewer system with historical problems with inflow and/or infiltration.

B. Coordination:
1. The Contractor shall coordinate all activities with the Owner, Engineer, and the [representatives from affected jurisdictional and private utility owners] for acceptable dates for connection to force mains and any pipe removal and/or abandonment.
   a. Contractor’s coordination shall include phone calls, meetings and discussions with the Owner, Engineer, and the [representatives from affected jurisdictional and private utility owners].
   b. Contact with these entities shall be initiated simultaneously with the written notice of the scheduled tie-in to the Owner and Engineer.
   c. Text messaging shall not be an acceptable form of communication for coordination or any other purposes related to the project.
2. The Contractor shall coordinate with the Engineer for preparation and submission of a Request for Valve Operation to Owner as follows:
   a. 5 business day notification to Owner for more than 2 required valve operations.
   b. 2 business day notification to Owner for 1-2 required valve operations.
   c. If the shutdown requires the operation of newly installed valves, a temporary valve guide must accompany the request.

3. [Insert CCTV inspection requirements during shutdown/tie-in operation, as applicable].

C. Plan of Operation: At a minimum the Contractor’s Plan of Operation shall include the following:
1. Schedule:
   a. Starting date.
   b. Sequential listing of specific tasks required to complete the tie-in.
   c. Anticipated duration for each task of the tie-in operation.
2. Method of dewatering the existing force main including where the sewage is to be disposed, and provide quantity of wastewater anticipated in dewatering.
3. Method of handling constant flow if valves or line stops do not close completely.  HRSD cannot guarantee that full stoppage of flow will be achieved.
4. List of pump stations that must be maintained including HRSD, Locality and private stations.
5. Number of pumper trucks, to include capacity of each truck, to be supplied to handle flow at the existing stations and the pipe dewatering operations.
6. Contingency plan for handling flow at the existing pump station if the shutdown hours exceed the anticipated time frame.
7. Contingency plan for meeting a deadline for full traffic to be restored if a Locality roadway is taken out of service or the capacity reduced during the tie-in and the completion schedule cannot be met.
8. Mobile phone contacts (local phone number) for Contractor personnel, HRSD key personnel, Locality operations personnel, and other identified key stakeholders.
9. List of equipment and number of crews to verify adequacy of Contractor’s ability to work both ends of the tie-in simultaneously and continuously until connections are complete.
10. Stone and other backfill materials to be on-site if rain is forecast and to be used if a heavy rain event occurs during the tie-in backfill and compaction stage.
11. Confirmation of availability and scheduling of asphalt placement and proper cure time for tie-ins under existing pavement to restore traffic movement.

D. Connection Work:
1. Shutdowns shall occur between the hours of 10 PM to 4 AM Tuesday through Thursday or as directed by the Owner or the [insert name of jurisdiction where work is being performed] at the time of shutdown.
2. The operation of all existing HRSD-owned mainline valves, air vents, and pump stations will be performed ONLY by HRSD forces.
3. The operation of all existing jurisdiction-owned mainline valves, air vents, and pump stations will be performed only by jurisdictional forces.
4. The operation of all existing privately-owned mainline valves, air vents, and pump stations will be performed only by forces of the private utility.
5. A decision point will be established by HRSD and the Engineer for the Contractor to cut the active force main.  This decision during the tie-in will be based upon the Contractor’s progress leading up to the cutting into the active force main.  Inadequate progress by the Contractor leading up to this critical decision point may lead to a postponement of the tie-in completion, backfilling the excavation, placing temporary pavement, and rescheduling the remainder of the tie-in work.
6. Unless otherwise noted herein, the Contractor shall work continuously once the force main has been cut until the connection work is complete, operating pressure restored, visual test for leaks is complete, and the trench is backfilled to the satisfaction of the Owner’s Representative.

7. The Contractor shall provide a crew with equipment for each connection point so that multiple connections can be completed simultaneously.

8. The Contractor is responsible for conveying sewage from all affected pump stations to prevent overflow throughout the entire duration of each shutdown. The fact that a facility served by one of these stations is closed at night is not a guarantee of zero sewage flow.

9. The amount of sewage within the force main anticipated to be handled by the Contractor during the shutdown, at the tie-in areas, is estimated for each service transfer. This data is given for information only, is derived from record drawings (not verified in the field) and no guarantees are given to the Contractor regarding volume of remaining sewage.

10. Once the dewatering of the force main has begun, all dewatering efforts in the tie-in trenches must be directed to an approved collection facility (e.g. vacuum truck or existing sanitary sewer collection system). This shall continue for the entire remaining duration of the tie-in. The Contractor is to be aware that discharging sewage from the tie-in excavation into an unapproved collection facility (e.g. creek, storm drainage, or drainage ditch) is unlawful and will not be permitted. Contractor to provide to Owner’s Representative tickets or other documentation for each truck / tanker cycle of fill / dump used for pump & haul operations during tie-in or shutdown.

11. [Engineer to coordinate with HRSD’s Project Manager to specify allowable time duration for HRSD to perform CCTV related to condition assessment of existing pipe to be connected to following the Contractor’s dewatering of the pipeline].

12. The Contractor is responsible for providing adequate screening during any bypass pumping or pump & haul operations in order to minimize debris.

13. The Contractor is responsible for providing adequate support and restraint, against system pressure of the exposed piping prior to and during startup and final backfill.

14. The Contractor shall follow the procedures herein for any joints of the new force main and fittings that have not been previously hydrostatically pressure tested:
   a. HRSD reestablishes services in the line.
   b. One half hour will elapse, after air venting is complete by HRSD.
   c. Joints will be visually inspected for signs of leakage by Owner or Owner’s Representative.
   b. Any leakage noted shall be corrected to the satisfaction of the Owner or the Owner’s Representative.
   c. After satisfactory visual testing of exposed joints by the Owner’s Representative and any corrective action, the Contractor shall wrap the pipe and/or fitting as required and immediately proceed to backfill the pipe and restore to grade conditions or for reestablishment of traffic if in a roadway. Soil backfill compaction tests may be specified by the Owner or Owner’s Representative for work within roadway travel lanes.
   d. If specified, utility warning tape shall be installed above the connection in accordance with the Bid Documents.
   e. Any joints not inspected by the Owner or the Owner’s Representative, will not be approved and shall be excavated for inspection.

15. The Contractor shall assist the Owner during the reestablishment of flows as follows:
   a. Provide riser pipe, fittings, sewage containment drums for each control air vent locations, and temporary valve at the air release point to vent air.
   b. Provide means of electronic communication to coordinate this operation.

1.4 **LINE [INSERT HRSD LINE NUMBER]** SHUTDOWN:

A. General: This section describes, in general, the Work required to connect the relocated **{insert HRSD line number}** Force Main. The interconnections shall be completed in two phases, using both pump and haul and a line stop/bypass operation. This shutdown procedure describes, in general, the overall connection sequences. Refer to Contract Drawings for additional details.
1. **Add additional details as necessary**.

B. Maximum Duration:
   1. **Insert duration of shutdown in hours**. Shutdown will only be allowed between the hours of **insert time period indicating PM and AM** **insert days of shutdown, e.g. “Tuesday through Thursday”**.

C. Affected Pump Stations: The Pump Stations directly impacted by the shutdown of Line **insert HRSD line number** are:
   1. **Insert all applicable pump stations affected**.

D. Prior Work:
   1. **Describe as needed**.

E. Bypass Pumping:
   1. This shutdown will require temporary bypass pumping **use if needed**.
      a. The average daily flow into the HRSD **insert pump station name** Pump Station is estimated to be **insert flow** gpm and the maximum daily flow is estimated to be **insert flow** gpm.
      b. Supply all necessary pumps, conduits, operating controls, and other equipment to divert the flow around the section of force main pipe that is shut down and isolated.
      c. The Contractor is responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system.
      d. Pumps and equipment shall be continuously monitored and maintained by the Contractor during periods that pumping and bypassing are required.
      e. Provide redundancy within the bypass pumping system. Back-up pumps shall be on-line and capable of isolating from the primary system by a valve.
      f. Select pumping/bypassing equipment that will not have excessive noise levels from pumping/bypassing equipment and shall be restricted to a maximum of seventy decibels (70 db) at a distance of 50 feet or as required to be in compliance with jurisdictional specific noise ordinances. Additional sound attenuation may be required in residential areas or as specified by HRSD.
      g. Contractor is solely responsible for sewage spills.
      h. The Contractor shall provide alarms during bypass operations.
         1) Bypass operations need alarms to contact Contractor as the primary responder and responsible operator.
         2) The bypass operation shall tie-into the existing HRSD SCADA/Telemetry system for secondary backup by HRSD Operations.
         3) HRSD requirements for bypass pumping operations is detailed in Part 3 Execution.
         4) This work is to be scheduled through HRSD at least 10 business days in advance of planned work.
   2. Submit a bypass pumping plan that includes the following details:
      a. Bypass pump sizes, capacity, number of each size to be on site, and power requirements.
      b. Calculations of static lift, friction losses, and flow velocity.
      c. Pump curves showing pump operating range.
      d. Size, length, material, location, and method of installation for suction and discharge piping. At a minimum, each pump shall have a separate leg consisting of a suction isolation valve, a discharge check valve, (separate from pump), and a discharge isolation valve. The layout of which shall be capable of completely isolating the pump and check valve. All piping shall be rated for vacuum conditions.
      e. Method of noise abatement for each pump and/or generator.
      f. Standby power generator size and location.
   3. The Contractor shall test operate bypass pumping system for 24 hours to confirm reliable operation of pumps, temporary systems, and alarms prior to bypass use. The start of the 24 hour bypass pumping test shall not start after Noon on Thursday or before Monday at 8:00 AM.
4. The operating bypass shall not terminate and be switched over to the newly installed infrastructure between Thursday Noon and Monday 8:00 AM unless otherwise stated or approved.

F. Work to be completed during Shutdown:
   1. {Describe work to be completed}.

1.5 LINE [INSERT HRSD LINE NUMBER] SHUTDOWN: {REPEAT AS NEEDED}
   A. {Describe work to be completed in a similar fashion as in 1.4 above}

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TEMPORARY PORTABLE PUMP ALARMS AND SETUP REQUIREMENTS

When a project requires a temporary portable pump to be alarmed, the following requirements need to be followed.

A. When work is performed at station: If power is available, all alarms are to be routed through existing HRSD’s SCADA system. Portable pump manufacture call box is not acceptable unless otherwise approved for site specific situations. If power is not available then, HRSD solar SCADA panel will be provided. A portable generator may be required depending on site specific situations.

B. When work is performed at a manhole: If power is available, all alarms are to be routed through existing HRSD’s SCADA system. Portable pump manufacture call box is not acceptable unless otherwise approved for site specific situations. If power is not available then, HRSD solar SCADA panel will be provided. A portable generator may be required depending on site specific situations. Naming of the alarms from a manhole should indicate the location of the manhole (i.e. Pearl and Ligon)

C. The name of the site is to be used followed by temporary lead, lag or second lag depending on the number of pumps. (Example: Arctic Temporary Lead, Arctic Temporary Lag and Arctic Second Lag.)

D. Both Contractor and HRSD will be alerted in the event of a pump alarm. The Contractor is responsible to be primary responder with the support of HRSD staff.

E. All pump maintenance and fuel requirement are the contractors responsibility.

F. Pump maintenance records are to be provided monthly through the duration of the project by Contractor, depending on length of project.

G. Battery chargers are required with all pumps. In situations where power is not available a portable generator may be required.

H. All discharge piping is to be pressure rated flanged or fused pipe. Isolations valves are required at each pump along with an additional external swing check valve. A means to bleed air off the discharge piping is required.

I. Float balls, level transducers and pressure transducers are acceptable. In a Lift station or manhole application, level transducers are preferred. If float balls are used for control, a two float setup is required per pump. All floats are to be secured in manhole or wet well so as not to become tangled, hindering pump operation. In a temporary PRS setup, owner furnished sensor valve will be provided to allow Contractor to connect pressure transducers for
control. An isolation valve is required to be furnished by Contractor at this location.

J. If work is to be performed during cold weather, the Contractor is responsible for providing freeze protection on pumps and controls, specifically transducers.

K. Depending on location and duration of job, concrete protective barrier wall may be required.

L. All manholes and wet wells where temporary pumps are being used must be secured to prevent trip hazards, fall risks and odor issues.

The following standard alarms are required. Site specific alarms will be evaluated on a as need basis.

**TWO PUMP LIFT STATION OR MANHOLE (DIESEL PUMPS)**

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<td>Alarm / Normal (HRSD furnished float ball if station alarms cannot be used)</td>
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<td>Overflow</td>
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**THREE PUMP LIFT STATION OR MANHOLE (DIESEL PUMPS)**

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**TWO PUMP LIFT STATION OR MANHOLE (DIESEL PUMPS) NEW PRIME GUARD CONTROLLER**

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<td>Lead</td>
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<td>High well</td>
<td>Alarm / Normal (HRSD furnished float ball if station alarms cannot be used)</td>
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Overflow Alarm / Normal (Determined necessary according to length of Job. HRSD furnished float ball if station alarms cannot be used.)

**TWO PUMP LIFT STATION OR MANHOLE (ONE ELECTRIC ONE DIESEL PUMP)**

**NEW PRIME GUARD CONTROLLER**

Dominion Power On / OFF

Lead Fail / Normal (Electric)

Lag On / off and Fail / Normal

High well Alarm / Normal (HRSD furnished float ball if station alarms cannot be used)

Overflow Alarm / Normal (Determined necessary according to length of Job. HRSD furnished float ball if station alarms cannot be used.)

(For HRSD monitoring purposes only, provide well level.)

**THREE PUMP LIFT STATION OR MANHOLE (ONE ELECTRIC TWO DIESEL PUMP)**

**NEW PRIME GUARD CONTROLLER**

Dominion Power On / OFF

Lead Fail / Normal (Electric)

Lag On / off and Fail /

Normal Second Lag On / off and Fail /

Normal

High well Alarm / Normal (HRSD furnished float ball if station alarms cannot be used)

Overflow Alarm / Normal (Determined necessary according to length of Job. HRSD furnished float ball if station alarms cannot be used.)

(For HRSD monitoring purposes only, provide well level.)

**TWO PUMP PRS (DIESEL PUMPS) NEW PRIME GUARD CONTROLLER**

Lead Fail / Normal
Lag On / off and Fail / Normal

(For HRSD monitoring purposes only, provide Suction and Discharge pressures.)

THREE PUMP PRS (DIESEL PUMPS) NEW PRIME GUARD CONTROLLER

Lead Fall / Normal

Lag On / off and Fail /

Normal Second Lag On / off and Fail /

Normal

(For HRSD monitoring purposes only, provide Suction and Discharge pressures.)

TWO PUMP PRS (ONE ELECTRIC ONE DIESEL PUMP) NEW PRIME GUARD CONTROLLER

Dominion Power On / OFF

Lead Fail / Normal (Electric)

Lag On / off and Fail / Normal

(For HRSD monitoring purposes only, provide Suction and Discharge pressures.)

THREE PUMP PRS (ONE ELECTRIC TWO DIESEL PUMP) NEW PRIME GUARD CONTROLLER

Dominion Power On / OFF

Lead Fail / Normal (Electric)

Lag On / off and Fail /

Normal Second Lag On / off and Fail

(For HRSD monitoring purposes only, provide Suction and Discharge pressures.)

END OF SECTION
SECTION 01560
ENVIRONMENTAL PROTECTION AND SPECIAL CONTROLS

PART 1 - GENERAL

1.1 SUMMARY
A. Section addresses minimizing the pollution of air, water, or land; control of noise, and the disposal of solid waste materials.

1.2 QUALITY ASSURANCE
A. Referenced Standards:
   1. Virginia Department of Environmental Quality (VDEQ):

1.3 SUBMITTALS
A. Shop Drawings: Submit a detailed proposal of all methods of control and preventive measures to be utilized for environmental protection.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Specifications for materials associated with the erosion and sediment control measures detailed in the drawings can be found in the Virginia Erosion and Sediment Control Handbook. A downloadable PDF copy of the Handbook can be obtained at the web site for the VDEQ at https://www.deq.virginia.gov/Programs/Water/StormwaterManagement/Publications/ESCHandbook.aspx

PART 3 - EXECUTION

3.1 INSTALLATION
A. Employ and utilize environmental protection methods, obtain all necessary permits, and fully observe all local, state, and federal regulations.

B. The implementation of environmental protection methods for the Project shall be coordinated with Owner and its contractors completing work on the site. Refer to Paragraph 1.3 of Section 01040 - Coordination for additional information and points of contact for other projects being constructed at the site.

C. Land Protection:
   1. Except for any work or storage area and access routes specifically assigned for the use of the Contractor, the land areas outside the limits of construction activity shall be preserved in their present condition. Contractor shall confine his construction activities to areas defined for work within the Contract Documents.
   2. Manage and control all borrow areas, work or storage areas, stockpile areas, access routes and embankments to prevent sediment from entering nearby water or land adjacent to the work site.
   3. Restore all disturbed areas and establish permanent type of locally adaptable vegetative cover.
   4. Plan and execute earthwork in a manner to minimize duration of exposure of unprotected soils.
5. The Contractor shall not deface, injure or destroy trees and vegetation, nor remove, cut, or disturb them without approval of the Engineer. Any damage caused by the Contractor's equipment or operations shall be restored to its original condition at the Contractor's expense.

D. Surface Water Protection:
1. Utilize erosion control methods to minimize the discharge of sediment to the surface water leaving the construction site. These controls shall be maintained until the site is ready for final pavement and landscaping or until they are no longer warranted and concurrence is received from the Engineer. The Contractor is responsible for obtaining all required permits from the jurisdiction and the VDEQ and having them readily available for inspection upon request.
   a. Install inlet protection prior to commencing excavation.
   b. Maintain erosion and sediment control measures.
      1) Inspect regularly especially after rainstorms.
      2) Promptly repair or replace damaged or missing items.
      3) Remove sediment from inlet protection to prevent overtopping.
   c. Provide storage and staging areas with graveled or rocked access entrance and exit drives and parking areas to reduce the tracking of sediment onto public or private roads.
2. Physically retard the rate and volume of run-on and runoff by:
   a. Implementing structural practices such as diversion swales, terraces, straw bales, silt fences, berms, storm drain inlet protection, rock outlet protection, sediment traps and temporary basins.
   b. Implementing vegetative practices such as temporary seeding, permanent seeding, mulching, sod stabilization, vegetative buffers, hydroseeding, anchored erosion control blankets, sodding, vegetated swales or a combination of these methods.
   c. Providing construction sites with graveled or rocked access entrance and exit drives and parking areas to reduce the tracking of sediment onto public and private roads.

E. Solid Waste Disposal:
1. Collect and remove solid waste from the site on a weekly basis at a minimum.
2. No building materials wastes or unused building materials shall be buried, dumped, or disposed of on the site.

F. Fuel and Chemical Handling:
1. Store and dispose of chemical wastes in a manner approved by regulatory agencies.
2. Take special measures to prevent chemicals, fuels, oils, and greases from entering drainage ways.
3. Do not allow water used in onsite material processing, concrete curing, cleanup, and other waste waters to enter a drainage way(s) or stream.
4. The Contractor shall provide containment around fueling and chemical storage areas to ensure that spills in these areas do not reach waters of the state.

G. Control of Dust:
1. The control of dust shall mean that no construction activity shall take place without applying all such reasonable measures as may be required to prevent particulate matter from becoming airborne so that it remains visible beyond the limits of construction. Reasonable measures may include paving, frequent road cleaning, or application of water. The use of chemical agents will not be allowed.
2. Utilize methods and practices of construction to eliminate dust in full observance of jurisdictional regulations and permit requirements.
3. The Engineer will determine the effectiveness of the dust control program and may require the Contractor to provide additional measures, at no additional cost to Owner.

H. Burning: Burning of material on the site is prohibited.

I. Control of Noise: Control noise by fitting equipment with appropriate mufflers and sound enclosures to meet noise ordinances of jurisdiction where work is being performed.
J. Completion of Work:
   1. Upon completion of work, leave area in a clean, natural looking condition.
   2. Ensure all signs of temporary construction and activities incidental to construction of required permanent work are removed. Grade, fill and seed all disturbed areas.

END OF SECTION
SECTION 01650
FACILITY AND SYSTEM START-UP

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: [Engineer to determine if this section is needed and how it complements or replaces HRSD’s Master Specification 01520 – Maintenance of Pipeline and Pumping Operations]
   1. Procedures and actions, required of the Contractor, which are necessary to achieve and demonstrate Substantial Completion.
   2. Requirements for Substantial Completion Submittals.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section XXXXXX - Equipment: Basic Requirements, [Engineer to provide this specification section and any other applicable sections as needed for specific project]

1.2 DEFINITIONS

A. Project Classified System (PCS): A defined part of the Project, consisting of an arrangement of items, such as equipment, structures, components, piping, wiring, materials, or incidentals, so related or connected to form an identifiable, unified, functional, operational, safe and independent system.

B. Pre-Demonstration Period: The period of time, of unspecified duration after initial construction and installation activities during which the Contractor, with assistance from manufacturer's representatives, performs in the following sequence:
   1. Completion of the filing of all required submittals.
   2. Completion of finish-type construction work to ensure the Work and each PCS has reached a state of Substantial Completion.
   3. Initial equipment start-up, testing and checkout.
   4. Personnel training.
   5. Filing of the Contractor's Notice of Substantial Completion and Request for Inspection.
   6. Obtaining Certificate of Occupancy and other related permits. [Engineer to review relevance of this requirement for specific project]

C. Demonstration Period: A period of time, of specified duration, following the Pre-Demonstration Period, during which the Owner, with the Contractor’s assistance, initiates process flow through the facility or PCS and starts up and operates the PCS or facility, without exceeding specified downtime limitations, to prove: [Engineer and HRSD to collaboratively establish demonstration durations for each equipment or process]
   1. Functional integrity of the system.
   2. Proper integration of the mechanical, electrical and control components and functions of the system.

D. Substantial Completion: See Division 0, General Conditions.

1.3 SUBMITTALS

A. Submit in the chronological order listed below:
   1. Master Facility and System Start-up Schedule:
      a. Submit prior to or at the same time as the first shutdown submittal required in Section XXXX [Engineer to edit this referenced Technical Specification section for the specific project]. Submittal to be in the required format [Engineer to specify the requirements in this Section or reference the Sections where these reside in the Bid Documents].

"Project Name" Facility And System Start-Up "Month, Year" 01650-1
b. Schedule to include the following for each Phase of Work:
   1) Time line for shutdowns and tie-ins.
   2) Time line for Pre-Demonstration Period requirements.
   3) Time line for Demonstration Period requirements.

2. Master Operation and Maintenance Training Schedule:
   a. Submit at least 20 business days prior to first training session for the Owner's personnel.
   b. Schedule to include:
      1) Date and time for Operation and Maintenance training for each system, both field and classroom.
      2) Target date for initiation of Demonstration Period.
   c. Submit for review and approval by the Owner.
   d. Include holidays observed by the Owner.
   e. Attend a schedule planning and coordination meeting 15 business days prior to first scheduled training session.
      1) Provide a status report and schedule-to-complete for requirements prerequisite to manufacturer's training.
      2) Identify final dates for individual manufacturer's training sessions.
   f. Owner reserves the right to insist on a minimum 5 business days’ notice of rescheduled training session not conducted on master schedule for any reason.
   g. Schedule to be resubmitted until approved and re-submitted when changes are required.

3. Substantial Completion Submittal:
   a. File the Contractor's Notice of Substantial Completion and Request for Inspection in accordance with Division 1 requirements.
   b. Approved Operation and Maintenance manuals must be received by the Owner minimum 10 business days prior to scheduled training.
   c. Written request for the Owner to witness each system pre-demonstration start-up. Request to be received by the Owner minimum of 5 business days before scheduled training of the Owner's personnel on that system.
   d. Equipment installation and pre-demonstration start-up certifications.
   e. Letter verifying completion of all pre-demonstration start-up activities including receipt of all specified items from manufacturers or suppliers as final item prior to initiation of Demonstration Period.

B. Submittals for Personnel Training Requirements: See Part 3 of this Section.

1.4 FACILITY AND SYSTEM PHASING AND SCHEDULING

A. Phased Construction: The major categories of the phased construction activities are described Section XXXX, Maintenance of Plant Operation and on the Drawings. Not all required phased construction activities are described. The Contractor is responsible for developing a detailed Progress Schedule and Master Facility and System Start-up Schedule incorporating all the Work activities including Pre-Demonstration Period and Demonstration Period requirements.

1.5 COST OF START-UP

A. The Owner will provide reasonable and necessary quantities of the items listed below during start-up. Contractor shall pay for all other costs associated with System and Facility Start-up.
   1. Electric power required to operate plant process equipment and to provide building lighting and heat. The starting and operation of large motors (>50 Hp) must be coordinated with the Owner at least 48 hours in advance. The Owner can incur substantial demand charges from the power utility as a result of large motor operation and the Owner may elect to shed other loads or operate the engine generator during the start-up and testing of large motors.
   2. Engine generator diesel fuel.
3. [Add process-specific chemicals here as appropriate – for example, polymer, hypochlorite, caustic, etc.]

4. Non-potable water (NPW). This includes only the water; Contractor to provide all equipment, temporary piping, connections and appurtenances required.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION

3.1 GENERAL

A. Facility Start-up is divided into two periods: Pre-Demonstration Period and Demonstration Period. See paragraph 1.2 Definitions.

3.2 PRE-Demonstration Period

A. Complete the submittal and approval process of all required submittals:
   1. Shop Drawings.
   2. Operation and Maintenance Manuals.
   3. Training schedule, agenda and materials.

B. Completion of Construction Work: Complete the Work to bring the Project or PCS to a state of Substantial Completion as defined in the General Conditions.

C. Initial Equipment Start-up:
   1. Requirements for individual items of equipment are included in Divisions 1 through 17 of these Specifications. [Engineer to verify these are correct Division references and edit as necessary]
   2. Prepare the equipment so it will operate properly and safely and be ready to demonstrate functional integrity during the Demonstration Period.
   3. Perform Equipment Start-up to the extent possible without introducing product flow.
      a. Test tanks, pumping and similar equipment requiring a fluid, using NPW.
      b. Dispose of water used for Equipment Start-up in a manner dictated by the Owner.
   4. Procedures include but are not necessarily limited to the following:
      a. Test or check and correct deficiencies of:
         1) Power, control, and monitoring circuits for continuity prior to connection to power source.
         2) Voltage of all circuits.
         3) Phase sequence.
         4) Cleanliness of connecting piping systems.
         5) Alignment of connected machinery.
         6) Vacuum and pressure of all closed systems.
         7) Lubrication.
         8) Valve orientation and position status.
         9) Tankage for integrity and water tightness.
         10) Pumping equipment.
         11) Instrumentation and control signal generation, transmission, reception, and response.
         12) Tagging and identification systems.
         13) Proper connections, alignment, calibration and adjustment of all equipment.
      b. Calibrate all safety equipment.
      c. Manually rotate or move moving parts to assure freedom of movement.
      d. "Bump" start electric motors to verify proper rotation.
      e. Perform other tests, checks, and activities required to make the equipment ready for Demonstration Period.
f. Documentation: Prepare a log showing each equipment item and listing what is to be accomplished during Equipment Start-up. Provide a place for the Contractor to record date and person accomplishing required work. Submit completed document before requesting inspection for Substantial Completion certification.

5. Obtain certifications, without restrictions or qualifications, and deliver to the Engineer:
   a. Manufacturer's equipment installation check letters.
   b. Instrumentation Supplier's Instrumentation Installation Certificate.

6. Cleanup: After successful demonstration, discontinue process flow, drain system and clean as necessary to achieve safe and sanitary conditions.

D. Personnel Training:

1. 
   a. Personnel training on individual equipment or systems will not be considered completed unless:
      1) All pretraining deliverables are received and approved before commencement of training on the individual equipment or system.
      2) No system malfunctions occur during training.
      3) All provisions of field and classroom training specifications are met.
   b. Training not in compliance with the above will be performed again in its entirety by the manufacturer at no additional cost to the Owner.

2. Conduct all personnel training after completion of Initial Equipment Start-up for the equipment for which training is being conducted.
   a. Personnel training on individual equipment or systems will not be considered completed unless:
      1) All pretraining deliverables are received and approved before commencement of training on the individual equipment or system.
      2) No system malfunctions occur during training.
      3) All provisions of field and classroom training specifications are met.
   b. Training not in compliance with the above will be performed again in its entirety by the manufacturer at no additional cost to the Owner.

3. Field and classroom training requirements:
   a. Hold classroom training on-site.
   b. Training instructor:
      1) Factory trained and familiar with giving both classroom and "hands-on" instructions. Session beginning and ending times to be coordinated with the Owner and indicated on the master schedule. Normal time lengths for class periods can vary.
      2) Submit qualifications and resume of proposed training instructor for approval. Replace proposed training instructor if not acceptable to the Owner or Engineer.
   c. Organize training sessions as shown in the Training Schedule (Operations, Maintenance and Electrical / Instrumentation and Control). Provide general training to all sessions as part of the specific training required for each group. Training material and sessions shall be specifically developed and tailored to the group being trained.
   d. Plan for minimum class attendance of 12 people at each session and provide sufficient classroom materials, samples, and handouts for those in attendance.
   e. Instructors to have a typed agenda, outline and well prepared instructional material. The use of visual aids, e.g., films, pictures, and slides is recommended for use during the classroom training programs. Submit proposed training agendas and outlines to the Owner and Engineer for approval a minimum of 15 business days prior to the training. Revise until acceptable. Provide equipment required for presentation of films, slides, and other visual aids. Training materials shall be related to the specific equipment; general sales brochures are not acceptable.
   f. In the on-site training sessions, cover the information required in the Operation and Maintenance manuals and the following areas as applicable to the PCS.
      1) Operation of equipment.
      2) Lubrication of equipment.
      3) Maintenance and repair of equipment.
      4) Troubleshooting of equipment.
      5) Preventive maintenance procedures.
      6) Adjustments to equipment.
      7) Inventory of spare parts.
      8) Optimizing equipment performance.
      9) Capabilities.
10) Operational safety.
11) Emergency situation response.
12) Takedown procedures (disassembly and assembly).
g. Maintain a log of classroom training provided including: Instructors, topics, dates, time, and attendance.
h. Provide an electronic copy (pdf or PowerPoint format) of the training handouts.

E. Filing of the Contractor's Notice of Substantial Completion and Request for Inspection of Project or PCS:
1. File the notice when the following have been completed:
   a. Submittal of required documents.
   b. Construction work (brought to state of Substantial Completion).
   c. Equipment Start-up.
   d. Personnel Training.
2. Engineer will review required submittals for completeness.
3. Engineer will inform the Contractor in writing of the status of the Work reviewed.
   a. Work determined not meeting state of Substantial Completion:
      1) Contractor: Correct deficiencies noted or submit plan of action for correction.
      2) Engineer: Re-inspect work within after notice of correction of deficiencies.
      3) Reinspection costs incurred by the Engineer will be billed to the Owner who will deduct them from final payment due the Contractor.
   b. Work determined to be in state of tentative Substantial Completion: Engineer to prepare tentative "Engineer's Certificate of Substantial Completion."
   c. Engineer's Certificate of Substantial Completion:
      1) Certificate tentatively issued subject to successful Demonstration of functional integrity.
      2) Issued for Project as a whole or for one or more PCS.
      3) Issued subject to completion or correction of items cited in the certificate (punch list).
      4) Issued with responsibilities of the Owner and Contractor cited.
      5) Executed by the Engineer.
      6) Accepted by the Owner.
      7) Accepted by the Contractor.
   d. Upon successful completion of Demonstration Period, the Engineer will endorse certificate attesting to the successful demonstration, and citing the hour and date of beginning the successful Demonstration Period of functional integrity as the effective date of Substantial Completion.

3.3 DEMONSTRATION PERIOD

A. General:
1. Demonstrate the functional integrity of the mechanical, electrical and control interfaces of the respective equipment and components comprising the facility or PCS as evidence of Substantial Completion.
2. Duration of Demonstration Period: 120 consecutive hours. [Engineer to provide specific durations for each type equipment or process to be demonstrated]
3. If, during the Demonstration Period, the aggregate amount of time used for repair, alteration, or unscheduled adjustments to any equipment or systems that renders the affected equipment or system inoperative exceed 10 percent of the Demonstration Period, the demonstration of functional integrity will be deemed to have failed. In the event of failure, a new Demonstration Period will recommence after correction of the cause of failure. The new Demonstration Period shall have the same requirements and duration as the Demonstration Period previously conducted.
4. Conduct the demonstration of functional integrity under full operational conditions.
5. Owner will provide operational personnel to operate the equipment and system. Contractor will perform all equipment repair, maintenance and corrective actions until successful completion of the Demonstration Period.
6. Owner reserves the right to simulate operational variables, equipment failures, routine maintenance scenarios, etc., to verify the functional integrity of automatic and manual backup systems and alternate operating modes.

7. Time of beginning and ending any Demonstration Period shall be agreed upon by the Contractor, Owner and Engineer in advance of initiating Demonstration Period.

8. Throughout the Demonstration Period, provide knowledgeable personnel and manufacturer’s representatives to answer the Owner's questions, provide final Personnel Training on select systems and to respond to any equipment or system problems or failures which may occur. Provide final Personnel Training as indicated in the Training Schedule.

9. Provide all labor, supervision, utilities, chemicals, maintenance, equipment, vehicles or any other item necessary to operate and demonstrate all systems being demonstrated.

END OF SECTION
SECTION 02510
DUCTILE IRON PIPE and FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ductile iron piping, fittings and appurtenances for the use of installation of sanitary force main systems.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. [Section XXXX - Trenching, Backfilling and Compaction for Utilities. Define frequency and location of backfill compaction testing by an independent testing firm].

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
   2. ASTM International (ASTM):
   3. American Water Works Association (AWWA):
      c. C600, Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.

B. Manufacturer and Installer Qualifications:
   1. Manufacturer shall have experience in manufacturing ductile iron pipe of similar size and type to that specified herein. For a manufacturer to be determined acceptable for providing ductile iron pipe, they must show evidence of manufacturing a minimum of 10,000 linear feet of ductile iron piping and ten years experience in the design and manufacturing of ductile iron pipe of similar size, type and application (water/wastewater) as specified herein.
   2. Pipe and fittings shall be by the same manufacturer and not have been used in any previous application.
1.3 SUBMITTALS

A. Shop Drawings:
   1. Refer to Specification “Section 01340 – Submittals” for requirements for the mechanics and administration of the submittal process.
   2. Product technical data for gaskets, pipe, fittings and appurtenances including:
      a. Acknowledgement that products submitted meet the requirements of standards referenced.
         1) Acknowledgement shall be in the form of a letter or company-standard form containing all required data and signed by an officer of the manufacturing, fabricating or supplying company and at a minimum include:
            a) Name and location of the Work.
            b) Name and address of the Contractor.
            c) Name of the manufacturing or fabricating company.
      b. Certificates: Provide affidavit of compliance per AWWA C110, C153 and C151 fittings.
      c. Test reports: Summarizing results of the final shop pressure and leakage test.
      d. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation for each type of pipe.
   3. Fabrication and/or layout drawings with information including:
      a. Scale (minimum scale 1 IN equals 10 FT).
      b. Dimensions of pipe lengths and fittings.
      c. Invert or centerline elevations of pipe crossings.
      d. Acknowledgement of bury depth requirements.
      e. Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments and related appurtenances.
      f. Acknowledge designated valve tag numbers, manhole numbers, instrument tag numbers, pipe and line numbers.
      g. Line slopes and vent locations.
   4. Details of temporary restraints required for testing.

B. Field quality control documents:
   1. Test reports summarizing results of the final field pressure and leakage test

1.4 DELIVERY, STORAGE AND HANDLING

A. Protect pipe, fittings, appurtenances, linings and coating during handling using methods recommended by the manufacturer and approved by the Engineer.
   1. Use of bare cables, chains, hooks, metal bars or narrow skids in the contact with coated and/or lined pipe is not permitted.
   2. Handle only from the outside of the pipe and fittings. Lifting by inserting forks into the pipe or fittings is not permitted.

B. Prevent damage to pipe during transit.
   1. Repair abrasions, scars and blemishes. If repair of satisfactory quality cannot be achieved, replace damaged material in its entirety immediately.

C. Store pipe in a manner to keep pipe interior free from dirt and foreign matter.
   1. Storing on stones or other hard material that can damage the pipe exterior is not permitted.
   2. Storing pipe on top of pipe is not permitted.
   3. Materials subject to corrosion shall be protected in accordance with the manufacturer’s recommendations.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers of restrained joint systems are acceptable:

1. Restraint System for Ductile Iron Pipe and Fittings:
   a. EBAA Iron, Inc.
   b. Sigma Corporation.
   c. Ford Meter Box Company.
   d. Smith Blair Camlok
   e. American Ductile Iron Pipe, FLEX-RING.
   f. U.S Pipe & Foundry Co., TR-FLEX.
   g. Or approved equal.

2. Mechanical Joint Adaptor:
   a. Infact Corporation, Foster Mechanical Joint Adaptor. Approval by HRSD on a case by case basis.

3. Lining Material:
   b. Permox CTF
   c. TNEMEC Series 431

B. Submit request for substitution in accordance with Specification Section.

2.2 MATERIALS

A. Pipe:

1. Push-on joints:
   a. AWWA/ANSI C151/A21.51.
   b. Special Thickness Class 51.
   c. Furnished where thrust restraint is not required.
   d. Furnish for buried application.

2. Mechanical joint:
   a. AWWA/ANSI C151/A21.51.
   b. Special Thickness Class 51.
   c. Furnish where thrust restraint is required and approved restraint system is not used.
   d. Furnish at connection locations.
   e. Furnish for buried application.
   f. Threaded bells shall not be used.

3. Flanged joint:
   a. AWWA/ANSI C115/A21.15.
   b. Special Thickness Class 53.
   c. Furnish for exposed pipe application only.
   d. No full stick of flanged pipe shall be installed in a buried application.

B. Fittings and Flanges:

   a. Reducers shall be eccentric. Match grade at top of pipe.

2. Flanges: Drilled and faced per ASME B16.1 for both 125 and 250 psi applications.

C. Saddles for Air Vents:

1. Smith Blair Service Saddle with 2-inch threaded outlet (Mueller CC threads).

2. Style 366 for pipe 18-inch diameter and larger.

3. Style 313 for pipe less than 18-inch diameter.

D. Nuts and Bolts:

1. Mechanically galvanized ASTM B695, Class 40
3. Threaded per ASME B1.1.
4. Project ends 1/4 IN to 1/2 IN beyond nuts.
5. All buried nuts and bolts shall be wrapped with polyethylene encasement unless otherwise as shown on the plans or specified herein.

E. Gaskets:
1. Mechanical joint: AWWA C111.
2. Push-on joint: AWWA C111 and manufacturer’s standard design dimensions and tolerances.
3. Flange: AWWA C111.
4. At no time shall gaskets be cut that will be used in the installation of pipeline

F. Linings and Coatings:
1. Provide one of the following interior linings:
   a. Ceramic novolac epoxy lining:
      1) Completely cover the interior surface of pipe and fittings.
      2) Shop apply in accordance with the manufacturer’s recommendations.
      3) Produce a pinhole free lining covering and properly adhered to the interior surface.
      4) The lining shall be 40 mils DFT nominal thickness, 35 mils DFT minimum.
      5) Apply within 8 hours after surface preparation.
      6) Apply directly to the cleaned substrate to achieve the specified dry film thickness.
         a) Multiple pass application is permitted provided the maximum allowable recoat time is not exceeded.
    7) The lining shall have a 6 mils DFT nominally and 10 mils DFT maximum for the gasket area and spigot area end up to 6 IN back from the end of the spigot on the outside of the pipe.
       a) These areas shall be coated with the approved manufacturer's joint compound applied by brush to ensure proper coverage. Care must be taken so that the joint compound is smooth without excessive build-up in the gasket seat or on the spigot ends.
       b) Coating of the gasket seat and spigot ends shall be performed after application of the lining to all other pipe or fitting surfaces.
   8) The lining in all pipe barrels and fittings shall pass 2,500 volt wet sponge holiday or discontinuity detection.
   9) Conduct holiday detection testing over 100 percent of lined surfaces.
      a) Testing shall be in accordance with ASTM D5162 and most recent version of NACE RP-0188.
      b) Testing shall be conducted over 100% of all lined surfaces for ductile iron.
      c) All holidays shall be repaired in accordance with manufacturer’s instruction and retested to ensure a pinhole free lining.
    10) Finished lining shall be generally smooth and free of runs, sags and sharp protuberances.
    11) Field cutting and tapping of lined pipe and fittings is not permitted without written approval from HRSD on a case by case basis. If field cuts are allowed, contractor shall repair cut with liner repair kit in accordance with manufacturer’s recommendations.
        a) All air release valve installations shall be field tapped at the true, as-constructed high point. All taps shall be verified from the inside of the pipe and the liner shall be repaired as necessary.
        b) Short lengths of pipe required to accommodate pipe and fitting geometry shall be furnished factory lined.

2. Exterior coatings:
   a. Pipe, fittings, and appurtenance, include mechanical joint and retainer glands and appurtenances.
   b. Asphaltic in accordance with AWWA/ANSI C110/A21.10.
3. Polyethylene encasement:
a. All ductile iron pipe and fittings shall be wrapped with polyethylene encasement conforming to the requirements of ANSI/AWWA C105/A21.5 unless otherwise shown on the plans or specified herein. 

b. Polyethylene encasement shall have minimum thickness of 8 mil per layer.

G. Utility Marking Tape:
1. Subsurface utility marking tape shall be of a durable, metalized, plastic film, bright green in color, imprinted with the legend “CAUTION: SEWER BELOW”.
   a. The utility marking tape shall be manufactured by Griffolyn Company or approved equal.

PART 3 - EXECUTION

3.1 INSPECTION
A. Items of material furnished under this Section shall be subject to inspection by the Owner’s representation prior to installation.
   1. Items found not to be in compliance with this Section shall be removed from the project site and replaced with items that have been approved for installation.
   2. Inspections and approvals do not relieve the Contractor from complying with the Contract Documents.

3.2 PIPE INSTALLATION
A. Trenching:
   1. Excavate trenches by open cut method to depth and width necessary to accommodate Work.
   2. Support existing utility lines traversing trench and stabilize excavation to prevent undermining of existing utility lines.
   3. Open only length of trench required to complete each day’s piping installation.

B. Dewatering:
   1. Install a dewatering system as required to prevent softening and disturbance of subgrade during construction. All dewatering system design is the Contractor’s responsibility.
   2. Groundwater shall be maintained at least 2 FT below the bottom of any excavation.
   3. Keep dewatering system in operation until backfill to cover pipe is in place.
   4. Dispose of uncontaminated groundwater to an area which will not impair construction operations or damage existing construction.
   5. Refer to the requirements of “Section 02710 - Contaminated Groundwater Management” if suspected or confirmed presence of hydrocarbon and other defined contaminants in the removed groundwater. 
   6. Contractor shall adhere to jurisdictional noise ordinance for operation of dewatering pumps and generators.

C. Preparation of Foundation for Pipe Laying:
   1. Subgrade Stabilization:
      a. If subgrade of pipe trenches is in a frozen, loose, wet, or soft condition before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved compacted material as authorized by Engineer in writing.
      b. Loose, wet, or soft materials, when approved by Engineer in writing, may be stabilized by a compacted working mat of well graded crushed stone.
         1) Over-excavate up to a depth of 2 FT below the design final subgrade elevation to remove the unsuitable material.
      c. Compact stone bedding material thoroughly into subgrade to avoid future migration of fines into the stone voids.
d. Unstable trench bottoms caused by the Contractor’s failure to dewater or Contractor operations shall be replaced at no additional compensation.

D. Laying Pipe in Trench:
1. Clean each pipe length thoroughly and inspect for compliance to Specifications.
2. Grade trench bottom and excavate for pipe bell and lay pipe on trench bottom.
3. Install gasket or joint material according to manufacturer's directions after joints have been thoroughly cleaned and examined.
4. Lay pipe in only suitable weather with good trench conditions.
   a. Never lay pipe in water except where approved by Engineer.
5. Seal open end of line with watertight plug if pipe laying stopped.

E. Joining Method - Push-On Joints:
1. Install in accordance with AWWA C600.
2. Assemble push-on joints in accordance with manufacturer's directions.
3. Lubricate spigot end of pipe to facilitate assembly without damage to gasket.
   a. Use lubricant that has no deteriorating effects on the gasket material
4. Assure the gasket groove is thoroughly clean.
5. For cold weather installation, warm gasket prior to placement in bell.
6. Taper of bevel shall be approximately 30 degrees with centerline of pipe and approximately 1/4 IN back.
7. Lining Up Push-On Joint Piping:
   a. Pipe deflections shall not exceed 50% of the maximum deflection values stated in manufacturer's written literature.
   b. Install shorter lengths of pipe in such length and number that angular deflection of any joint does not exceed 50% of the maximum deflection values stated in manufacturer's written literature.

F. Joining Method - Push-On Mechanical Joints (Restrained):
1. Install in accordance with AWWA C600.
2. Assemble mechanical joints in accordance with manufacturer's directions.
3. Bevel and lubricate spigot end of pipe to facilitate assembly without damage to gasket.
   a. Use lubricant that has no deteriorating effects on the gasket material
4. Assure the gasket groove is thoroughly clean.
5. For cold weather installation, warm gasket prior to placement in bell.
6. Taper of bevel shall be approximately 30 degrees with centerline of pipe and approximately 1/4 IN back.
7. Do not overstress bolts. The use of a torque wrench is required.
8. Install restraint system in accordance with manufacturer's directions and as required in the plans.

G. Installation of Saddles for Air Vents [Engineer to review this requirement against HRSD Standard Detail]
1. Approved stainless steel saddle shall be used to install air vent assembly at each high point along pipeline.
2. Field taps shall be made at each location for air vent assembly.

H. Polyethylene Encasement:
1. Wrap all ductile iron pipe, fittings, and nuts and bolts in polyethylene encasement in full compliance to ANSI/AWWA C105/A21.5 unless otherwise shown on the plans or specified herein.
   a. Encase underground appurtenances required as part of installation.
   b. Where tapping polyethylene encased pipe, first wrap location of tap with three (3) layers of polyethylene adhesive tape and make tap through tape.
   c. Make sections of tubing 2 FT longer than pipe section to be covered.
   d. Slip tube over pipe while pipe is suspended immediately before placing in trench.
e. After installing in trench, pull tube ends over joint and overlap.

f. Fasten securely in-place on each side of each joint with joint tape or strapping.

g. Pull loose tube along pipe barrel up snugly around pipe and fasten in-place with joint tape at 3 FT intervals.

h. Completely cover fittings and connections with film held snugly in-place with joint tape or strapping.

2. Mid span restraints used for the construction of the thrust collars shall be wrapped in polyethylene encasement.

I. Backfilling Methods:
1. Comply with the following:
   a. Observe specific pipe manufacturer's recommendations regarding backfilling and compaction.
   b. Over excavation shall be filled with #57 stone at the contractor’s expense.
   c. Place backfill in lifts not exceeding 8 IN (loose thickness).
   d. Hand place, shovel slice, and pneumatically tamp all backfill to a depth of 6-IN above top of pipe.
   e. Compact each lift to specified requirements
   f. Compaction testing as defined in the Bid Documents for locations and frequency will be performed by an independent testing firm
   g. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.

2. Water flushing for consolidation is not permitted.

J. Utility Marking Tape:
1. Install utility marking tape in accordance with the following:
   a. Tape shall be placed no less than 6 IN and no greater than 12 IN below the proposed finished grade.

3.3 CONNECTIONS WITH EXISTING PIPING

A. Scheduling: Refer to “Section 01520 – Maintenance of Pipe and Pumping Operations” for notification requirements.

B. Prior to the beginning of pipe laying, verify the location, configuration, type, and dimensions of the existing joint and pipe where the connections to the existing system are to be installed. This information shall be furnished to the Engineer for review.

C. Provide suitable equipment to dewater, drain, and dispose of liquid removed from existing pipe during connection.

3.4 FIELD QUALITY CONTROL

A. Backfill Compaction Testing
1. Compaction testing as required and defined in the Bid Documents for locations and frequency to be tested by an independent firm.

B. Testing of Pipe:
1. General Procedures for Hydrostatic Pressure Testing:
   a. Testing shall be in accordance with AWWA C600.
   b. Provide temporary restraints for exposed joints during test.
   c. All piping and appurtenances (including air vents) shall be fully installed to the extent possible prior to performing testing.
   d. Test buried piping after backfilling.
   e. Ports for testing shall be at 2-IN taps for proposed air vents or in plugs installed for testing. Under no circumstances shall the contractor tap the proposed force main for testing purposes.
   f. Test requirements:
      1) Test medium: Potable water only.
      2) Pressure: 100 psi.
3) Duration: 2 hrs.

g. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates. [Note to Engineer: coordinate with HRSD Project Manager as to a preference for Owner provided calibrated gauge versus Contractor provided calibrated gauge for specific hydrostatic test]

1) Contractor shall furnish and use a gauge that has been calibrated within 12 months of the planned use. Contractor shall provide to Engineer verification certification of stated calibration of the pressure test gauge.

2) Select each gauge so that the specified test pressure falls within the upper half of the gauge's range.

3) Notify the Owner's Representative a minimum of 2 business days prior to each test.

4) Owner's Representative shall be present during the test.

h. Completely assemble and test new piping systems prior to connection to existing pipe systems.

i. The hydrostatic pressure test shall not be done against any valve.

j. The test allowance shall be calculated in accordance with AWWA C600. The testing allowance is defined as the quantity of water that must be supplied to the pipe section being tested to maintain a pressure within 5 psi of the specified hydrostatic test pressure. No installation will be accepted if the quantity of makeup water is greater than that determined by the formula:

\[
Q = \frac{LD \sqrt{P}}{148,000}
\]

Where:
- \(Q\) = quantity of makeup water (gph)
- \(L\) = length of pipe section being tested (FT)
- \(D\) = nominal diameter of the pipe (IN)
- \(P\) = average test pressure during the hydrostatic test (psig)

k. The Contractor shall bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.

l. Prepare hydrostatic test report and submit to Engineer in accordance with “Section 01340 – Submittals”.

END OF SECTION
SECTION 02520
POLYVINYL CHLORIDE PIPE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Polyvinyl Chloride (PVC) pipe, fittings, and appurtenances.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. [Section XXXXX - Trenching, Backfilling and Compaction for Utilities. Define frequency and location of backfill compaction testing by an independent testing firm].

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American National Standards Institute (ANSI):
      a. B40.100, Pressure Gauges and Gauge Attachments.
   2. ASTM International (ASTM):
      a. PVC (polyvinyl chloride) materials:
         2) D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
        14) F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
      b. Installation:
   3. American Water Works Association (AWWA):
      a. PVC (Polyvinyl Chloride) materials:
1) C605, Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
2) C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 IN through 12 IN, for Water Transmission and Distribution.
3) C905, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 IN through 48 IN, for Water Transmission and Distribution.

b. Polyethylene (PE) materials:
1) C901, Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2 IN through 3 IN, for Water Service.

c. Ductile Iron materials:
1) C600, Standard for Installation of Ductile Iron Water Mains and Their Appurtenances.


5. National Sanitation Foundation International (NSF).

B. Manufacturer’s and Installer’s Qualifications:
1. Manufacturer shall have experience in manufacturing polyvinyl chloride (PVC) pipe of similar size and type to that specified herein. For a manufacturer to be determined as acceptable for providing PVC pipe, they must show evidence of manufacturing a minimum of 10,000 linear feet of PVC piping and ten years experience in the design and manufacturing of PVC pipe of similar size, type, and application (water/wastewater) as specified herein.
   2. Pipe and fittings shall not have been used in any previous application.

1.3 SUBMITTALS

A. Shop Drawings:
1. Refer to Specification “Section 01340 – Submittals” for requirements for the mechanics and administration of the submittal process.
2. Product technical data for gaskets, pipe, fittings, and appurtenances including:
   a. Acknowledgement that products submitted meet the requirements of standards referenced.
      1) Acknowledgement shall be in the form of a letter or company-standard form containing all required data and signed by an officer of the manufacturing, fabricating, or supplying company and at a minimum include:
         a) Name and location of the Work.
         b) Name and address of the Contractor.
         c) Name of the manufacturing or fabricating company.
         d) Design calculations.
   b. Certificates: Provide affidavit of compliance per AWWA C110 or AWWA C153 for fittings.
   c. Test reports: Summarizing results of the final field pressure leakage test.
   d. Copies of manufacturer’s written directions regarding material handling, delivery, storage, and installation for each type of pipe.
3. Details of temporary restraints for testing.

B. Field quality control documents:
1. Test reports.

1.4 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall use all means necessary to protect pipe materials, fittings, and appurtenances before, during, and after installation.
B. Contractor shall use straps and not chains, cables, or unpadded forks to handle pipe.
1. Handle only from the outside of the pipe and fittings.

C. Prevent damage to the pipe, fittings, and appurtenances during handling and transit by using methods recommended by the manufacturer and approved by the Engineer.
   1. Repair abrasions, scars, and blemishes.
      a. If repair of satisfactory quality cannot be achieved, replace damaged material in its entirety immediately.
   2. All damaged pipe, fittings, and appurtenances shall be removed from the site by the Contractor and when directed to do so by the Owner.

D. Pipe shall be stored to assure the preservation of quality and fitness for the Work.
   1. Store pipe in a manner to keep pipe interior free from dirt and foreign matter.
   2. Storage on stones or other hard material that can damage the pipe exterior is not permitted.
   3. Storage of pipe on top of pipe is not permitted.
   4. Protect pipe stored outside from sunlight.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Restraint System for PVC Bell and Spigot Joints:
      c. Sigma Corporation, PV-LOK Series.
      d. Smith-Blair Camlok
      e. Or approved equal.
   2. Restraint System for PVC to Mechanical Joint Fittings:
      a. EBAA Iron, Inc., Series 2000 PV.
      b. Ford Meter Box Company, Inc., Series 1500.
      c. Sigma Corporation ONE-LOK Series.
      d. Or approved equal.

B. Submit request for substitution in accordance with Specification Section [Insert applicable section].

2.2 MATERIALS

A. PVC Force Main Piping:
   1. Furnish materials in full compliance with the following requirements:
      a. PVC Pipe:
         1) 4 IN through 12 IN, AWWA C900.
         2) 14 IN through 48 IN, AWWA C905 – DR25.
         3) Laying lengths shall be 13 FT or 20 FT.
         4) Restrainted joint where shown on the Contract Drawings.
         5) Unplasticized polyvinyl chloride plastic pressure pipe with integral wall bell and spigot joints and shall bear the seal of approval by the National Sanitation Foundation (NSF).
      b. Joints:
         1) Push-on joints:
            a) O-ring gaskets, ASTM F477.
            b) Flexible factory assembled elastomeric ring in the integral bell-end, ASTM D3139.
         2) Joint material including gaskets and lubricants:
            a) AWWA C900 and ASTM D3139.
            b) At no time shall gaskets be cut that will be used in the installation of pipeline
c. Fittings:
   1) ANSI/AWWA C110/A21.10 ductile iron or C15/A21.53
      a) Refer to Specification “Section 02510 – Ductile Iron Pipe and Fittings”.

d. Polyethylene encasement:
   1) All ductile iron fittings shall be wrapped [Engineer to decide if single/double wrapping and to coordinate with HRSD Project Manager if newly introduced biowrap is acceptable or preferable] with polyethylene encasement conforming to the requirements of ANSI/AWWA C105/A21.5 unless otherwise shown on the plans or specified herein. [Engineer to decide if required]
   2) Polyethylene encasement shall have minimum thickness of 8 mil per layer.

e. Tracer Wire:
   1) Copper tracer wire shall be 10 gauge, solid wire with plastic coating.

f. Utility Marking Tape:
   1) Subsurface utility marking tape shall be of a durable, metalized, plastic film, bright green in color, imprinted with the legend “CAUTION: SEWER BELOW”.
      a) The utility marking tape shall be manufactured by Griffolyn Company or approved equal.
      b) Tape shall be placed no less than 6 IN and no greater than 12 IN below the proposed finished grade.

B. PVC Gravity Sewer Piping:
   1. Furnish materials in full compliance with the following requirements:
      a. PVC Pipe, Joints, and Fittings:
         1) Pipe sizes 6 IN through 15 IN DIA, ASTM D3034 SDR 26.
         2) Pipe sizes 18 IN through 27 IN DIA, ASTM F679.
         3) Manufactured from approved PVC compound, ASTM D1784.
         4) Laying lengths shall be 13 FT or 20 FT.
         5) Integral bell with gasketed joints, except where specified otherwise on the Drawings.
         6) Joints:
            a) ASTM D3034, Section 6.
            b) Performance requirements of ASTM D3212.
         7) Rubber gaskets shall meet physical requirements in ASTM F477 and ASTM D1869.
         8) At no time shall gaskets be cut that will be used in the installation of pipeline

C. Utility Marking Tape:
   1. Subsurface utility marking tape shall be of a durable, metalized, plastic film, bright green in color, imprinted with the legend “CAUTION: SEWER BELOW”.
      a. The utility marking tape shall be manufactured by Griffolyn Company or approved equal.

D. Saddles for Air Vents:
   1. Smith Blair Service Saddle with 2-inch threaded outlet (Mueller CC threads).
   2. Style 366 for pipe 18-inch diameter and larger.
   3. Style 313 for pipe less than 18-inch diameter.

PART 3 - EXECUTION

3.1 INSPECTION

A. Items of material furnished under this Section shall be subject to inspection prior to installation.
   1. Items found not to be in compliance with this Section shall be removed from the project site and replaced with items that have been approved for installation.
   2. Inspections and approvals do not supplement the need to comply with the Contract Documents.

3.2 PIPE INSTALLATION
A. Trenching:
1. Excavate trenches by open cut method to depth and width necessary to accommodate Work.
2. Support existing utility lines traversing trench and stabilize excavation to prevent undermining of existing utility lines.
3. Open only length of trench required to complete each day’s piping installation.

B. Dewatering:
1. Install a dewatering system as required to prevent softening and disturbance of subgrade during construction. All dewatering system design is the Contractor’s responsibility.
2. Groundwater shall be maintained at least 2 FT below the bottom of any excavation.
3. Keep dewatering system in operation until backfill to cover pipe is in place.
4. Dispose of uncontaminated groundwater to an area which will not impair construction operations or damage existing construction.
5. Refer to the requirements of “Section 02710 – Contaminated Groundwater Management” if suspected or confirmed presence of hydrocarbon and other defined contaminants in the removed groundwater. [Engineer to determine applicability of this section]
6. Contractor shall adhere to jurisdictional noise ordinance for operation of dewatering pumps and generators.

C. Preparation of Foundation for Pipe Laying:
1. Subgrade Stabilization:
   a. If subgrade of pipe trenches is in a frozen, loose, wet, or soft condition before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved compacted material as authorized by Engineer in writing.
   b. Loose, wet, or soft materials, when approved by Engineer in writing, may be stabilized by a compacted working mat of well graded crushed stone.
      1) Over-excavate up to a depth of 2 FT below the design final subgrade elevation to remove the unsuitable material.
   c. Compact stone bedding material thoroughly into subgrade to avoid future migration of fines into the stone voids.
   d. Unstable trench bottoms caused by the Contractor’s failure to dewater or Contractor operations shall be replaced at no additional compensation.
   e. All trenching and subgrade preparation shall be in accordance with the manufacturer’s recommendations.

D. Laying Pipe in Trench:
1. Clean each pipe length thoroughly and inspect for compliance to Specifications.
2. Grade trench bottom and excavate for pipe bell and lay pipe on trench bottom.
3. Install gasket or joint material according to manufacturer's directions after joints have been thoroughly cleaned and examined.
4. Lay pipe in only suitable weather with good trench conditions.
   a. Never lay pipe in water except where approved by Engineer.
   b. Never use rock, brick, or other materials under the pipe while aligning the pipeline grade that may result in a fracture point for the PVC pipe.
   c. Never allow debris, angular materials or other unsuitable bedding and backfill materials to be in contact with PVC pipe.
5. Seal open end of line with watertight plug if pipe laying stopped.

E. Joining Method - Push-On Joints:
1. Install in accordance with AWWA C605
2. Assemble push-on joints in accordance with manufacturer's directions.
3. Lubricate spigot end of pipe to facilitate assembly without damage to gasket.
   a. Use lubricant that has no deteriorating effects on the gasket material
4. Assure the gasket groove is thoroughly clean.
5. For cold weather installation, warm gasket prior to placement in bell.
6. Taper of bevel shall be approximately 30 degrees with centerline of pipe and approximately 1/4 IN back.
7. Lining Up Push-On Joint Piping:
   a. Pipe deflections shall not exceed 50 percent of the maximum deflection values stated in
      manufacturer's written literature.
   b. Install shorter lengths of pipe in such length and number that angular deflection of any
      joint does not exceed 50 percent of the maximum deflection values stated in
      manufacturer's written literature.
   c. Measure and mark on the spigot end of the pipe the proper insertion point into the bell
      or fitting to prevent stress related damage.

F. Joining Method - Push-On Mechanical Joints (Restrained):
   1. Install in accordance with AWWA C605.
   2. Assemble mechanical joints in accordance with manufacturer's directions.
   3. Bevel and lubricate spigot end of pipe to facilitate assembly without damage to gasket.
      a. Use lubricant that has no deteriorating effects on the gasket material
   4. Assure the gasket groove is thoroughly clean.
   5. For cold weather installation, warm gasket prior to placement in bell.
   6. Taper of bevel shall be approximately 30 degrees with centerline of pipe and approximately
      1/4 IN back.
   7. Do not overstress bolts. The use of a torque wrench is required.
   8. Install restraint system in accordance with manufacturer's directions and as required in the
      plans.

G. Installation of Saddles for Air Vents [Engineer to review this requirement against HRSD
   Standard Detail]
   1. Approved stainless steel saddle shall be used to install air vent assembly at each high point
      along pipeline.
   2. Field taps shall be made at each location for air vent assembly.

H. Polyethylene Encasement:
   1. Wrap all ductile iron fittings in polyethylene encasement in full compliance to
      ANSI/AWWA C105/A21.5 unless otherwise shown on the plans or specified herein.
      a. Encase underground appurtenances required as part of installation.
      b. Make sections of tubing 2 FT longer than the fitting to be covered.
      c. Slip tube over fitting while fitting is suspended immediately before placing in trench.
      d. After installing in trench, pull tube ends over joint and overlap.
      e. Fasten securely in-place on each side of each joint with joint tape or strapping.
      f. Completely cover fittings and connections with film held snugly in-place with joint tape
         or strapping.

I. Backfilling Methods:
   1. Comply with the following:
      a. Observe specific pipe manufacturer’s recommendations regarding backfilling and
         compaction.
      b. Over excavation shall be filled with #57 stone at the contractor’s expense.
      c. Place backfill in lifts not exceeding 8 IN (loose thickness).
      d. Hand place, shovel slice, and pneumatically tamp all backfill to a depth of 6-IN above
         top of pipe.
      e. Compact each lift to specified requirements
      f. Compaction testing as defined in the Bid Documents for locations and frequency of
         testing to be performed by an independent testing firm.
      g. Avoid displacing joints and appurtenances or causing any horizontal or vertical
         misalignment, separation, or distortion.
   2. Water flushing for consolidation is not permitted.

J. Tracer Wire:
   1. Install tracer wire in accordance with the following:
      a. Tracer wire shall be installed on all PVC pipe installations.
b. Tracer wire shall be attached to the top of the pipe with plastic strapping at a minimum spacing of 10 FT.

c. Tracer wire access boxes shall be installed at a maximum distance of 400 FT apart.
   1) Use of air vents or valve boxes as tracer wire access boxes is not permitted.
   2) Combination Tracer Wire/Cathodic Test Station box shall be used for the tracer wire access point.
   3) There shall be adequate wire in the tracer wire test station box to pull the wire 2 FT outside of the box.

K. Utility Marking Tape:
   1. Install utility marking tape in accordance with the following:
      a. Tape shall be placed no less than 6 IN and no greater than 12 IN below the proposed finished grade.

3.3 CONNECTIONS WITH EXISTING PIPE

A. Scheduling: Refer to Section “01520 – Maintenance of Pipe and Pumping Operations”.

B. Locations of existing piping shown on the Contract Drawings shall be considered approximate.

C. Verify exact location of existing piping prior to laying connection piping which could alter the Work.
   1. Re-laying of pipe as a result of an incorrect alignment to an existing pipe shall be corrected.

D. Use suitable and proper fittings to suit conditions encountered.

E. Provide suitable equipment to dewater, drain, and dispose of liquid removed from existing pipe during connection.

F. Where connections necessitate employment of past installation methods not currently part of trade practices, utilize special piping components.

3.4 FIELD QUALITY CONTROL

A. Backfill Compaction Testing
   1. Compaction testing as required and defined in the Bid Documents for locations and frequency to be tested by an independent firm.

B. Testing of PVC Pressure Pipe:
   1. General Procedures for Hydrostatic Pressure Testing:
      a. Testing shall be in accordance with AWWA C605.
      b. Provide temporary restraints for exposed joints during test.
      c. Test buried piping after backfilling.
      d. Ports for testing shall be at 2-IN taps for proposed air vents or in plugs installed for testing. Under no circumstances shall the contractor tap the proposed force main for testing purposes.
      e. Test requirements:
         1) Test medium: Water.
         2) Pressure: 100 psi.
         3) Duration: 2 hrs.
      f. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates. [Note to Engineer: coordinate with HRSD Project Manager as to a preference for Owner provided calibrated gauge versus Contractor provided calibrated gauge for specific hydrostatic test]  
         1) Contractor shall furnish and use a gauge that has been calibrated within 12 months of the planned use. Contractor shall provide to Engineer verification certification of stated calibration of the pressure test gauge.
         2) Select each gauge so that the specified test pressure falls within the upper half of the gauge's range.

{Project Name}  Polyvinyl Chloride Pipe  {Month, Year}  02520-7
3) Notify the Owner’s Representative a minimum of 2 business days prior to each test.
4) Owner’s Representative shall be present during the test.

g. Completely assemble and test new piping systems prior to connection to existing pipe systems.
h. PVC Force Main Test Allowance: Testing allowance shall be defined as the quantity of water that must be supplied to the pipe section being tested to maintain a pressure within 5 psi of the specified hydrostatic test pressure. No installation will be accepted if the quantity of makeup water is greater than that determined by the formula:

\[
Q = \frac{LD\sqrt{P}}{148,000}
\]

Where:
- \(Q\) = quantity of makeup water (gph)
- \(L\) = length of pipe section being tested (FT)
- \(D\) = nominal diameter of the pipe (IN)
- \(P\) = average test pressure during the hydrostatic test (psig)

i. The Contractor shall bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.

j. Prepare hydrostatic test report and submit to Engineer in accordance with Section “01340 – Submittals”.

C. PVC Gravity Sewer Allowable Leakage Rates:
   1. Hydrostatic exfiltration and infiltration:
      a. Leakage outward or inward shall not exceed 100 gallons per inch diameter per mile per day (2,400 GPD/MI maximum) at a minimum of 4 FT of head above the crown of the pipe.
      b. Groundwater level is below the top of pipe:
         1) Leakage rate: 200 gallon per inch diameter per mile per day at average head on test section of 3 FT.
            a) Average head is defined from groundwater elevation to average pipe crown.
         2) Acceptable test head leakage rate for heads greater than 3 FT:
            a) Acceptable leakage rate (gallons per inch diameter per mile per day) = 115 \times (actual test head to the 1/2 power).
      c. Groundwater level is above the top of pipe:
         1) Allowable leakage rate: 200 gallon per inch diameter per mile per day when depth of groundwater over top of pipe is 2 to 6 FT.
         2) Leakage rate at heads greater than 6 FT: Allowable leakage rate (gallons per inch diameter per mile per day) = 82 \times (actual head to the 1/2 power).

D. Tracer Wire:
   1. The tracer wire shall be tested for continuity as part of the project acceptance.
   2. Any breaks in the tracer wire shall be excavated and spliced to restore continuity.

END OF SECTION
1.0 GENERAL

1.1 Description of Work

A. The Contractor shall furnish all labor, supervision, material (except as herein provided), tools, equipment, supplies, and services; and, shall perform all Work necessary for the installation of line stopping fittings and equipment and bypass piping on HRSD sanitary sewer force main systems as indicated in the Contract Documents. Contractors shall utilize a qualified Line Stop subcontractor. Contractors shall not self-perform line stops.

1.2 Qualifications

A. Refer to Article 4 – Qualifications of Bidders of “Section 00200 - Instructions to Bidders”.

1.3 Submittals

Submittals shall be made by the Contractor in accordance with the procedures set forth in “Section 01340 – Submittals” and as described below:

A. Documentation of Experience/Qualifications: Refer to Article 4 – Qualifications of Bidders of “Section 00200 - Instructions to Bidders”.

B. Calculations – Submit head loss calculations for proposed line stop/bypass configuration based on flow/pressure data furnished by the Owner. Total head loss shall between line stop units shall include losses through the tapping sleeve, plugging head, line stop housing unit, all bends and fittings, and the bypass piping.

C. Measurements: Submit all field measurements taken to verify pipe outside and inside diameter, wall thickness, etc.

D. Manufacturer’s catalog cuts, technical data, operation and maintenance data, and/or shop Contract Documents are required for the following components (shop drawings shall be drawn to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the work):

1. Sketches and drawings of line stop equipment including dimensions and weights
2. Field sketch of line stop locations based on exploratory excavation
3. Written procedure for installing and operating line stop equipment
4. Tapping fittings
5. Completion plug
6. Coatings for completion plug and flange
7. HDPE bypass piping and fittings
8. Automatic air vents
9. Section view of line stop equipment showing folding plunger engaged in stop position

2.0 PRODUCTS

2.1 Line Stop Fittings
A. General: Stopper head, line stop fitting, completion plug, and blind flange shall be pressure rated at 150 PSI. All line stop equipment shall be suited for vacuum conditions.

B. Stopple insertion head gaskets: Contractor must have, at their disposal numerous size stopple cups/gaskets in ¼” increments. Contractor will be required to bring a minimum of three (3) stopple cups/gaskets to the job site: One (1) will be of a size that is anticipated to fit the inside diameter of the pipe, the other two (2) will be ¼” larger and ¼” smaller than that size. Contractor must have the ability to obtain any size stopple cup/gasket within 24 hours of tapping the pipe.

C. After completion of fabrication, all fittings shall be coated both internally and externally with a heavy coat of corrosion resistant metal primer of fusion bonded epoxy coating per AWWA C-213.

D. Tapping Fittings for Concrete Cylinder Pipe

1. The tapping sleeve shall be manufactured in three (3) sections and have a separate gland which permits the installation of the sleeve prior to cutting of the pre-stressing wires. The lower half of the tapping sleeve shall have multiple straps that are contoured to the outside pipe diameter and will bolt the top half of the sleeve that has also been contoured to the outside diameter of the pipe. The top half will be provided with foam outer seals, two (2) grout outlet horns and an outer neck flange assembly. The third component shall consist of the inner neck flange assembly that is provided with a contoured elastomeric ring neck seal and terminating in a locking flange to permit recovery of the temporary control valve under pressure at the completion of the project.

2. Tapping Saddle Body: The tapping saddle body shall be ASTM-283 Grade C or ASTM A-36 steel. The back portion of the saddle shall use support straps that draw the saddle plate to the pipe surface in a uniform manner. Straps will be manufactured from rolled steel in accordance with ASTM A-36.

3. Outer Neck Assembly and Bottom Draw Flange: The outer neck assembly that is connected to the upper saddle plate shall be ASTM-283 Grade C or ASTM A-36 steel. The bottom draw flange shall be in accordance with AWWA C-207-B minimum thickness and shall mate to the top draw flange of the inner neck assembly. Flange material shall be ASTM-283 Grade C or ASTM A-36.

4. Inner neck assembly will be manufactured from ASTM A-283 Grade C or ASTM A-36 steel. The interior of the inner neck assembly shall be factory coated with cement mortar or a minimum of 15 mils of epoxy paint in accordance with AWWA C-213. The inner neck assembly shall be fabricated having two flanges: a top draw flange facing downward and a tapping flange facing upward. The top draw flange will mate to the outer neck assembly bottom draw flange. A pressure plate (ASTM A-283 Grade C) shall be gusseted to the top draw flange. The tapping flange used to connect the temporary control valve will be fitted at the factory with a completion plug flange.

5. The gasket for sealing to the gland-nozzle assembly to pipe’s steel cylinder shall have a broad flat sealing surface. Gasket material shall be Buna-N with a Shore A durometer range between 50-70.

6. The inner neck flange will be provided from the factory, with an internal locking mechanism that permits recovery of the temporary control valve used in hot tapping/stopping process upon project termination.

7. Fasteners: All external bolting, studs and nuts that shall become a permanent part of the fitting installation shall be corrosion resistant, high strength, low alloy (AWWA C-111, ANSI 21.111).
E. Tapping Fittings for Reinforced Concrete Pipe/Ductile Iron/Cast Iron/Asbestos Cement Pipe

1. All tapping saddles will be two-piece, made with full front and back. Steel run sections will conform to and re-enforce the existing pipe. All steel for saddles will conform to ASTM A-283 Grade C or ASTM A-36 steel. Saddles will have a recess for installation of a Buna-N rubber gasket around the hot tapping outlet. All bolts will be corrosion resistant alloy material (per AWWA C-111, ANSI 21.11). There shall be a ¾” test outlet placed into the nozzle branch outlet, at the factory for site pressure testing, after saddle has been installed. Plug threads shall be coated to prevent galling.

2. Tapping saddle body shall be ASTM A-283 Grade C or ASTM A-36 steel. Saddle plate thickness shall be in accordance with the design criteria for the entire fitting. A minimum wall thickness for saddle plates shall be 0.375”. All welding of materials shall be in accordance with applicable code standards. Saddle plates shall be designed to permit longitudinal bolting of the top and bottom halves around the pipe.

3. Nozzles attached to the saddle plates and used for hot tapping shall be constructed of A-106 Grade B steel or ASTM A-283 or A-36 steel. Nozzle thickness will be as a minimum standard steel pipe wall thickness (0.250”).

4. Fasteners: All external bolting, studs and nuts that shall become a permanent part of the fitting installation shall be corrosion resistant, high strength, low alloy (AWWA C-111, ANSI 21.11).

F. Line Stop Housing

1. For instances where the bypass is proposed through the line stop housing, the use of any type of flow-through style strainer that is placed into the flow path once the folding plugger is extended into its stopped position will not be permitted.

2.2 Completion Plugs:

A. All flanges used for line plugging will be manufactured from ASTM-A-105 grade or equal and shall be machined to accept completion plug.

B. The completion plug shall be manufactured from carbon steel plate in accordance with ASTM A-36 with circumferential groove to contain a compressible “O” ring to seal pressure tight against the bore of the flange. Completion plug locking mechanisms shall consist of ring segments or steel leaves that lock from or into the flange bore. Set screw style locking mechanisms that tighten against wedges set against the completion plug and have removable thread inserts within the tapping fitting flange are also acceptable. Set screws set directly against completion plugs and/or without removable thread inserts within the tapping fitting flange will NOT be acceptable.

C. Blind flanges for mating with line plugging flanges shall be in accordance with ASTM A-181 or ASTM A-105 grade steel. Minimum thickness shall be AWWA C-207, Class D.

D. Flange gaskets shall be of non-asbestos composition and will be designed to mate to the inner bore and inner bolt circle of the line plugging flange. All gaskets will be at least 0.125” minimum thickness.

2.3 Temporary Bypass Piping:

A. Bypass piping shall be watertight HDPE pipe joined by butt-fusion method in strict accordance with the
manufacturer’s recommendations.
B. Bypass piping shall be DR 17 minimum HDPE piping.
C. Approximate location of the bypass piping is shown on the plans. The exact location of the bypass piping shall be determined by the Contractor following field investigations.
D. An automatic 2-inch air vent shall be placed on the bypass piping at any localized high points to vent air during start-up and operation.
E. The bypass piping shall include a tee and branch valve for controlled dewatering of residual sewage after the bypass piping is taken out of service.
F. In-line isolation valves shall be provided on the bypass piping at each line stop location.

3.0 EXECUTION

3.1 Line Stop Installation Requirements

A. Refer to Specification Sections “01040 – Coordination” and “01520-Maintenance of Pipeline and Pumping Operations” for meeting and coordination requirements.

B. Prior to starting any work related to the line stops, the Contractor shall perform explorations on the existing force main pipe to determine joint locations and the locations for the line stops. A sketch of the field verified information shall be included in the shop drawings. The Contractor shall locate the proposed line stop such that there is a minimum of one (1) full stick of pipe between the line stop and the force main connection point.

C. If other utilities or obstructions encroach the line stop fitting zone, the Contractor shall notify the company performing the line stop for exact clearance required for drilling, plugging and completion machines.

D. The length of pipe receiving the line stop fitting must be completely free and clear of corporation stops, air release valves, joints or any other irregularities that would prevent the installation of the line stop fitting.

E. The line stop fitting shall be tested after being installed before the final concrete collar is poured around the force main.
   1. Coordinate with Owner and Owner’s Representative for allowable test pressure.
   2. Allowable leakage shall be zero and test duration shall be one (1) hour.
   3. The line stop fitting shall be tested and accepted prior to tapping the force main. The pressure test shall be performed in the presence of the Owner’s representative.

F. For the initial installation and pressure equalization of the line stops, if necessary, the Contractor is permitted to tap a section of the existing force main that is to be abandoned. Additional taps of the new or existing force main that is to remain in service will not be permitted.

G. The line stop unit shall be equipped with a pressure gauge to monitor line pressures on the active side of the force main for the duration of the line stop.

H. Once line stops are inserted, the Contractor shall work continuously until connections are made and service is returned to the force main.

I. A completion plug and blind flange shall be installed on the line stop fitting (on the force main that is to remain in service) prior to backfilling.
J. GPS coordinates of the center of the blind flange shall be obtained by the Contractor and recorded on the Record Drawings and Valve Guides.

3.2 Concrete Support/Reaction Blocking Requirements

A. The shear key floor, concrete support blocking, and reaction blocking are provided as a means of thrust restraint and support of the line stop fitting, valves, equipment, etc. The Contractor shall use care at all times when performing work on or near the HRSD force main to prevent differential settlement, excessive loading, etc., which may damage the force main.

B. Linestop Blocking Basis of Design: Operating Pressure = 30 PSI. [to be confirmed by Engineer]

C. All concrete shall be air entrained. High early strength, VDOT Class A3 (minimum). The Contractor is to prepare test cylinders and provide certified testing to ensure the required compressive strength is reached prior to mounting the tapping machine and line stop equipment.

D. Thrust surface area of floor is based upon bearing against undisturbed soil of 1,500 PSF minimum bearing strength. Contractor shall verify actual soil conditions and increase bearing surface area as required. Reduction of the bearing surface area will not be permitted.

E. All exposed joints of the force main must be supported with concrete support piers.

F. Concrete support and reaction blocking for line stop fitting shall be poured immediately after pressure test of assembled line stop fitting. Blocking must engage shear keys in concrete floor. Top of blocking shall be poured to cover the top of the line stop fitting where possible and not encroach onto lower bolts of the gate valve.

G. The Contractor shall utilize straps instead of chains, cables, or unpadded forks to handle pipe.

3.3 Bypass Piping Installation Requirements

A. Prior to connecting bypass piping to line stop housing, bypass piping shall be tested at 50 PSI.

B. The Contractor shall provide a means for minimizing pipe movement during pressurization and operation.

C. Test pressure shall be applied to the bypass piping for three (3) hours to allow for initial expansion of the pipe. After three (3) hours, reduce initial test pressure by 10% and monitor pressure for one (1) hour. If the test pressure remains steady (to within 5% of target value) for one (1) hour, no leakage is indicated.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Gate Valves.
   2. Eccentric Plug Valves.
   3. Automatic Air Release Valves
   4. Ball Valves for Air Release
   5. Corporation Stops.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 01 - General Requirements.
   3. Section XXXX - Trenching, Backfilling and Compaction for Utilities.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
   2. American Water Works Association (AWWA), latest revision:
      e. C550, Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.
   3. Manufacturers Standardization Society of the Valve and Fittings Industry Inc. (MSS):
      a. SP-9, Spot Facing for Bronze, Iron, and Steel Flanges.
      b. SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
      c. SP-72, Ball Valves with Flanged or Butt-Welding Ends for General Service.
      d. SP-110, Ball Valves; Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 DEFINITIONS

A. The following are definitions of abbreviations used in this section:
   1. SWP: Steam working pressure.
   2. WOG: Water, oil, gas working pressure.
   3. CWP: Cold Working Pressure

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification “Section 01340 – Submittals” for requirements for the mechanics and administration of the submittal process.
2. Bi-directional hydrostatic testing of valves shall be conducted by the valve manufacturer. A certificate of compliance, including test methods and results, shall be provided to HRSD for each valve and included with the shop drawing submittal to Owner and Engineer. Minimal acceptable test pressures shall be in accordance with applicable AWWA valve standards (C-500, C-509, C-515 and C-517) for the valve type to be installed.

3. Certified maximum operating torque on the valve shaft and the mechanical advantage of the geared actuator shall be provided by the manufacturer and included in the shop drawing submittal to HRSD.

4. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.

5. Operation and Maintenance Manuals:
   a. Refer to Specification “Section 01340 – Submittals” for requirements for the content of Operation and Maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect valves, linings, and coatings during handling using methods recommended by the manufacturer. Use of bare cables, chains, hooks, metal bars, or narrow skids in contact with coated pipe is not permitted.

B. Prevent damage to valves during transit. The operator nut and stem for gate valves and plug valves shall be protected during shipping and installation. Repair abrasions, scars, and blemishes. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

PART 2 - PRODUCTS

2.1 RESILIENT WEDGE SEATED GATE VALVES

A. Valves 14 IN and smaller shall be resilient wedge gate valves to be installed in the vertical position only.
   1. Vertical position refers to the position of the traveling gate.

B. Acceptable Manufacturers:
   1. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
      a. Clow.
      b. Mueller.
      c. American Flow Control.
      d. M&H.
      e. U.S. Pipe Valve and Hydrant.

C. Design Requirements:
   1. Valves shall be designed for a working pressure of not less than 150 psi and tested at a pressure of not less than 300 psi.
   2. Valves shall be capable of drip-tight, bidirectional shutoff.
   3. Valves shall operate in a vertical position.
      a. Operator: Non-rising stem with standard 2 IN wrench nut, open left (counter-clockwise).
      1) Extension stems are not allowed.
   4. Valves shall be approved by the manufacturer for buried service.
   5. Gear cases and shafts shall be totally enclosed type, suitable for buried service.
      a. Reduction gears are not permitted.

D. Materials:
   1. Furnish materials in full compliance with the following requirements:
      a. Valves shall conform to AWWA C509 or AWWA C515.
      b. Wedges: Ductile iron encapsulated with EPDM.
      c. Body: Ductile iron with fusion bonded epoxy coating on interior and exterior in accordance with AWWA C550.
      d. Valve ends shall be as indicated in the Drawings.
2.2 DOUBLE DISC, PARALLEL SEAT GATE VALVES

A. Buried Gate Valves 16 IN and larger shall be double disc parallel seated gate valves to be installed in the horizontal position only.
   1. Horizontal position refers to the position of the traveling gate.

B. Acceptable Manufacturers:
   1. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
      a. Clow.
      b. Mueller.
      c. M&H.

C. Design Requirements:
   1. Valves shall be designed for a working pressure of not less than 150 psi and tested at a pressure of not less than 300 psi.
   2. Valves shall be capable of drip-tight, bidirectional shutoff.
   3. Valves shall operate in a horizontal position.
      a. Operator: Non-rising stem with standard 2 IN wrench nut, open left (counterclockwise).
         1) Extension stems are not allowed.
   4. Valves shall be approved by the manufacturer for buried service.
   5. Bypasses shall be provided on double disc gate valves 36 inches and larger.
   6. Gear cases and shafts shall be totally enclosed type, suitable for buried service.
      a. Provide 4:1 gearing ratio for horizontal installed valves.

D. Materials:
   1. Furnish materials in full compliance with the following requirements:
      a. Valves shall conform to AWWA C500. Valves in accordance with Section 4.4.8.1.1 of AWWA C500 will not be allowed.
      b. Seats in the body shall be replaceable without removing the valve from the pipeline.
      c. Discs shall be cast iron and bronze faced.
      d. Discs are to be free to revolve 360 degrees.
      e. Valve to be furnished with bronze rollers, bronze tracks and bronze scrapers.
      f. Body: Ductile iron with fusion bonded epoxy coating on interior and exterior in accordance with NSF-61 unless otherwise specified.
      g. Valve ends shall be as indicated in the Drawings.

2.3 ECCENTRIC PLUG VALVES

A. Valves 16 IN and larger.

B. Acceptable Manufacturers:
   1. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
      a. DeZurik, Inc.
      b. Milliken Valve Company, Inc.
      c. Val-Matic Valve & Manufacturing Corp.

C. Design Requirements:
   1. Valves shall be designed for a working pressure of not less than 150 psi. Valve actuator shall be sized based upon the working pressure.
   2. Valves shall be given bidirectional leakage test and low-pressure 5 psi seat test in accordance with the procedures outlined in AWWA C517. Certified copies of the Proof-of-Design test reports documenting that all requirements of AWWA C517 were successfully met shall be furnished to HRSD prior to installation.
   3. Valves shall operate in a horizontal position.
      a. Horizontal position refers to the alignment of the rotating shaft on which the plug is affixed.
b. Operator: Non-rising stem with standard 2 IN wrench nut, open left (counterclockwise).
   1) Extension stems are not allowed.
   2) Stem shear and coupling pins shall be solid 316 stainless steel.
4. For exposed service applications, plug valve shaft seals shall be externally adjustable and repackable without removing the actuator or bonnet from the valve under pressure. The actuator mounting bracket shall allow access to the packing gland and provide an air gap to visually inspect the packing.
5. For buried service applications, plug valve shaft seals shall be fully enclosed and protected from the surrounding groundwater and soil via full circumferential metal to metal contact between the bonnet and the actuator body or by other means as approved by the Owner.
6. Operator stems and nuts shall be provided with an enclosure that will protect the stem from being bent and provide a base and guide for the riser pipe.
7. All exposed nuts, bolts, springs and washers shall be 316 stainless steel.

D. Materials: Furnish materials in full compliance with the following requirements:
1. Valves shall conform to AWWA C517 and shall have an interior and exterior epoxy coating.
2. Valve body and plugs shall be ASTM A126 Class B cast iron.
3. Plugs shall be solid one piece with a cylindrical seating surface eccentrically offset from the center of the shaft. Plug facing shall be Buna-N with a minimum hardness (Shore A) of 70 durometer.
4. Seats shall be welded in overlay minimum 1/8 IN thick nickel raised surface of not less than 95% pure nickel. Bearings shall be sintered, permanently lubricated 316 stainless steel.
5. Packing shall be multiple v-type or “U” cup type.
6. Washers at the top and bottom of the plug journal shall be provided to keep grit and debris out of the bearings and packing.
7. Plug valves in the horizontal position shall be installed so that the plug rotates upward as the valve opens.
8. Valves shall be furnished with a standard 2 IN wrench nut and shall open left (counterclockwise).
9. Valve ends shall be mechanical joint unless otherwise specified.
10. Port area shall be not less than 70% of the pipe area for a given size valve.

2.4 BALL VALVES

A. Acceptable Manufacturers:
1. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   a. NIBCO #T5857066-2.

B. Comply with MSS SP-110.

C. Materials:
2. Stem, stem gland nut: Brass.
3. Ball: Brass, chrome plated.
4. Seats, stuffing box ring, and thrust washer: Reinforced Teflon.
5. Handle: Vinyl coated or zinc- or cadmium-plated steel.

D. Design Requirements:
1. Rated for 600 psi WOG.
2. 100 percent full opening.
3. Handles showing direction of opening.
4. Stuffing boxes capable of being repacked under pressure and adjustable for wear.
5. Stem with reinforced Teflon stuffing box ring and blowout-proof design.
6. Renewable reinforced Teflon seats.
7. Ball design which does not allow media contact with stem.
8. Balancing stop for all applications.
9. Bodies with mounting pad for applications requiring actuators.

2.5 AUTOMATIC AIR RELEASE VALVES {approval on a case by case basis}

A. General:
   1. Automatic air release valves and appurtenances shall be provided and installed at locations shown on the plan and per the details in the Contracts Documents.

2.6 CORPORATION STOPS FOR AIR VENTS

A. General:
   1. The Contractor shall provide corporation stops for manual air vents at all high points in the force main. The corporation outlets shall be field tapped. All field taps shall be verified from the inside of the pipe and a repair kit shall be used to touch up the interior lining of the pipe. A tapping saddle with CC threads shall be provided at every 2-inch tap. Use Teflon tape or approved pipe thread compound on threads of the corporation stops to ensure tight seal. The Contractor shall keep the corporation stops in a closed position, unless air is being removed from the main, until the brass riser pipe and ball valve is installed. Corporation stops shall be opened prior to backfilling. Install air vent assembly in accordance with the Contract Drawings.

B. Acceptable Manufacturers:
   1. Mueller 2” Corporation Stop model H10045N
   2. No other products nor manufacturers are acceptable

C. Air Vent Assembly
   1. Parts and installation per the Contract Drawings

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer’s instructions.

B. Setting Buried Valves:
   1. Locate valves installed in pipe trenches where buried pipe is indicated in the Contract Drawings.
   2. Set valves and valve boxes plumb.
   3. Place valve boxes directly over valves with top of box being brought to surface of finished grade.
   4. Place valve on firm footing in trench to prevent settling.
   5. After installation, backfill up to top of box for a minimum distance of 4 FT on each side of box.

C. Installation of Plug Valves:
   1. Geogrid support pad (Tensar TX-160) to be installed below stone base and between 12-inch stone (VDOT 21A or 21B) lifts. Refer to detail on Contract Drawings. [Engineer to include referenced detail]
   2. Valve shall be oriented so the plug rotates 90 degrees to the top of the pipe when open.
   3. Closed face of plug valve to installed facing the normal direction of flow in the pipe. Refer to detail on Contract Drawings. [Engineer to include referenced detail]

3.2 FIELD QUALITY CONTROL

A. Valve Operation:
   1. Fully open and close each gate valve and each plug valve for one cycle, recording the number of turns, in the presence of HRSD’s Representative prior to installation.

B. Air Vent Assemblies:
1. Saddles used for corporation stop installations shall be hydrostatically tested at 50 psi for 30 minutes with zero leakage prior to tapping the pipe. Failed tests shall be redone at the Contractor’s expense.

2. HRSD Representative shall be present at all saddle tests. Failure to have the HRSD Representative present shall result in retesting at the Contractor’s expense.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Management of contaminated groundwater from construction dewatering activities.

1.2 DEFINITIONS
A. Contaminated Effluent: Effluent from construction dewatering activities that is impacted with contaminants of concern and require special handling in accordance with applicable federal and state regulations.

B. Contaminated Groundwater: Groundwater that is impacted with contaminants of concern and require special handling in accordance with applicable federal and state regulations.

C. Effluent: Groundwater pumped from the ground during construction.

D. EPA: Environmental Protection Agency

E. HRSD: Hampton Roads Sanitation District

F. HRSD Industrial Wastewater Permit: HRSD permit in a form of a Letter of Authorization that allows contaminated groundwater to be discharged into the sanitary sewer system for treatment by HRSD.

G. VDEQ: Virginia Department of Environmental Quality

H. VPDES: Virginia Pollutant Discharge Elimination System

1.3 ACTION SUBMITTALS
A. Contaminated Groundwater Management Plan: Submit a Contaminated Groundwater Management Plan within 30 calendar days of contract award but prior to construction commencement. This plan shall include:
   1. Summary of information regarding the location and nature of known or suspected groundwater contamination from studies provided by the HRSD.
   2. Summary of permits required for the discharge and plan for securing such permits.
   3. Proposed methods and procedures for contaminated groundwater management generated from construction dewatering activities including treatment equipment required.
   4. Sampling, monitoring and reporting requirements and plans.

B. Proposed Protection Measures: Submit informational report, including drawings, indicating the measures proposed for worker protection from contaminated groundwater in accordance to applicable federal and state regulations.

1.4 REQUIRED INFORMATIONAL SUBMITTALS
A. Discharge Permit Submittals: Provide all contaminated groundwater discharge permits, correspondence and submittals related to VPDES permit compliance to include Discharge Monitor Reports (DMRs), and reporting for compliance with HRSD’s Industrial Waste Water Permit, if applicable.

1.5 QUALITY ASSURANCE
A. Regulatory Requirements: Review the requirements of all permits issued for contaminated groundwater discharge. Comply with governing EPA regulations in regard to discharging contaminated groundwater before beginning construction.
B. Contaminated Groundwater Management Conference: Conduct a contaminated groundwater discharge conference at project site. Review methods and procedures related to contaminated groundwater management including, but not limited to, the following:
   1. Review and discuss the Contaminated Groundwater Management Plan including duties of contaminated groundwater management coordinator responsible for this task.
   2. Review plan for documenting volume of effluent generated.
   3. Review procedures for encountering and discharging of known or suspect contaminated effluent.

PART 2 - EXECUTION

2.1 GROUNDWATER MANAGEMENT PROTOCOLS
   A. Comply with applicable Contract document terms, regulations, approvals, and permit conditions regarding dewatering. Measures to direct discharge to both HRSD and state waters under a VPDES permit shall be explored and implemented as appropriate.
   B. Employ best management practices as required by Virginia Erosion and Sediment Control Law including use of control measures, such as sediment basins and dewatering structures, per VDEQ regulations.
   C. Monitor dewatering discharge to ensure compliance with regulations and permits. Sample if required by permitting agency and adjust control measures accordingly.

2.2 PLAN IMPLEMENTATION
   A. General: Implement approved contaminated groundwater management plan.
   B. Training: Train workers, subcontractors, and suppliers on proper contaminated groundwater management procedures, as appropriate for the work.

2.3 PROCEDURE
   A. The Contractor shall dewater only the minimum volume of groundwater as necessary to construct the proposed improvement.
   B. Apply for and secure all permits required to discharge contaminated groundwater. Contractor shall be the Permittee for all required permits to discharge contaminated groundwater, and will be solely responsible for compliance with all provisions of the applicable permit(s). HRSD or Engineer will periodically monitor compliance. Any upset, as defined by VDEQ or HRSD, shall be reported to HRSD immediately.
   C. Dewatering discharge shall be monitored to ensure compliance with regulations and permits. Sample in accordance to EPA and permit requirements and adjust control measures accordingly.
   D. Discharge as per regulations and applicable permits.
   E. If during construction activities, the Contractor detects a petroleum odor or other evidence of groundwater contamination (e.g. staining, turbidity, etc.) in an area of unknown contamination, then the Contractor shall immediately call the HRSD to report the suspected contaminated groundwater. All work should be temporarily stopped in this area of suspect contamination until additional guidance is provided by HRSD regarding the handling and treatment of such materials.
   F. Contractor shall not discharge any contaminated groundwater except as authorized and specified by applicable permits.

{Project Name}  Contaminated Groundwater Management  {Month, Year}
2.4 MEASUREMENT AND PAYMENT

A. Information regarding the location and nature of known or suspected groundwater contamination from previous studies is provided to assist the Contractor in calculating the quantity and cost for managing contaminated groundwater during construction dewatering activities. [Note to Engineer: make a recommendation on whether costs associated with the proper management of contaminated groundwater shall be included in the lump sum bid for this project, covered under an allowance, or included as specific unit price items in Section 01270 - Measurement and Payment].

End of Section
SECTION 02761
TELEVISION INSPECTION OF PIPELINES

1.0 GENERAL

1.1 DESCRIPTION

A. Scope

1. The Contractor shall perform internal inspections of the sewer mains and record any defects discovered. The intent of the inspection is to obtain data on the full circumference of the pipeline.

B. Requirements

1. CCTV Inspection. If directed by the Engineer, the Contractor shall inspect the pipeline interior above the flow line using a color closed circuit television camera (CCTV) and document the inspection on a digital recorder.

2. Conveyance. The Contractor may mount the CCTV camera on either a wheeled or tracked crawler or on a specially designed flotation device. The crawler may be either tethered or free roving.

3. Data Management. All inspection video shall be submitted in MPEG file format (.mpg) and saved on CDs, DVDs, or external hard drives for submittal. Each inspected pipeline segment should have an associated MPEG file. Electronic PDF (.pdf) files of each inspection log and digital photographs (.jpg) files shall accompany the video inspections for each pipeline segment inspected. The nature of the inspections shall be to verify condition of the pipelines and to provide a permanent record of the existing pipeline condition as it relates to pipe dimensions, materials, obstructions, structural defects, connections, and deterioration.

1.2 QUALITY ASSURANCE

A. The Contractor shall have all CCTV operators who are responsible for logging defects into the data collection software successfully trained and certified through National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP).

B. The Contractor shall use CCTV defect logging software that is PACP-certified, which assures that the software can be used to export a database of all inspection and defect details that conform to the NASSCO PACP database standard. The Contractor shall add Owner specific defect codes to the database as required to insure uniform defect identification and naming.

1.3 SUBMITTALS

A. The following submittals shall be provided in accordance with Section “01340 – Submittals”:

1. Submit resumes and project references for the field personnel who will be employed for this project, including the NASSCO PACP Certification number for each operator.

2. See Section 3.8 for reporting submittal requirements.

2.0 PRODUCTS
2.1 TELEVISION CAMERA AND MONITOR

A. The camera(s) shall be operative in 100 percent humidity/submerged conditions. The CCTV camera equipment shall provide a view of the pipe ahead of the equipment and of features to the side and rear of the equipment through turning and rotation of the lens. The camera shall be capable of tilting at right angles along the axis of the pipe while panning the camera lens through a full circle about the circumference of the pipe. The lights on the camera shall also be capable of panning 90-degrees to the axis of the pipe. If the equipment proves to be unsatisfactory, it shall be replaced with adequate equipment. The camera unit shall have sufficient quantities of line and video cable to inspect sewers with access as far apart as 2,500 feet.

B. The television camera, electronic systems and monitor shall provide an image that meets the following specifications:

1. The gray scale shall show equal changes in brightness ranging from black to white with a minimum of five stages.
2. With the monitor control correctly adjusted, the six colors - Yellow, Cyan, Green, Magenta, Red, and Blue, plus Black and White, shall be clearly resolved with the primary colors in order of decreasing luminance. The gray scale shall appear in contrasting shades of gray with no color tint.
3. The picture shall show no convergence or divergence over the whole of the picture. The monitor shall be at least 13 inches diagonally across the picture tube.
4. The live picture on the CCTV monitor shall be capable of registering a minimum of 500 lines horizontal resolution and be a clear, stable image with no interference.

C. Lighting intensity shall be remote controlled and shall be adjusted to minimize reflective glare. Lighting and camera quality shall provide a clear, in-focus picture of the entire inside periphery of the sewers and laterals for all conditions except submergence. Under ideal conditions (no fog in the pipeline) the camera lighting shall allow a clear picture up to five pipe diameter lengths away for the entire periphery of the sewer. The lighting shall provide uniform light free from shadows or hot spots.

D. Camera focal distance shall be remotely adjustable through a range of 6 inches to infinity.

E. The monitor and software shall be able to capture and save screen images of typical pipeline details and all defects. Screen image files shall be named using pipeline segment number and footage and submitted on CDs, DVDs, or external hard drives following paragraph 3.08, this section.

2.2 VIDEO RECORDINGS

A. The video and audio recordings of all inspections shall be made using digital video equipment. The digital recording equipment shall capture pipeline inspection on CD, DVD, or external hard drive, with each segment inspection recorded as an individual movie file (.mpeg, .mpg). The files shall be named according to segment numbering system provided by the Engineer.
B. The audio portion of the composite CCTV video shall be sufficiently free from electrical interference and background noise to provide complete intelligibility of the oral report. Audio shall be recorded by the operating technician on the inspection video as the pipeline is inspected and shall include the pipeline segment identification number, location (address or cross streets) of starting point, inspection direction, length of inspection, flow information, complete descriptions of the pipeline conditions as they are encountered, and other relevant commentary to the inspections. In addition, the audio reports shall include the distance traveled on the specific run, a description of abnormal conditions in the pipeline as they are encountered, explanations for pausing, backing up, or stopping the survey, and the final measured distance. Audio dubbing after the inspection is prohibited.

C. The segments shall be inspected from upstream to downstream, wherever possible. The images recorded on the CCTV video shall be the same images that are required to be displayed on the CCTV monitor. The footage counter shall be zeroed at the beginning of each inspection and at each intermediate access point along the inspection run. The video recorder shall be paused if the camera progress is stopped for a period longer than 30 seconds due to breakdown of the equipment, or any purpose other than analyzing conditions of the pipeline. The operator shall document the delay on the recording when progress resumes.

D. The equipment used for the inspection must provide for simultaneous monitoring of the in-pipeline inspection by the Engineer or Owner.

E. Typed labels shall be attached to the face of each CD, DVD or external hard drive. The typed index labels shall include the following information:

1. Content
2. Contractor name
3. Type of survey
4. Interceptor name and ID number
5. Reaches included (Segment number, stationing)
6. Date of survey
7. Work order number (if applicable)

F. The inspection video shall be delivered on a medium that is not re-recordable. Contractor shall maintain a copy of all inspection documentation (CDs/DVDs, databases, and logs) for the duration of the work and warranty period.

3.0 EXECUTION

3.1 GENERAL

A. The CCTV camera shall be positioned as close to the spring line as possible while maintaining the required equipment stability. If the flow levels are above the spring line, then the vertical position of the camera shall be just above the free water surface.
B. The speed that the camera or survey unit is conveyed through the pipeline while performing general inspections shall be uniform and shall be limited to a maximum of 30-feet per minute. During CCTV inspection, the survey unit shall be slowed, stopped, or backed-up to perform detailed inspections of significant features. The camera shall be stopped at all defects, changes in material, water level, size, side connections, junctions, or other unusual areas. When stopped at the defect or feature, the operator shall pan the camera to the area and along the circumference of the pipe. The operator shall also record audio of the type of defect or feature, clock position, footage, extent or other pertinent data. Still photographs or screen captures shall be taken at all defects and general line condition photographs should be taken at least every 200 feet.

C. During period of camera advancement along the reach, the operator should pan to view the flow line conditions along both sides of the pipe and the crown at regular intervals. This may be done while the camera is moving forward as long as the recorded picture quality is not adversely affected. When viewing the flow line area, the camera should be returned to the forward position providing a full view of the pipe before panning to view the opposite side of the pipeline or the crown conditions.

D. At the Contractor's discretion or direction of the Engineer, the camera shall be stopped or backed up (when conditions allow) to view and analyze conditions that appear to be unusual or uncommon for a sound pipeline. The lens and lighting shall be readjusted, if need be, in order to ensure a clear, distinct, and properly lighted feature. The video recorder shall be paused if the camera progress is stopped for a period longer than 30 seconds due to breakdown of the equipment, or any purpose other than analyzing conditions of the sewer. The operator shall document the delay on the recording when progress resumes.

3.2 LINEAR MEASUREMENT

A. The Contractor shall measure the camera progress along the full length of each segment. The length counter shall be zeroed at the beginning of each inspection, and at any intermediate access points. In the case of resuming an inspection at an intermediate point along the pipeline, the length counter shall start at the last point recorded. The Contractor shall ensure that the counter starts to register immediately when camera progress starts. Markings on the cable are not acceptable.

B. Prior to commencing inspections, the Contractor shall demonstrate compliance with the linear measurement tolerance specified below:

1. The equipment shall measure the location of the survey unit in 1-foot increments from the beginning of each continuous section. This footage location must be displayed on the CCTV monitor and recorded.
2. The accuracy of the measured location shall be within +0.5% of the actual length of the pipeline segment being surveyed, or 1 foot, whichever is greater.

3.3 CCTV MONITOR DISPLAY

A. The images displayed on the CCTV monitors shall be a view of the pipe above the water surface as seen by the CCTV camera as the unit is conveyed through the pipeline.

B. The camera lighting shall be fixed in intensity prior to commencing the survey and the white balance set to the color temperature emitted. In order to ensure color constancy, ideally no variation in illumination shall take place during the survey.
3.4 DATA DISPLAYS

A. The CCTV images shall include an initial data display that identifies the sewer reach being surveyed and a survey status display that provides continuously updated information on the location of the survey unit as the survey is being performed. These data displays shall be in alphanumeric form. The size and position of the data shall not interfere with the main subject of the monitor picture.

B. The on-screen text display should be white during inspections where the background behind the display is dark and, conversely, black where the background is light.

C. At the beginning of each pipeline segment being inspected, the following information shall be electronically generated and displayed on the CCTV monitors as well as included in the audio track:
   1. Date of survey
   2. Interceptor name/identification number
   3. Segment identification number or stationing
   4. Direction of survey (upstream or downstream)
   5. Time of start of survey

D. During inspections, the following information shall be electronically generated, automatically updated, and displayed on the CCTV monitors:
   1. Survey unit location in the pipeline in feet and tenths of feet from adjusted zero.
   2. Pipeline diameter.

3.5 PHOTOGRAPHS

A. During CCTV inspections, screen captures shall be taken from the monitor images and saved electronically of typical conditions every 200 feet and at all defects. The screen capture shall have the interceptor name, segment identification number, survey direction, footage, and date when photograph was taken. The annotation shall be clearly visible and in contrast to its background, shall have a figure size no greater than 1/4-inch, and shall be type-printed. The annotation shall be positioned on the front of the photograph so as to not interfere with the subject of the photograph. Files shall be named using the segment identification numbers.

B. The image of the pipeline interior shall fill the photographic image. Photographs must clearly and accurately show what is displayed on the monitor, which shall be in proper adjustment. Where significant features exist within 6-feet of each other, one photograph shall be made to record these features. Where there is a continuous feature, photographs shall not be taken at intervals of less than 6-feet unless absolutely necessary to show a change in the feature.

C. The images shall be kept electronically, copied to a CD, DVD, or external hard drive, and submitted with the inspection videos and logs per paragraph 3.8 in this section.

3.6 PIPELINE IDENTIFICATION, INSPECTION FORMS AND DEFECT CODES

A. The Contractor shall use the Owner’s pipeline identification numbering system and the segment identification system when performing the inspections for this project, as provided by the Engineer. CCTV inspection defect codes shall conform to those specified in the NASSCO PACP specification.
3.7 PRE-CLEANING INSPECTIONS

A. If the survey unit cannot pass the entire pipeline segment from its starting direction, the reach shall be inspected as much as possible and the Contractor shall notify the Engineer immediately of the failure to complete and why inspection could not be completed. The Engineer and HRSD will determine if the Contractor shall proceed with cleaning of the pipeline as specified. The Engineer may also decide to clean the line prior to proceeding with inspection. The Contractor shall be prepared to clean any and all lines, at the Engineer’s discretion, before, during or after inspection.

B. If any Contractor equipment becomes stuck in the pipeline, the Contractor shall be responsible for all costs associated with extracting the equipment from the main.

C. Any damages to public or private property resulting from Contractor activities shall be repaired by the Contractor at no cost to the Owner.

3.8 REPORT

A. Two copies of the inspection videos for each pipeline segment saved in mpeg format on CDs, DVDs, or external hard drives; electronic version (.jpg) of still photographs saved on CDs, DVDs, or external hard drives; a digital Microsoft Access database conforming to the NASSCO PACP database standard populated with all inspection and defect information; and hard copies and electronic PDF files of the inspection logs shall be submitted to the Engineer for review and approval. DVDs or sections thereof that do not conform to the specifications shall be re-recorded in the field at the Contractor's expense. Original DVDs and re-recorded runs shall be edited to provide a record with all inspections in sequential order from upstream to downstream. DVDs not in sequential order are unacceptable.

B. The inspection report shall include video recordings, pictures and any Owner required inspection forms and defect codes. Contractor shall provide equal documentation on both the videos and forms. Contractor shall maintain a copy of all report material. The Contractor shall provide comments as necessary to fully describe the existing condition of the pipeline, both through the voice over on the videos and on the inspection forms. Photographs shall further document both typical pipeline features, and defects.

C. Payment will not be made for any work until the Engineer has received, reviewed and approved up to date copies of all report documentation items specified in this paragraph 3.8. The Contractor shall submit these report documentation items a minimum of 10 business days in advance of any payment request to provide the Engineer ample time to review the files.

END OF SECTION
SECTION 02773
ULTRASONIC PIPELINE INSPECTION

1.0 GENERAL

1.1 DESCRIPTION

A. Scope

1. The Contractor shall perform external inspections of the project cast iron pipe (CIP) and ductile iron pipe (DIP) pressure mains and record the estimated pipe wall thickness using ultrasonic technologies. The pressure mains will remain in service during the ultrasonic inspection. The intent of the inspection is to obtain data of sufficient quality and quantity to identify areas of pipe wall material loss due to internal corrosion, particularly at high points of the pipeline. Ultrasonic thickness testing shall be completed at locations identified in the contract documents.

B. Requirements

1. The Contractor shall prepare the exterior of the pipeline for inspection including any pipe cleaning and surface grinding to provide a good contact surface for the ultrasonic probe.
2. Calibrate the ultrasonic testing (UST) equipment using a section of pipe similar to the test pipe in terms of material and original wall thickness. The UST equipment shall be calibrated to match the measured wall thickness of the sample.
3. The Contractor shall conduct an external inspection of the identified project ferrous pipe main sites using ultrasonic testing equipment and shall document the site of each test and the measured wall thickness at each site. A minimum of six locations around the circumference of the pipe shall be tested at each test site. These shall include a minimum of three locations at the pipe crown at the 1:00, 12:00 and 11:00 positions, one at each side of the pipe at the spring line and one in the lower half of the pipe circumference depending on ease of access.
4. Prepare a report for submittal to the Engineer which documents the testing conducted on the pipe at each site, with test results referenced to each site and at each test location. The documentation will present the test results of the UST including an evaluation of the data from each test and an assessment of the thickness of the pipe wall at each location around the pipe circumference. The draft reports should be prepared on a monthly basis.
5. The Contractor shall also provide daily field reports to the Engineer.

1.2 QUALITY ASSURANCE

A. Consider incorporating the following in Section “00200 - Instruction to Bidders” Article 4:

1. Contractor’s Qualifications: The Contractor shall have a minimum of five years of experience in such work necessary to successfully meet this specification and provide references for five ferrous pipe inspection projects involving the ultrasonic testing (UST) equipment to be used on this project.
2. Supervisor’s Qualifications: The Contractor shall assign a qualified field inspection team with a supervisor having a minimum of three years of experience in such work necessary to successfully meet this specification and provide references for three ferrous pipe inspection projects involving the UST equipment to be used on this project.

B. Equipment Calibration:
1. The Contractor must calibrate the UST equipment to work on the type of pipe to be inspected in this project. The Contractor must submit a plan for calibrating the equipment on site prior to beginning the first inspection. Alternatively, the Contractor must provide documentation that the equipment to be used has been calibrated on identical pipe. The documentation should confirm that the equipment operator during the calibration is the same operator on the project work.

1.3 SUBMITTALS

A. The following submittals shall be provided in the proposal:

1. Submit with bid resumes and project references a list of five similar projects within the past 5 years that required UST inspection.
2. Submit with bid resumes and project references for the field personnel who will be employed for this project.
3. Submit an example of previous work for approval. The example shall consist of one hard copy, CD or DVD of previous pipeline inspection work complete with inspection results, evaluation and conclusions. The submitted example shall be the work of the field supervisor or foreman to be used on this project and shall be for ferrous mains. Contractor shall be responsible for modifications to equipment and/or inspection procedures to achieve report material of acceptable quality.
4. Submit a work plan for calibrating the UST equipment prior to starting the inspection work. Alternatively, submit evidence of recent calibration of the UST equipment on the same type of pipe as for this project.

2.0 PRODUCTS

2.1 ULTRASONIC TESTING EQUIPMENT

A. The ultrasonic testing (UST) equipment shall be capable of measuring wall thickness in both cast iron and ductile iron pipe from [Engineer to specify range] in diameter, the range of sizes expected for this project.

3.0 EXECUTION

3.1 GENERAL

A. The Contractor will be responsible for the following:

1. Preparing access to the pipeline for the inspection including all excavation to expose the pipeline at the indicated test sites.
2. Provision of ventilation of the access pits for the duration of the inspection if needed.
3. Traffic control if needed.
4. At the conclusion of the inspection, backfilling of any excavation and restoration of the site.

3.2 ULTRASONIC TESTING

A. The Contractor shall conduct an ultrasonic survey of the project ferrous pipe segments identified in the contract documents and evaluate the ultrasonic data obtained to estimate the wall thickness at each location on the pipe circumference at each test site.
B. The field notes from the ultrasonic survey shall clearly identify each test location around the pipe perimeter and the measured wall thickness at each test location. Copies of the original field notes shall be provided as part of the documentation. The field notes shall include date and time, weather conditions, names of the inspection team members, and the identification of the inspection site. The notes shall include the identification number of the pipe segment being inspected as provided by the Owner or Engineer.

3.3 PREPARATION

A. The Contractor shall undertake all measures needed to prepare the ferrous pipelines for inspection using the Contractor’s equipment. This shall include any additional cleaning of the pipe exterior and any smoothing of the pipe wall as required to obtain an accurate measurement.

3.4 PIPELINE IDENTIFICATION

A. The Contractor shall use the Owner’s pipeline identification numbering system and the segment identification system when performing the inspections for this project, as provided by the Engineer.

3.5 INSPECTION REPORT

A. The Contractor shall provide an Inspection Report to the Engineer which will include the following at a minimum:

1. Identification of the test site by street address, intersection or easement. The report shall provide the pipe segment identification numbers assigned by the Engineer and the Owner as well as the date of the inspection and any other pertinent information.
2. A description and documentation of the calibration of the ultrasonic equipment used for this inspection.
3. A description of the inspections performed including the location along the pipe perimeter of each ultrasonic inspection and the resulting wall thickness measurements. This data should be presented in tabular form.

B. Five hard copies and one electronic copy of the Inspection Report shall be delivered to the Engineer within 14 calendar days of completing all inspections or testing on each pipeline segment.

C. Within 10 business days of receipt of any comments from the Engineer, the Contractor shall incorporate any comments and submit 5 hard copies [Engineer to verify the need for paper copies] and 2 electronic copies of the Final Inspection Report to the Engineer.

END OF SECTION
SECTION 02774
CONDITION ASSESSMENT DATA COLLECTION FOR PIPELINES BEING REPAIRED OR TO BE ABANDONED

1.0 GENERAL

1.1 DESCRIPTION

A. Scope:

1. Where a pipeline is being repaired or is being prepared for abandonment, HRSD wishes to collect condition assessment data on the pipeline while it is out of service. This section specifies the procedures for collecting condition assessment data on pipelines being repaired or to be abandoned. This section pertains to both pressure mains and gravity sewer mains. This section does not cover the work involved in the repair work or in the actual abandonment of the pipeline.

B. Requirements:

1. The condition assessment data may be taken from all types of pipe including ductile iron pipe, cast iron pipe, asbestos cement pipe, reinforced concrete pipe, prestressed concrete cylinder pipe and possibly high density polyethylene pipe or polyvinyl chloride pipe.

2. The condition data shall be formatted to fit HRSD data management requirements and provided to HRSD for review prior to the commencement of the abandonment procedures or repairs.

2.0 MATERIALS

2.1 EQUIPMENT

A. General:

1. All equipment specified in this section shall be in good working condition and manufactured or fabricated to withstand the severity of the work covered under this section.

B. Closed Circuit Television (CCTV) [if applicable]

1. CCTV equipment shall meet the minimum requirements specified in Section “02761 – Television Inspection of Pipelines” for CCTV Inspection. This includes the camera and lighting equipment, conveyance system and video recording equipment.

C. Ultrasonic Ferrous Pipe Wall Thickness Testing Equipment [if applicable]

1. Ultrasonic wall thickness testing equipment (UST) for ferrous material pipe shall meet the minimum requirements specified Section “02773 – Ultrasonic Pipeline Inspection”.

3.0 EXECUTION

3.1 GENERAL

A. The Contractor shall collect data on the physical condition of HRSD pipelines as and where directed by the Engineer.
3.2 PIPELINE CONDITION INSPECTION

A. Contractor shall be responsible for obtaining coupons or sections from the pipelines being repaired or to be abandoned, assessing the condition of the coupon and recording critical information. Wherever possible and appropriate, the Contractor shall use coupons taken from line stop operations, bypassing operations or from any other operations where material is removed from the pipe wall as part of the work. Where this is not possible, the Contractor shall take coupons or sample sections from the pipeline where directed by the Engineer.

B. For each site of repair work or from each pipeline to be abandoned, the Contractor shall record the following information:

1. General Data Each Site, All Pipelines
   a. Line identification number (HRSD assigned facility ID Number)
   b. Street or other location identification.
   c. Pipe material
   d. Where appropriate and available, record pipe class.
   e. Pipeline inner diameter.
   f. Presence and type of external coating or wrap
   g. Presence and type of interior liner, coating
   h. If a repair of a failure, record description of apparent cause of failure
   i. Photograph of inspection site and if a repair, photograph of failure section

2. Coupon Data
   a. GPS coordinates of coupon location to 0.1 foot accuracy. The vertical datum must include the pipe crown elevation at the site of the coupon, regardless of where the coupon was taken from the pipe wall.
   b. The clock position of the center of the coupon or section taken from the pipe. The clock reference should be when looking downstream.
   c. The flow direction shall be painted on the coupon prior to cutting.
   d. Coupon thickness, taken at a minimum of 3 locations
   e. General condition of coupon especially interior wall. Note presence and extent of corrosion, pitting or tuberculation.
   f. Take photographs of the coupon, including one photograph of the exterior of the coupon, one of the interior and one close-up of the coupon on edge. The Unique Coupon #, as assigned by the Engineer, clock position of coupon, and the flow direction shall be clearly denoted in every photo.
   g. All documentation, photos and videos shall bear the Coupon Tag number in the title. This number is a combination of the date the coupon was retrieved, the HRSD asset ID number and the Unique Coupon #.

3. For All Pipelines
   a. When directed by the Engineer in the plans, insert CCTV equipment and conduct a visual inspection of the pipeline and record the inspection electronically. The CCTV inspection should extend as far as is practicable for the equipment.
   b. Where access is feasible, conduct a visual inspection of the open ends of the pipeline and record observations of interior conditions. Note instances of corrosion or wall loss, pitting or tuberculation on the pipe interior.

4. For Ferrous Pipelines [if applicable]
   a. Where access to interior of the pipeline is feasible, take wall thickness measurements around the exposed pipe ends in at least the four quadrants (crown, invert and both springlines).
   b. Where access to the interior of the ferrous pipeline is not feasible, conduct external wall thickness testing using ultrasonic testing (UST) equipment as specified in Section “02773 – Ultrasonic Pipeline Inspection”. UST wall thickness tests should be conducted at as many locations around
the pipe perimeter as time permits with a minimum of at least three locations at the pipe crown, and once at each of the springline locations.

5. For Asbestos Cement Pipelines [if applicable]
   a. Visually inspect the condition of interior wall of the pipe and note areas of softness and depth of soft material.
   b. The coupon/sample shall be contained in accordance with appropriate asbestos handling procedures and delivered as requested by OWNER for further testing.

6. For Reinforced Concrete Pipe [if applicable]
   a. Visually inspect the condition of interior wall of the pipe and note areas of softness and depth of soft material.
   b. The coupon/sample thickness dimensions should include the thickness of the concrete material over the reinforcing steel on both the interior and exterior sides of the steel reinforcing.

7. For Prestressed Concrete Cylinder Pipe [if applicable]
   a. Visually inspect the condition of interior wall of the pipe and note areas of softness and depth of soft material.
   b. The coupon/sample thickness dimensions should include the thickness of each layer of the composite pipe including the interior mortar layer, the steel cylinder thickness, the mortar layer between the steel cylinder and the prestressing wires (for embedded PCCP only) and the exterior concrete layer. Where there is not cementitious layer between the cylinder and wire, record as a lined cylinder PCCP.

8. For All Plastic Pipe [if applicable]
   a. Where plastic pipelines (HDPE, PVC or GRP) are being repaired or abandoned, only coupons or sample wall sections will be needed as indicated above. No additional internal inspection tests will be required.

3.3 DATA MANAGEMENT

A. All documentation, photos, and videos shall be turned over to the Engineer. When requested, coupons shall be turned over to HRSD upon direction by the Engineer, and the Contractor shall coordinate with Engineer on how to affix the Coupon Tag number prior to delivery.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Removal of unsound and, as necessary, sound concrete and surface preparation, including full-depth, partial-depth, and shallow-depth concrete rebuilds.
2. Surface preparation of reinforcing steel and installation of supplemental reinforcement.
3. Installation of adhesive-grouted dowels.
4. Cast-in-place concrete for rebuild applications, including but not limited to formwork; proprietary rebuild materials; batching, mixing, and placement procedures; finishing; and curing.
5. Rebuild Materials and Placement Procedures:
   a. Full depth rebuilds cast-in-place from top surface.
   b. Formed-and-poured partial depth concrete rebuilds on horizontal, vertical and overhead surfaces.
   c. Drypacked vertical and overhead partial depth rebuilds.
   d. Trowel-applied shallow-depth rebuilds at vertical and overhead surfaces.
   e. Core hole rebuilds.

1.2 RELATED SECTIONS

A. Following Work items are related to Work in this Specification, but are specified in other Specifications:
1. Section 03800: Embedded Galvanic Anodes for Concrete Rebuilds [Engineer to verify applicability]
2. Section 07900: Joint Sealant and Expansion Joint Systems [Engineer to verify applicability]

B. This section does not include all requirements related to shoring that may be necessary prior to performing concrete demolition and rebuild. The ENGINEER should review the proposed rebuild location and structure to determine the structural impact of any concrete demolition and repair and provide additional shoring requirements, if necessary.

1.3 DEFINITIONS

A. Abrasive – Any hard, strong substance, such as rocks, sand, water, or minerals, that will cut, scour, pit, erode, or polish another substance.

B. Adhesion – The bonding of two surfaces through interfacial effects such as molecular (valence) forces or interlocking action, or both.

C. Admixture – A material other than water, aggregates, hydraulic cement, or fiber reinforcement, added to concrete, mortar, or grout, during batching or mixing to enhance plastic or hardened material properties, or both.

D. Aggregate – Granular materials, such as sand, gravel, and crushed stone, commonly used in concrete, mortar, or grout.

E. Bond – Adhesion and grip of a material to other surfaces against which it is placed.

F. Cathodic Protection – A form of corrosion protection for reinforced concrete wherein a sacrificial metal is caused to corrode in preference to the reinforcement, thereby protecting the reinforcement from corrosion.

G. Cofferdam – A temporary structure enclosing all or part on a construction area so that construction or repair can proceed in the dry.
H. Cohesion - The state in which the constituents of a mass of material are held together by chemical and physical forces.

I. Consolidation – The process whereby the volume of freshly placed mortar or concrete is reduced to the minimum practical space, usually by vibration, rodding, tamping, or some combination of these actions.

J. Corrosion – Degradation of concrete or steel reinforcement caused by electrochemical or chemical attack.

K. Cure – The process by which a compound attains its intended performance properties by means of evaporation, chemical reaction, heat, radiation, or combinations thereof.

L. Degradation – A detrimental change in the physical and/or chemical properties of a material.

M. Delamination – A separation along a plane parallel to a surface.

N. Deterioration – Physical manifestation of failure of a material (e.g., cracking, delamination, flaking, pitting, scaling, spalling, staining) caused by service conditions or internal autogenous influences.

O. Erosion – Progressive disintegration of a solid by the abrasive or cavitation action of gases, fluids or solids in motion.

P. Form – A temporary structure, or mold, to support a material while it is curing and gaining sufficient strength to be self-supporting.

Q. Grout – A mixture of cementitious material and water, with or without aggregate, proportioned to produce a pourable consistency without segregation of the constituents.

R. Keyway – A recess or groove in a concrete substrate which is filled with material to provide increased shear strength along the interface.

S. Proprietary – Made and marketed by one having the exclusive right to manufacture and distribute.

T. Reinforcement – Bars, wires, strands, fibers, or other slender members which are embedded in concrete primarily to improve tensile strength.

U. Reinforcement Continuity – A condition in reinforced concrete in which the reinforcing steel is sufficiently interconnected to provide a path for electrical current.

V. Sacrificial Anodes – Chemically active metals such as zinc, aluminum, and magnesium which, when electrically connected to the reinforcing bar, will provide the energy needed to cathodically protect the reinforcing bar.

W. Saturated Surface-Dry – Condition of an aggregate particle or other porous solid when the permeable voids are filled with water and no water is on the exposed surfaces.

X. Segregation – The differential concentration of the components of mixed concrete, aggregate, or the like, resulting in nonuniform proportions in the mass.

Y. Shrinkage – A decrease in one or more dimensions of an object or material.

Z. Slump – A measure of consistency of freshly mixed concrete.

1.4 REFERENCE STANDARDS

   1. American Concrete Institute (ACI):
      a. ACI 117: Specification for Tolerances for Concrete Construction and Materials and Commentary
      b. ACI 207.1R: Guide to Mass Concrete
      c. ACI 222R: Protection of Metals in Concrete Against Corrosion
d. ACI 301: Specifications for Structural Concrete  
e. ACI 305R: Guide to Hot Weather Concreting  
f. ACI 306R: Guide to Cold Weather Concreting  
g. ACI 315: Details and Detailing of Concrete Reinforcement  
h. ACI 318: Building Code Requirements for Structural Concrete and Commentary  
i. ACI 347: Guide to Formwork for Concrete  
j. ACI 355.4: Qualification of Post-Installed Adhesive Anchors in Concrete and Commentary  

2. ASTM International (ASTM):  
a. ASTM A276: Standard Specification for Stainless Steel Bars and Shapes  
b. ASTM A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement  
c. ASTM A706: Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement  
d. ASTM C31: Standard Practice for Making and Curing Concrete Test Specimens in the Field  
e. ASTM C33: Standard Specification for Concrete Aggregates  
f. ASTM C39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens  
g. ASTM C42: Standard Test Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete  
h. ASTM C94: Standard Specification for Ready-Mixed Concrete  
j. ASTM C114: Standard Test Methods for Chemical Analysis of Hydraulic Cement  
k. ASTM C138: Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete  
l. ASTM C143: Standard Test Method for Slump of Hydraulic-Cement Concrete  
m. ASTM C150: Standard Specification for Portland Cement  
o. ASTM C171: Standard Specification for Sheet Materials for Curing Concrete  
p. ASTM C185: Standard Test Method for Air Content of Hydraulic Cement Mortar  
r. ASTM C231: Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method  
s. ASTM C260: Standard Specification for Air-Entraining Admixtures for Concrete  
u. ASTM C309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete  
v. ASTM C403: Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance  
w. ASTM C469: Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression  
x. ASTM C494: Standard Specification for Chemical Admixtures for Concrete  
y. ASTM C496: Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens  
z. ASTM C618: Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete  

aa. ASTM C856: Standard Practice for Petrographic Examination of Hardened Concrete  
bb. ASTM C1012: Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution
cc. ASTM C1064: Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
dd. ASTM C1152: Standard Test Method for Acid-Soluble Chloride in Mortar and Concrete
e. ASTM C1202: Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration
ff. ASTM C1218: Standard Test Method for Water Soluble Chloride in Mortar and Concrete
hh. ASTM C1293: Standard Test Method for Determination of Length Change of Concrete Due to Alkali Silica Reaction
ii. ASTM C1439: Standard Test Methods for Evaluating Polymer Modifiers in Mortar and Concrete
jj. ASTM C1524: Standard Test Method for Water Extractable Chloride in Aggregate (Soxhlet Method)
ll. ASTM C1621: Standard Test Method for Passing Ability of Self Consolidating Concrete by J Ring

3. American Welding Society (AWS):
a. AWS D1.4/1.4M: Structural Welding Code-Reinforcing Steel
4. Concrete Reinforcing Steel Institute (CRSI):
a. Manual of Standard Practice
5. ICC Evaluation Service (ICC-ES):
a. AC308: Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements
6. International Concrete Repair Institute (ICRI):
b. Technical Guideline No. 310.2 Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
7. The Society for Protective Coatings (SSPC):
8. United States Army Corps of Engineers (USACE):
   CRD-C 39: Test Method for Coefficient of Linear Thermal Expansion of Concrete.

1.5 DEFINITIONS

A. Abrasive Blast Cleaning: Surface preparation of substrates by abrasive propelled at high speed.
B. Concrete Rebuild: Repairing or restoring deteriorated, damaged, or otherwise unsound concrete.
C. Corrosion: The oxidation or eating away of a metal or other material by exposure to chemical or electrochemical action.
D. Feather Edging: Reducing the thickness along the edge of a material.
E. Full-Depth Concrete Rebuild: Reinforced concrete repair that encompasses the full section of an existing concrete element.
F. Overlay: A layer of non-structural construction material, such as cementitious mortar, placed over an existing structural element or substrate to improve aesthetics, provide function and/or add protection.
G. Partial-Depth Concrete Rebuild: Reinforced concrete repair that extends past, at least, the first later of reinforcing of an existing concrete element.
H. Quality Assurance Inspector: Certified and/or qualified individual(s) responsible for inspecting and/or testing Work such as conditions, materials, installations, applications, etc. to verify Work is performed in accordance with applicable specifications and requirements.
I. Shallow-Depth Concrete Rebuild: Concrete repair that is less than 2 inches deep with no reinforcing bars exposed.

J. Welding Specialist: A Certified Welding Inspector (CWI) as per the AWS D1.4/D1.4M.

1.6 SUBMITTALS

A. Pre-Award Submittals: Submitted with Bid
   1. CONTRACTOR and Subcontractor Qualifications
   2. Ready-Mix Concrete Supplier Qualifications
   3. Qualifications for Installer of Adhesive-Grouted Dowels
   4. Intent to Warrant Documentation

B. Pre-Construction Submittals: Submitted prior to performing Work.
   1. Quality Control Plan / Work Plan
      a. To be submitted as part of Quality Control System.
   2. Product Data / Safety Data
      a. List of proposed materials, including aggregates for extension, and additives.
      b. Technical data sheets for each type of manufactured material and product indicated, including but not limited to:
         1) Rebuild materials.
         2) Reinforcing bar mechanical splices.
         3) Reinforcement supports.
         4) Corrosion-inhibiting coating.
         5) Adhesive for grouted dowels.
         6) Curing blanket.
         7) Curing compound.
      c. Safety Data Sheets.
      d. Written verification from proprietary rebuild material manufacturer of aggregate extension requirements.
   3. Shop Drawings:
      a. Steel Reinforcement: Details of fabrication, bending, and placement, prepared in accordance with ACI 315. Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
      b. Welding: Description of reinforcing bar weld locations, welding procedure specifications and AWS welder certification when welding is permitted.
      c. Formwork: Detailing of fabrication, assembly, and support of formwork prepared by, or under supervision and sealed by professional engineer licensed in State of Virginia.
   4. Material Manufacturer Written Certification for Proprietary Rebuild Material Indicating:
      a. Lot numbers of materials for Project have been tested and meet or exceed material properties published in product data sheets, including compressive strength, slump during lot testing, and amount of water used during mixing.
      b. CONTRACTOR’s foremen and laborers have been trained in use of rebuild products.
      c. Proposed alternate proprietary rebuild materials, include supplemental pre-qualification information and test reports. Include notice if tests indicate concrete or mortar is not in conformance with product data sheets.
   5. Design Mixes for each Ready-Mix Concrete:
      a. Indicate amount of mix water to be withheld for later addition at Site without adversely affecting hardened concrete.
      b. Indicate dosage range for all admixtures, including retarding, accelerating, and water reducing admixtures that may potentially be added on site, and the anticipated effects on mix set time, slump retention, and air content.
      c. For proposed alternate mix designs, include supplemental pre-qualification information and test reports.
6. Concrete Placement Plan, including control measures for ensuring SSD prior to placement and limiting effects due to temperature and humidity during placement, finishing, and curing.

7. Batch Tickets for all Ready-Mix Concrete.

8. Weld Procedure Specification (WPS) for Welding Reinforcing Bars:
   a. AWS D1.4/D1.4M; including but not limited to:
      1) If chemical analysis and carbon equivalent of reinforcing bars is not known, use pre-heat temperature of 300 to 500 degrees F and E7018 electrodes.
      2) Minimum preheat, welding process, and filler metal.
         a) If chemical analysis and carbon equivalent of reinforcing bars is not known, use pre-heat temperature of 300 to 500 degrees F and E7018 electrodes.
         b) If oxyacetylene torch is used to achieve preheat, clean steel surface with grinder or wire brush before welding.
      3) Tension and macroetch test results for welds other than fillet welds, using maximum reinforcing bar size approved by ENGINEER; unless specifically waived by ENGINEER.

C. Closeout Submittals: Submitted upon completion of Work prior to final payment.
   1. Record documentation of Work performed such as:
      a. Red-line Drawings, Specifications and/or Sketches.
      b. Construction Photos.
      c. Quality Assurance Inspection and Quality Control Reports.

D. Executed Warranty(s)

1.7 QUALITY ASSURANCE AND QUALITY CONTROL

A. CONTRACTOR Qualifications:
   1. Experienced with successful installations of specified materials in similar environments and on similar structures in use for minimum of 5 years.
   2. Foremen with minimum of 5 years of experience as foremen on similar projects, who are fluent in English, to be on site at all times during Work. Do not change foremen during course of Project except for reasons beyond control of CONTRACTOR; inform OWNER in advance of any changes.
   3. Foremen and at least 50 percent of laborers shall be trained by material manufacturers in use of specific products to be used.

B. Qualifications for Installer of Adhesive-Grouted Dowels:
   1. ACI-CRSI certified Adhesive Anchor Installer and/or installers who are qualified by the product manufacturer.
   2. Foreman or laborer with minimum 5 years of experience performing similar Work to be on site at all times during Work. Do not change foreman or laborer during course of Project except for reasons beyond control of dowel Installer; inform OWNER in advance of any changes.

C. Ready-Mix Concrete Supplier Qualifications:
   1. ASTM C94; Certification of Production Facilities and Delivery Vehicles by National Ready Mixed Concrete Association.

D. Adhesive for Adhesive-Grouted Dowels:
   1. Provide samples of adhesive to OWNER and/or Quality Assurance Inspector for observation of set and compression testing.
   2. Provide minimum of 3 samples per shift during first 4 shifts of adhesive use on project.
   3. Make samples by placing adhesive in 3/8-inch-diameter test tubes to height of approximately 1 inch so that after trimming cylinder of 3/8-inch diameter and 3/4-inch length can be obtained.

E. Pre-Construction Meeting:
1. Review requirements for concrete rebuild Work, including but not limited to:
   a. Schedule.
   b. Availability of materials and CONTRACTOR’s personnel, equipment, and facilities needed to make progress and avoid delays.
   c. Site use, access, staging, and set-up location limitations, including on-site testing laboratory and sample storage.
   d. Limitations due to OWNER’s use of facility.
   e. Procedures for concrete rebuild Work, including but not limited to:
      1) Removal of unsound and sound concrete.
      2) Surface preparation.
      3) Coating of exposed reinforcing steel.
      4) Installation of supplemental reinforcement.
      5) Installation of adhesive-grouted dowels.
      6) Rebuild material placement: including but not limited to formwork; proprietary rebuild materials; batching, mixing, and placement procedures; finishing; and curing.
   f. Approved mockup requirements and procedures.
   g. Testing and inspection requirements.
   h. Site protection measures and protection of adjacent surfaces.
   i. Governing regulations.

2. CONTRACTOR’s site superintendent / foremen. CONTRACTOR’s quality control representative, OWNER, ENGINEER, representatives of other trades directly affected by Work and/or other stakeholders shall attend.

F. Pre-Placement Meeting:
1. Conduct meeting at Project site before concrete placements.
2. Review requirements for specific concrete rebuild placement, including but not limited to:
   a. Materials and CONTRACTOR’s personnel, equipment, and facilities that will be used for placement.
   b. Site use, access, and staging.
   c. Coordination with OWNER’s use of facility.
   d. Procedures for concrete rebuild placement, including but not limited to:
      1) Prewetting concrete substrate.
      2) Batching, mixing, and placement procedures.
      3) Finishing.
      4) Curing.
      5) Special procedures related to temperature and humidity during placement, finishing, and curing, and thermal/mass concrete effects.
   e. Testing and inspection requirements.
   f. Site safety and protection measures, including but not limited to protection of adjacent surfaces.
   g. Criteria for formwork stripping and shoring removal.
3. CONTRACTOR’s site superintendent / foremen, ENGINEER, OWNER, Quality Assurance Testing and Inspection Representative(s) and representatives of other trades directly affected by Work shall attend.

G. CONTRACTOR’s Quality Control System:
1. CONTRACTOR’s quality control system is the means of assurance that construction complies with the requirements of the ENGINEER and/or specification. Controls shall be adequate to cover all construction operations.
2. Establish a quality control system and perform sufficient inspection and tests of all items of Work, including that of subcontractors, to ensure conformance to the specification for materials, workmanship, construction, finish, functional performance, and identification.
3. Maintain records of all inspections and tests performed, instructions received from OWNER, ENGINEER or Quality Assurance Inspector(s), and actions taken as a result of those instructions. These records shall include evidence that the required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, etc.), proposed or directed remedial action, and corrective action taken. CONTRACTOR shall document inspections and tests as required by this section.

4. Testing and Inspection: Include a comprehensive schedule of Work requiring testing or inspection, including the following:
   a. CONTRACTOR-performed tests and inspections including subcontractor performed tests and inspections. Include required tests and inspections and CONTRACTOR-elected tests and inspections.
   b. OWNER-performed tests and inspections.

5. Materials and fabrication procedures are subject to inspection. Tests in the mill, shop, or field shall be conducted by a qualified Inspection Agency. Such inspections and tests will not relieve CONTRACTOR of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

6. CONTRACTOR shall promptly remove and replace materials or fabricated components that do not comply with the specified requirements.

H. Field Quality Control and Quality Assurance Testing:
1. Quality Assurance Testing Agency: OWNER or CONTRACTOR (at the request of OWNER) will provide qualified third-party Quality Assurance Testing and Inspection to perform inspections and tests and submit reports during Work. Reports will be provided to OWNER and CONTRACTOR.
   a. Quality Assurance Testing and Inspection shall be performed, supervised and/or reviewed by a professional engineer licensed in State of Virginia unless otherwise permitted by OWNER.

2. Sampling of materials shall be in accordance with ASTM C172 and will be performed on-grade. Sampling shall generally comply with the following requirements:
   a. When pumping, the rebuild material will be directed to a wheel barrow or other suitable means for testing agency to acquire sufficient materials for testing and casting all specimens (approximately 2-1/2 cubic feet).
   b. Collect first test sample at beginning of placement, and subsequent samples at frequency noted in Table 1 of this Specification.
   c. Samples from proprietary rebuild material shall be taken from the second batch prepared. If two or more mixers are used, ensure that samples are obtained from mixers in an alternating fashion.

3. Test Sample Set:
   a. Six 3-inch diameter by 6-inch long cylinders, 4-inch diameter by 8-inch long cylinders or 6-inch diameter by 12-inch long cylinders should the coarse aggregate size exceed 3/4 inches will be made and cured in accordance with ASTM C31. The number of required sets shall be in accordance with the Table 1 of this Specification.
   b. Slump in accordance with ASTM C143.
   c. For Self-Consolidating Concrete: Slump flow in accordance with ASTM C1611.
   d. Air content in accordance with ASTM C231
   e. Concrete and air temperature in accordance with ASTM C1064.

4. Cylinders will be cured under field conditions for 1 day; then transported to testing laboratory and cured for remaining period until testing.

5. For each test sample set, 2 cylinders will be tested in compression at 3 days, 2 cylinders at 7 days and 2 cylinders at 28 days. Compression tests will be performed in accordance with ASTM C39 and shall be an average of 2 samples at a given age. OWNER may adjust required number of sample test sets and/or frequency of testing upon CONTRACTOR request and/or based on schedule and need.
6. For proprietary rebuild materials, CONTRACTOR shall record material bag weights for minimum of 10 percent of planned bags per lot of material. The average bag weight shall be used to determine amount of water to be used, proportional to manufacturer’s product data based on the measured bag weight.

7. Test reports for each test sample will include following information:
   a. Specimen number.
   b. Portion of structure represented by material tested.
   c. Date cast.
   d. Date tested.
   e. Slump or slump flow and visual stability index.
   f. Air content.
   g. Concrete and air temperature.
   h. Individual cylinder strength and type of failure.
   i. Rebuild material strength on product data sheet.
   j. Notice if test indicates rebuild material does not conform with following criteria:
      1) Rebuild material strength will be considered satisfactory if average of two 28-day test results meets or exceeds the specified 28-day strength and neither 28-day test results is below 90% of the specified 28-day strength.
      2) Proprietary rebuild materials shall be within 1 inch of the manufacturer’s specified slump or slump flow. Rebuild material may be rejected if slump or slump flow not within specified limits or if segregation is visible at leading edge of spread. Manufacturer shall provide slump or slump flow if not reported on typical product data sheet.
   k. Non-Conforming Rebuild Material:
      1) If tests indicate that rebuild material is not in conformance with criteria above, remove and replace non-conforming rebuild material or perform additional testing, acceptable to OWNER and/or ENGINEER, to verify conformance with Specification, at no cost to OWNER.
      2) For Additional CONTRACTOR Performed testing:
         a) Procure core samples in accordance with ASTM C42.
         b) If tests indicate that slump, air entrainment, or other requirements have not been met, examine core samples petrographically, according to ASTM C856, to evaluate hardened concrete characteristics.
         c) If compressive-strength tests do not meet acceptance requirements, procure 3 core samples from each portion of structure represented by unsatisfactory tests, and test in compression. Strength of rebuild material in area represented by core tests is satisfactory if average of 3 compressive strength tests equals or exceeds 85 percent of specified 28-day compressive strength and no compressive-strength test value is less than 75 percent of specified 28-day compressive strength. If strength acceptance criteria are not met, remove and replace non-conforming rebuild material areas at no cost to OWNER.
      3) Perform additional inspection and testing and inspecting, at no cost to OWNER, to determine compliance of replaced or additional Work with specified requirements.
      4) CONTRACTOR is responsible for any schedule delays, costs and related items resulting from non-conforming materials or additional testing of suspected non-conforming materials.

8. Cast additional cylinders to verify rebuild material strength to determine when shoring or formwork may be removed as required. Cast cylinders with final placement of day and field cure adjacent to rebuild location until tested. CONTRACTOR to pay for cost of sampling and testing.

9. CONTRACTOR Responsibilities:
   a. CONTRACTOR shall Coordinate Work schedule to allow inspections and testing.
   b. Provide access to Work in timely manner for inspections and testing.
   c. Record lot numbers, expiration dates, and use dates of materials.
   d. Maintain record of locations and quantities of Work installed.
10. Inspections:
   a. Inspections are to be performed at critical steps throughout the rebuild process. Unless indicated otherwise, a qualified Quality Assurance Inspector and/or ENGINEER shall perform inspections.
   b. CONTRACTOR’s Quality Control representative shall perform initial inspections and correct any items not in conformance with specification prior to requesting inspection.
   c. Do not proceed with Work that may make hold point inspections difficult or impossible to perform until inspection has been completed and deficiencies corrected, unless ENGINEER and/or OWNER waives specific inspection requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials according to manufacturer’s recommendations and in such manner as to prevent damage to materials and structure.

B. Keep materials dry and do not allow materials to be exposed to moisture during transportation, storage, handling, or installation. Reject and remove from Site new materials which exhibit evidence of moisture during application or which have been exposed to moisture.

C. Deliver materials to Project site in original, unopened containers, labeled with manufacturer's name, product brand name and type, date of manufacture, lot number, and directions for storing and mixing with other components.

D. Store materials in original, undamaged containers in clean, dry, protected location on raised platforms with weather-protective coverings, within temperature range required by manufacturer. Protect stored materials from direct sunlight.

E. Store aggregate stockpile in manner to avoid segregation or contamination with foreign matter. Store away from normal drainage paths and cover with canvas or plastic if necessary to keep dry.

F. If containers become torn or otherwise damaged prior to use, dispose of affected materials.

G. Limit stored materials on structures to safe loading of structure at time materials are stored and to avoid permanent deck deflection.

H. Conspicuously mark unlabeled, damaged, or opened containers or containers with contaminated materials and remove from site as soon as possible.

I. Remove and replace materials that cannot be applied within stated shelf life.

1.9 SAFETY

A. Adhere to requirements herein and applicable requirements within the Contract Documents.

B. The CONTRACTOR shall ensure OWNER and CONTRACTOR personnel are aware of any hazards peculiar to the jobsite.
   1. Identify location(s) of supplied and/or existing first aid stations, eye wash stations and pertinent safety equipment
   2. Provide contact information of responsible personnel and emergency phone numbers.
   3. Obtain contact information for OWNER stakeholders and pertinent OWNER site personnel.
   4. Determine and communicate evacuation routes.

C. Keep all work areas clean and safe.

D. Obey all plant rules and regulations.

E. Barricade and/or establish appropriate labeled boundaries to prevent entry to Work location by individuals whom do not have a business need to enter.
   1. Establish appropriate sound and/or material exposure/hazard boundaries *(as required)*.
   2. Hang appropriate hazard labels and/or communicate applicable hazards to appropriate OWNER personnel.
3. Ensure appropriate contact information is clearly displayed and/or communicated such that individuals may contact responsible personnel to communicate hazards and/or permit access.

F. The CONTRACTOR shall conduct all work covered by this section in accordance with all pertinent OSHA regulations.

1.10 CHANGES IN WORK

A. It shall be the responsibility of the CONTRACTOR to notify OWNER of any conflicts, obstructions, discrepancies, damage, deterioration and similar items at variance with the Contract Document content, specifications, instructions, field conditions, weather, etc. that could jeopardize integrity or performance of coating systems promptly upon discovery by means of a formally submitted Request for Information (RFI).

B. CONTRACTOR shall submit proposed changes relating to Work including but not limited to scope, execution, materials, schedule, etc. to OWNER by means of a formally submitted RFI.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Ready-Mix Concrete Materials:
   1. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mixes or field-test data, according to ACI 301.

2. Aggregate and Paste Materials:
   a. Source Limitations: Obtain each type or class of cementitious material of same brand from same manufacturer's plant, each aggregate from single source.
   b. Cement: ASTM C150, Type II or V.
   c. Fly Ash: ASTM C618, Type F. Include 20 to 30 percent by mass of total cementitious materials, as cement replacement, unless otherwise approved.
   d. Aggregates: ASTM C33, including Table 3; from single source with documented record of at least 10 years of satisfactory service using similar aggregates and cementitious materials in similar applications and service conditions.
      1) Coarse Aggregates: Uniformly graded; Maximum size of coarse aggregate per ACI 318 unless noted otherwise; Class 4S.
   e. Water: ASTM C1602; potable; free from substances known to be harmful to portland cement; and with less than 0.05 percent chloride ions.
   f. Maximum Water-Cementitious Materials Ratio, by weight: 0.45.

3. Admixtures:
   a. General:
      1) No more than 0.05 percent chloride ions.
      2) Admixture manufacturer shall certify that admixtures meet requirements and are compatible with other concrete mixture components.
      3) Use admixtures according to manufacturer's written instructions.
      4) No chlorides shall be intentionally introduced into concrete mix.
      5) Obtain admixtures from single manufacturer.
   b. Air-Entraining Admixture: ASTM C260. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content recommended by ACI 318 for moderate exposure, unless otherwise indicated. Use one of following:
      1) Air Mix, Eucon Air 40; Euclid Chemical Company.
      2) Darex AEA ED, Daravair 1000; W. R. Grace & Co.
      3) MasterAir AE 200; BASF Corporation.
      4) Sika Air; Sika Corporation.
      5) Approved Equal
c. Water-Reducing Admixture: ASTM C494, Type A. Products that may be incorporated in the work include, but are not limited to, the following:
   1) Eucon WR 75; Euclid Chemical Company.
   2) WRDA 20; W. R. Grace & Co.
   3) MasterPolyheed 1020; BASF Corporation.
   4) Sikament 686; Sika Corporation.
   5) Approved Equal

d. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or Type G. Products that may be incorporated in the work include, but are not limited to, the following:
   1) Eucon 37; Euclid Chemical Company.
   2) Daracem 19; W. R. Grace & Co.
   3) MasterRheobuild 1000; BASF Corporation.
   4) Sika ViscoCrete 2100; Sika Corporation.
   5) Approved Equal

e. Water-Reducing, Non-Corrosive, Non-Chloride Accelerating Admixture: ASTM C494, Type C or E. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least 1 year duration) using an acceptable accelerated corrosion test method, such as electrical potential measures. Products that may be incorporated in the work include, but are not limited to, the following:
   1) Eucon AcN 200; Euclid Chemical Company.
   2) PolarSet; W. R. Grace & Co.
   3) MasterSet FP 20; BASF Corporation.
   4) SikaSet NC; Sika Corporation.
   5) Approved Equal

f. Water-Reducing, Retarding Admixture: Products that may be incorporated in the work include, but are not limited to, the following:
   1) Eucon Retarder 75; Euclid Chemical Company.
   2) Daratard 17; W. R. Grace & Co.
   3) MasterSet R 100; BASF Corporation.
   4) Plastiment ES; Sika Corporation.
   5) Approved Equal

g. Anti-Microbial Admixture: For use in H₂S and microbial-induced corrosion environments. Shall have documented performance of 10 (min) applications in service for 5 years (min) with minimal-to-no deterioration in H₂S environments averaging 50ppm (min). Products that may be incorporated in the work include, but are not limited to, the following:
   1) Conmic®Shield® HD.
   2) Approved Equal.

h. Crystalline Waterproofing Admixture: Chloride content shall be no greater than 0.1%. Shall be capable of sealing cracks up to 0.4mm. Shall have a minimum 50% reduction in concrete permeability per CRD-C 48. Products that may be incorporated in the work include, but are not limited to, the following:
   1) Xypex Admix C-500/C-500 NF; Xypex Chemical Corporation.
   2) Crystal-X AdMix; ConShield Technologies Inc.
   3) Approved Equal.

i. Hardening Admixture: Products that may be incorporated in the work include, but are not limited to, the following:
   1) Hard-Cem; Kryton International Inc.
   2) Approved Equal.

B. Proprietary Concrete Rebuild Materials:
   1. Shall contain no calcium chloride or added gypsum.
   2. Water-Cementitious Materials Ratio: 0.45 maximum.
   3. Aggregate Materials:
a. Aggregates: Use the + No. 170 mesh fraction obtained by wet sieving according to ASTM C1171 for the tests specified in the section titled “Methods of Sampling and Testing” of ASTM C33. If aggregate(s) is added to product as an extender, each additional aggregate is to be tested per ASTM C33 requirements. Pea gravel or other coarse aggregate added as an extension shall meet requirements of Table 3, Class 3S. ASTM C1260 test results for the + No. 170 mesh fraction, as well as each additional aggregate shall be reported to OWNER and/or ENGINEER for approval.
b. Obtained from single source with documented record of at least 10 years of satisfactory service using similar aggregates and cementitious materials in similar applications and service conditions; acceptable to proprietary concrete manufacturer.
c. Extension of products with aggregate:
   1) Pre-packaged material may only be extended in strict accordance with the manufacturer’s guidance.
   2) Obtain written verification of product extension requirements from the manufacturer. Submit written verification to OWNER and ENGINEER for approval.
   3) Aggregate used for extension shall be clean, rounded, 3/8-inch pea gravel, or as approved by product manufacturer. Aggregate shall be thoroughly washed and/or saturated surface dry as recommended by manufacturer. Aggregates for extension shall meet ASTM C33 requirements including deleterious materials as described below.
   4) Maximum aggregate extension shall be in keeping with manufacturer’s recommendations. In no case shall total coarse aggregate content exceed 50 percent of the total rebuild product weight including the aggregate extension.

C. Compressive Strength:
   1. Compressive Strength: 4,000 psi (min).

D. Concrete Rebuild Mixes:
   1. General:
      a. For applications exposed to H2S and microbial-induced corrosion, at least one of the following shall be incorporated into the Work:
         1) Incorporate anti-microbial admixture into the concrete rebuild material.
         2) Utilize surface applied coatings and/or materials designed to protect concrete surfaces from exposure to H2S.
   2. Full-depth Rebuilds Cast-in-Place from Top Surface:
      a. HRSD Mix 1: Ready-mix concrete with low electrical resistivity (less than 15,000 ohm-cm) for use with galvanic anodes.
         1) Provide required data and mix design for evaluation.
         2) Provide required testing data including electrical resistivity testing data for evaluation.
   3. Formed-and-poured partial-depth concrete rebuilds on horizontal, vertical and overhead surfaces:
      a. HRSD Mix 2: Proprietary silica-fume or polymer-modified concrete or cementitious mortar with 3/8-inch aggregate added, per manufacturer’s recommendations, with high electrical resistivity (greater than 15,000 ohm-cm).
         1) Sikacrete 211 SCC Plus; Sika Corporation.
         2) Eucocrete; Euclid Chemical Company.
         3) SikaTop 111 Plus; Sika Corporation.
         4) Approved Equal
   4. Trowel-applied (drypacked) vertical and overhead partial and shallow-depth rebuilds with lift thickness not to exceed 1-1/2 inches (vertical) / 1-inch (overhead), unless otherwise specified by manufacturer:
      a. HRSD Mix 3: Proprietary silica-fume- or polymer-modified cementitious, non-sag mortar with high electrical resistivity (greater than 15,000 ohm-cm).
         1) SikaTop 123 Plus; Sika Corporation.
2) Verticoat Supreme; Euclid Chemical Company.
3) EucoRepair V100; Euclid Chemical Company.
4) DuralTop Gel; Euclid Chemical Company.
5) Approved Equal

5. Horizontal shallow-depth rebuilds:
   a. HRSD Mix 4: Proprietary silica-fume- or polymer-modified cementitious, mortar with low electrical resistivity (less than 15,000 ohm-cm).
      1) Concrete-Top Supreme; Euclid Chemical Company.
      2) Approved Equal
   b. HRSD Mix 5: Proprietary silica-fume- or polymer-modified cementitious, mortar with high electrical resistivity (greater than 15,000 ohm-cm).
      1) Concrete-Top Supreme; Euclid Chemical Company.
      2) Sikacrete 211 SCC Plus; Sika Corporation.
      3) Eucocrete; Euclid Chemical Company.
      4) SikaTop 111 Plus; Sika Corporation.
      5) Approved Equal.

   a. HRSD Mix 6: Proprietary crystalline modified portland cement waterproofing parge coat.
      1) Krystol Bari-Cote; Kryton International Inc.
      2) Xypex Magamix I; Xypex Chemical Corporation.
      3) Vandex Unimortar ZSL; Euclid Chemical Company.
      4) Approved Equal.

   a. HRSD Mix 7: Proprietary crystalline modified portland cement waterproofing.
      1) Xypex Magamix II; Xypex Chemical Corporation.
      2) Vandex Unimortar ZSL; Euclid Chemical Company.
      3) Approved Equal.
   b. HRSD Mix 8: Proprietary crystalline modified portland cement waterproofing for surfaces with exposure to H2S and microbial-induced corrosion.
      1) Xypex Magamix II with Bio-San; Xypex Chemical Corporation.
      2) Approved Equal.

8. Other Materials and Products:
   a. Hydraulic Cement: Rapid-setting crystalline hydraulic cement for plugging and sealing active leaks.
      1) Krystol Plug; Kryton International Inc.
      2) Xypex Patch’N Plug; Xypex Chemical Corporation.
      3) Vandex Plug; Euclid Chemical Company.
      4) Approved Equal.
   b. Reinforcing Bars: Grade of reinforcing bars shall be Grade 60 minimum and based on the original design with sizes to match existing unless otherwise shown in Contract Documents.
      1) Use ASTM A706 reinforcement where reinforcing bars are welded.
   c. Reinforcing Bar Mechanical Splices: Mechanical butt splices utilizing lock-shear bolts and internal serrated grip rails within the coupling sleeve capable of developing twice the tensile capacity of reinforcing bars. Use one of the following:
      1) Standard Reinforcement:
         a) Lenton Lock B-Series; Erico International Corporation.
         b) Approved Equal.
      2) Epoxy-Coated Reinforcement:
         a) Lenton Lock B-Series (Epoxy Coated); Erico International Corporation.
         b) Approved Equal.
   d. Stainless Steel Wire: For shallow-depth rebuild.
1) 16 Gauge Stainless Steel Type 316 for shallow depth concrete rebuild.

c. Tie Wire: Wire used to secure reinforcing bars during concrete placement.
   1) Standard (uncoated) Reinforcing: 16 gauge black annealed wire reinforcing.
   2) Epoxy-Coated Reinforcing: 16 gauge PVC coated wire.

f. Corrosion-Inhibiting Coating Materials: Use material specifically intended for reinforcing steel embedded in concrete; use one of following:
   1) Cementitious Coating: Sika Armatec 110 EpoCem; Sika Corporation.
   2) Cementitious Coating: Duralprep A.C.; Euclid Chemical Company.
   3) Epoxy: Sikadur 32 Hi-Mod; Sika Corporation.
   4) Approved Equal.

h. Adhesive-Grouted Dowels:
   1) Dowels:
      a) ASTM A615, Grade 60, uncoated steel bars, cut true to length with ends square and free of burrs.
      b) ASTM A276, Type 316 stainless steel threaded rods.
   2) Adhesive Grout for Dowels: Tested and evaluated for cracked concrete according to ACI 355.4 or ICC-ES AC308; use one of the following
      a) HIT-RE 500 V3 Epoxy Adhesive; Hilti, Inc.
      b) HIT-HY 200 Epoxy Adhesive; Hilti, Inc.
      c) Approved Equal

i. Helical Concrete Anchors for shallow depth rebuild:
   1) 3/8-inch diameter Heli-Tie Helical Wall Ties; Simpson Strong-Tie Company, Inc.
   2) Approved Equal.

j. Helical Concrete Anchors for core hole rebuild:
   1) 1/4-inch diameter Heli-Tie Helical Wall Ties; Simpson Strong-Tie Company, Inc.
   2) Approved Equal.

j. Concrete screws for shallow depth rebuild:
   1) 1/4-inch (min) diameter Stainless Steel Type 316.

9. Forms:
   a. Forms for surfaces exposed to view shall be constructed of a new 1-inch, Plyform Grade B-B EXT-APA Class 1 exterior plywood of concrete-form grade or equal. Plywood may be reused for formed surfaces exposed to view as long as it is in good condition. Plywood may be 3/4-inch or less provided it can maintain position and shape and meet the deflection criteria in ACI 347 during placement of the concrete. Steel forms are acceptable for curved surfaces.
   b. Forms are to provide finish-to-match finish and profile of existing finish of adjacent material.
   c. The use of form release or form oil is not permitted unless approved by OWNER and/or ENGINEER.

10. Curing Materials:
   a. Moisture-Retaining Cover: ASTM C171, white burlap-polyethylene sheet:
      1) Sika UltraCure; Sika Corporation.
      2) Approved Equal.
   b. Water: Potable.
   c. Dissipating Membrane-Forming Curing Compound: ASTM C309, Type 1, 1-D, or 2; VOCs less than 2.9 lbs/gal (350 g/L):
      1) Kurez DR VOX; Euclid Chemical Company.
      2) Cure R; L&M Construction Chemicals, Inc.
      3) 1100-Clear; W.R. Meadows, Inc.
      4) Approved Equal.
   d. Solvent-Based Membrane-Forming Curing Compound: ASTM C309, Type 1, Class A & B; ASTM C1315, Type 1, Class A; VOCs less than 2.9 lbs/gal (350 g/L):
      1) Super Diamond Clear 350; Euclid Chemical Company.
      2) Approved Equal.
PART 3 - EXECUTION

3.1 PROJECT CONDITIONS
   A. Verify existing dimensions and details prior to concrete rebuild Work. Notify OWNER and/or ENGINEER of conditions found to be different than those indicated in the Contract Documents. OWNER and/or ENGINEER will review condition and inform CONTRACTOR of required changes or resolutions.
   B. Environmental Limitations: Install materials at temperatures, humidity, and other environmental conditions recommended by material manufacturer.
   C. Handle and install materials in strict accordance with safety requirements of material manufacturers, Safety Data sheets, and local, state, federal and regulatory requirements.
   D. Maintain adequate ventilation during surface preparation, mixing and placement of materials.

3.2 EXAMINATION
   A. Examine substrates and conditions with representatives of proprietary concrete rebuild manufacturers for compliance with requirements and other conditions affecting performance of concrete rebuild Work.
   B. Ensure that Work done by other trades is complete and ready to receive concrete rebuild material.
   C. Verify that areas and conditions under which concrete rebuild Work is to be performed permit proper and timely completion of concrete rebuild Work.
   D. Notify OWNER and/or ENGINEER in writing of conditions which may adversely affect concrete placement or performance. Do not proceed with concrete placement until these conditions have been corrected and reviewed by OWNER and/or ENGINEER.

3.3 PROTECTION
   A. Protect adjacent surfaces, equipment, utilities, and surrounding site from staining, damage, or debris from concrete rebuild Work.
   B. Restore surfaces and site to condition prior to concrete rebuild Work, to satisfaction of OWNER.

3.4 COORDINATION
   A. Coordinate Work to ensure that adjacent areas are not adversely affected. Coordinate with:
      1. OWNER and/or OWNER’s designated representative.
      2. Other trades with Work in progress to ensure proper sequencing and satisfactory completed construction.
      3. Other trades to avoid or minimize Work on, or in immediate vicinity of, concrete rebuild Work in progress. Ensure that Work from other operations will not adversely affect quality of completed installation.

3.5 CONCRETE REMOVAL AND SURFACE PREPARATION
   A. Prior to Concrete Removal Work:
      1. Develop plan for confining and disposing of broken concrete and other debris from removal Work.
      2. Coordinate with OWNER and remove or temporarily shore existing plumbing, mechanical, and/or electrical lines and associated fixtures that interfere with Work. Reattach removed items at completion of Work.
      3. Install structural shoring as required and/or specified by Contract Documents OWNER and/or ENGINEER.
   B. Equipment: Use following or approved equal.
      1. Pneumatic Chipping Hammers:
a. Nominal 30-lb class or less for removal of concrete at rebuild areas.
b. Nominal 15-lb class or less for detail work adjacent to and beneath reinforcing steel.

2. Saws capable of cutting concrete to specified depth.
3. Abrasive blasting equipment capable of removing and cleaning laitance, dirt, loose pieces of concrete, and surface contaminants from exposed concrete surfaces and rust, concrete, and surface contaminants from exposed steel surfaces.
4. High-pressure, oil-free compressed air equipment capable of removing dust and dirt from exposed concrete removal areas.

C. Sound concrete surfaces with hammer, chain, reinforcing bar, or similar metal object; and mark areas of unsound concrete.

D. For partial depth rebuild, remove unsound concrete and, as necessary, sound concrete to create minimum removal depth of 1-inch behind all exposed reinforcing bars as shown in Drawing 00-30 [Engineer to specify] and Drawing 00-33 [Engineer to specify]. Refer to ICRI Technical Guideline No. 310.1R. Reinforcing bars shall be considered exposed if 25 percent of the surface area is visible along any given 1 foot length.
1. Exercise care to avoid cracking underlying sound concrete, punching through member, or damaging embedments such as utilities or conduit.
2. Limit chipping hammer size and impact angle to minimize damage to sound concrete. Impact angle shall be no more than 60 degrees to surface.

E. Concrete Removal Geometry:
1. Slope removal of substrate to avoid abrupt changes in removal thickness.
2. Where possible, make removal area rectangular in shape in plan (for top- and overhead-surface rebuilds) and elevation (for vertical-surface rebuilds).
3. Remove concrete at a 45-degree-angle to eliminate re-entrant corners.
4. Extend concrete removal at least 4-inches beyond edge of unsound concrete.
5. Create rounded or square edges at removal areas by core-drill or sawcut. Provide 1-inch minimum depth at top surface removal areas. Adjust depth of sawcut to avoid sawing into reinforcing steel, embedded electrical conduits, or other embedments.

F. Notify OWNER and/or ENGINEER of embedded electrical conduit, utilities or similar encountered in removal areas. Proceed as directed by OWNER and/or ENGINEER. Unless otherwise directed, remove abandoned embedded materials in removal area.

G. Inspect and sound concrete surfaces in and around removal areas. Remove additional unsound concrete and concrete contaminated with oil or other materials. Sawcut, or core-drill, and chip removal area perimeter and corners as necessary to provide square configuration. Limit abrupt changes in geometry to prevent re-entrant corners.

H. Abrasive blast clean surfaces of removal area, including vertical edges, to remove surface contaminants, loose pieces of concrete, and concrete that is bruised or micro-fractured and to roughen surfaces. Clean removal area surfaces with dry, oil-free compressed-air jet.

I. Test and record substrate pH using pH indicating papers. pH testing frequency should be performed once every 100 square feet of surface area to be coated.
1. For dry substrate spray the surface lightly with distilled, de-ionized water from a commercially available spray bottle that has been properly rinsed to preclude any dissolved solids. The spray shall wet the surface to a "shiny" appearance and water shall not run down the wall. Wait 60 seconds to allow chemical equilibria to be established and then test the pH of the water on the surface.
   a. The selected preparation and cleaning method must produce a concrete surface pH of 8.0 to 11.0. If after surface preparation, the surface pH remains below 8.0, perform additional waterblasting, cleaning, or abrasive blast cleaning until additional pH testing indicates an acceptable pH level.

J. Achieve final surface profile of CSP 7 or higher according to ICRI Guideline No. 310.2.
3.6 REINFORCEMENT PREPARATION

A. Leave existing reinforcing in place unless otherwise directed by OWNER and/or ENGINEER.

B. Notify OWNER and/or ENGINEER of reinforcing bars that are incorrectly located or have less than 2 inches of concrete cover; damaged; fractured; or have lost more than 10 percent of their original cross-sectional area at any point. OWNER and/or ENGINEER will determine if remedial action is required.

C. Abrasive blast clean exposed steel surfaces, including but not limited to existing reinforcement and embedments, to SSPC-SP 6/NACE No. 3 (SSPC Painting Manual, Volume 2), Commercial Blast Cleaning, finish, with minimal rust or concrete debris. Clean steel surfaces with dry, oil-free compressed-air jet. Exercise care to clean undersides of reinforcing bars.

D. Prior to placement, reinforcement shall be free of materials deleterious to bond.

E. Place, support, and fasten reinforcement as indicated in Contract Documents and/or by OWNER and/or ENGINEER. Do not exceed tolerances specified in ACI 117.

F. Unless otherwise specified, concrete cover for reinforcement shall conform to Table 2 of this Specification. Concrete cover tolerances shall comply with ACI 117. Position tie ends away from exposed surfaces. Build out concrete rebuild as needed to achieve minimum cover.

G. Unless otherwise permitted, furnish and use templates for placement of column dowels.

H. Field bending or straightening: When permitted, bend, or straighten reinforcing bars embedded in concrete (black steel only). Reinforcing bar sizes No. 3 through 5 may be bent cold the first time, provided bar temperature in above 32°F. For other bar sizes, preheat reinforcing bars before bending.

I. Preheating: Apply heat by methods that do not harm reinforcing bar material or cause damage to concrete. Preheat length of reinforcing bar equal to at least five bar diameters in each direction from center of bend but do not extend preheating below concrete surface. Do not allow temperature of reinforcing bar at concrete interface to exceed 500°F. Preheat temperature of reinforcing bar shall be between 1100 and 1200°F. Maintain preheat temperature until bending or straightening is complete. Unless otherwise permitted, measure preheat temperature by temperature measurement crayons or contact pyrometer. Do not artificially cool heated reinforcing bars until bar temperature is less than 600°F.

J. Field cutting reinforcement: Field cut reinforcement only when specifically permitted using cutting methods specified by or acceptable to OWNER and/or ENGINEER.

K. Reinforcement through expansion joint: Do not continue reinforcement or other embedded metal items through expansion joints, unless permitted and/or specified by OWNER and/or ENGINEER.

L. Apply 2 coats of corrosion-inhibiting material on exposed steel surfaces. Corrosion-inhibiting material not required for embedded steel items that are galvanized or otherwise coated with a corrosion-inhibiting coating. Protect existing galvanized and/or coated embedded items during abrasive blasting.

1. Batch, mix, and apply material according to recommendations of material supplier.
   a. Minimum dry film thickness: 10 to 12 mils.
2. Exercise care to coat difficult-to-reach surfaces, such as undersides of reinforcing bars.
3. Minimize spillage on concrete surfaces. Remove materials that will act as bond breaker by chipping or other means.

M. Provide and install supplemental reinforcement as specified herein or as directed by Contract Documents and/or OWNER and/or ENGINEER.
1. Where existing reinforcement has lost 10 percent or more of its original cross-sectional area, add supplement bars of same size as existing bars, unless smaller sized bars are approved by OWNER and/or ENGINEER.
   a. Develop supplement reinforcement by lap splice with existing bars, as shown in Drawing 00-36 and 00-37 [Engineer to specify]. If lap splices are not feasible, develop with mechanical reinforcing bar splices, as shown in Drawing 00-38 and 00-39 [Engineer to specify]. If mechanical splices are not feasible, notify OWNER and/or ENGINEER and, if approved by OWNER and/or ENGINEER, develop by welding supplement bars to existing bars using approved WPS and as shown in Drawing 00-40, 00-41 and 00-42 [Engineer to specify].
2. Where existing reinforcement is located 3-inches or more below the concrete surface, or is spaced further apart than 12-inches, add supplemental No. 3 bars in both directions with 2 inches minimum of clear cover to result in maximum spacing between fully exposed bars of 12-inches, as shown in Drawing 00-43 [Engineer to specify].
   a. Secure outer layer of supplemental No. 3 bars with adhesive-grouted stainless steel threaded rods at 12-inches maximum on center, as shown in Drawing 00-43 and 00-44 [Engineer to specify].
3. Remove additional sound concrete to properly position bars with minimum concrete and full encasement by rebuild material; and to develop supplemental reinforcement beyond areas of deteriorated existing bars. At welded splices, expose full circumference of existing reinforcing bars for at least 3-inches beyond weld.

N. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

O. Do not weld reinforcement unless specifically approved by OWNER and/or ENGINEER.

P. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.7 EMBEDDED ITEMS
A. Place and secure items to be embedded in concrete rebuild placement including, but not limited to, discrete galvanic anodes.
B. For concrete rebuilds adjacent to existing embed plates, extend rebuild behind edge of embed plate as shown in Drawing 00-45 [Engineer to specify]. Clean and coat plate surfaces with corrosion inhibiting material. Do not extend demolition behind embed plate greater than 1-inch without approval of OWNER and/or ENGINEER.

3.8 INSTALLATION OF ADHESIVE-GROUTED STEEL DOWELS
A. Equipment:
   1. Percussive or rotary drilling equipment for making holes in concrete substrate for dowel installation.
B. Dowels:
   1. Install dowels at locations and in sizes specified in Contract Documents or as directed by OWNER and/or ENGINEER.
   2. Dowels to be installed in the adhesive shall be clean, oil-free, and free of loose rust, paint, or other coatings.
   3. Install in concrete removal areas on vertical and overhead surfaces that do not include exposed reinforcing bars, as shown in Contract Documents or as directed by OWNER and/or ENGINEER and shown in Drawing 00-44 [Engineer to specify], to mechanically anchor rebuild material. Install dowels in 12-inch grid pattern.
C. Remove unsound concrete and install dowels in sound concrete.
D. Install dowels in accordance with adhesive manufacturer.
E. Dry drill holes with rotary impact hammer drill or rock drill perpendicular to concrete surface.
   1. Locate existing reinforcement and embedded items with reinforcing bar locator and position holes to avoid existing reinforcement.
   2. Do not damage existing reinforcement.
   3. Make hole diameter at least 1/8-inch larger than dowel diameter, unless otherwise recommended by adhesive manufacturer.

F. Clean holes with stiff brush and dry, oil-free compressed-air jet to remove loose concrete, dust, and debris.

G. Inject adhesive with tube into back of hole and fill hole to front, withdrawing tube.
   1. Unless otherwise indicated by manufacturer, adhesive shall be dispensed through a tube or cartridge extension, beginning at the maximum depth of the hole and withdrawn as adhesive is injected, followed by insertion and rotating the dowel to the specified depth. Where necessary, spaces around anchors at the surface shall be sealed at horizontal to vertical overhead locations to prevent loss of the adhesive during curing.
   2. Carefully proportion and mix 2-part epoxies according to manufacturer's directions. Scrape out entire contents of both containers to assure accurate proportions.
   3. Mix adhesive for approximately 3 minutes with paint stirrer attached to low speed (400 to 600 rpm) electric or pneumatic drill, unless otherwise specified by manufacturer. Move stirrer up and down and around sides of mixing container until even, streak-free color is attained. Do not whip in air.
   4. Install sufficient material to completely fill annular space around dowel.

H. Insert dowel to bottom of hole and secure in center of hole, perpendicular to surface, until adhesive has set. Provide 2-inch minimum clear cover from concrete surface.

I. Promptly remove excess adhesive.

J. Apply 2 coats of corrosion-inhibiting material on exposed steel surfaces. Corrosion inhibiting material not required for embedded steel items that are galvanized or otherwise coated with a corrosion-inhibiting coating.

3.9 SHALLOW DEPTH REBUILD PROCEDURE

A. For rebuilds less than 2-inches deep with no exposed reinforcing steel, perform shallow depth concrete rebuild as shown in Drawing 00-46 and 00-47 [Engineer to specify].

B. Wet substrate thoroughly and then remove standing water.

C. Place shallow-depth rebuild materials by troweling toward edges of rebuild area to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch.

D. For vertical patching, place material in lifts of not more than 1-1/2 inches or less than 1/4 inch. Do not feather edge.

E. For overhead patching, place material in lifts of not more than 1 inch or less than 1/8-inch. Do not feather edge.

F. Where multiple lifts are used, score surface of lifts to provide a rough surface for application of subsequent lifts. Allow each lift to reach final set before placing subsequent lifts.

G. Allow surfaces of lifts that are to remain exposed to become firm and then finish to a smooth surface with a wood or sponge float.

H. If 25 percent or more of the surface area of the reinforcement is exposed along a 1-foot length, remove concrete to a depth of 1-inch behind reinforcing bar and perform partial depth rebuild.

3.10 CORE HOLE REBUILD PROCEDURE
A. For rebuild at concrete core holes, perform concrete rebuild as shown in Drawing 00-48 and 00-49 [Engineer to specify].

B. Surface preparation:
   1. Depth of core hole shall extend at least 2 inches from surface of concrete.
   2. Surface of core hole shall be cleaned of dust, dirt, oil, or other contaminants that may inhibit proper bonding of rebuild materials.
   3. Cleaning shall be by wire brushing followed by water flushing. Remove all excess water with compressed air free of suspended oils to provide a saturated surface-dry condition.
   4. The wire brushing shall be aggressive enough to roughen the surface of the core hole and provide an open pore structure.

C. Supplemental mechanical anchorage:
   1. Install 2 helical concrete anchors, per anchor manufacturer’s recommendations, at each core hole. If core hole is full depth through wall thickness 12-inches or greater, install 4 helical anchors, two from each face.
   2. Drill angled pilot hole through the core hole.
   3. Install anchor with hammer drill.
   4. Recess anchor to a 1/2-inch depth, seal surface penetration with an approved epoxy.

D. Select rebuild material based on depth and orientation of core using concrete rebuild mixes specified herein.

E. Place rebuild material in accordance with specifications herein and material manufacturer’s instructions.

3.11 FORMWORK

A. Formwork shall be in accordance with applicable provisions of ACI 347. Forms shall be of wood, metal, structural hardwood or other suitable material that will produce the required surface finish.

B. Construct formwork so final appearance and shape of rebuild material matches adjacent existing concrete, and so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
   1. Limit abrupt or gradual concrete surface irregularities to ACI 347 Class C, 1/2-inch.
   2. Provide 3/4-inch chamfer at exterior corners and edges of permanently exposed concrete.
   3. Construct forms tight enough to prevent loss of concrete mortar.

C. Notify OWNER and/or ENGINEER of rebuilds on overhead and vertical surfaces where reinforcement has less than 2 inches of clear cover. Form and build-out rebuild surface to provide 2 inches minimum of clear cover, as shown in Figure 3 [Engineer to specify], unless otherwise directed by OWNER and/or ENGINEER. Chamfer edges of build-out.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Do not allow metal tools to come into contact with concrete surfaces. Kerf wood inserts for forming keyways, reglets, and recesses, for easy removal.

E. Arrange form ties such that metal is at least 2 inch below concrete surfaces exposed to weather. Lugs, cones, washers, and other devices shall not leave depression or hole larger than 2 inches in diameter.

F. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical (1.5:1).

G. Do not use form-release oil unless approved by OWNER and/or ENGINEER.

H. Provide temporary openings for cleanouts, air relief holes, and inspection ports as required. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations. Rebuild all cored air relief holes as specified herein.
I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris immediately before placing concrete.

J. Retighten forms and bracing before placing concrete to prevent mortar leaks and maintain proper alignment.

K. Removing and Reusing Forms: Formwork, for sides of beams, walls, columns, and similar parts of Work, that does not support weight of concrete, may be removed after cumulatively curing at not less than 50 degree F for 24 hours after placing concrete, provided concrete is hard enough not to be damaged by form-removal operations and provided curing and protection operations are maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 percent of 28-day design compressive strength.
   2. Clean and repair surfaces of forms to be reused in Work. Do not use split, frayed, delaminated, or otherwise damaged form-facing material, or patched forms, for exposed surfaces.

3.12 MIXING AND PLACEMENT

A. Concrete Mixing:
   1. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94.
      a. Deliver concrete to Site and discharge within 90 minutes or before 300 revolutions of mixer drum, whichever comes first, after introduction of mix water. Concrete that exceeds specified time limit will be rejected without prior approval from OWNER and/or ENGINEER. Alternate mixing or discharge times, may be approved by the OWNER and/or ENGINEER depending on the approved mix design and the environmental conditions during placement.
      b. Temperature: If the measured concrete temperature at delivery is not within the limits specified below or as otherwise specified, a check test will be performed immediately at a new location in the sample. If the check test fails, the concrete is considered to have failed to meet the requirements of this Specification.
      c. Concrete temperature: When the average of the highest and lowest ambient temperature from midnight to midnight is expected to be less than 40°F for more than three successive days, deliver concrete to meet the following minimum temperatures immediately after placement:
         • 55°F for sections less than 12 in. in the least dimension
         • 50°F for sections 12 to 36 in. in the least dimension
         • 45°F for sections 36 to 72 in. in the least dimension
         • 40°F for sections greater than 72 in. in the least dimension
         The temperature of concrete as placed shall not exceed these values by more than 20°F. These minimum requirements may be terminated when temperatures above 50°F occur during more than half of any 24-hour duration. Unless otherwise specified or permitted by OWNER and/or ENGINEER, the temperature of concrete as delivered shall not exceed 95°F.
      d. Do not add water-reducing or high-range, water-reducing admixture indiscriminately to increase slump.
      e. Introduce high-range, water-reducing admixture at Site with additional mixing per manufacturer’s recommendations.
      f. Reject concrete that arrives at Site with slump exceeding maximum specified slump.
   2. Project-Site Mixing: Measure, batch, and mix concrete materials according to manufacturer’s written instructions and ASTM C94.
      a. Develop batching and mixing operations so that quality control is assured.
      b. Designate one or two individuals to batch and mix concrete. Fully instruct these individuals on batching and mixing procedures.
c. Maintain accurate mix proportions. Batch materials by weight on basis of whole bags of proprietary material. Maintain calibrated scale at site during concrete placement operations. Batching by volume is permitted if weight-volume relationship for each material is verified on daily basis, and aggregate moisture content is measured at least once daily and aggregate volume is adjusted for bulking.
d. Combine and mix ingredients to uniform consistency.
e. Mix concrete materials in appropriate paddle-type mortar/plaster mixer(s) in lieu of volumetric-type mixer(s), unless otherwise permitted by OWNER and/or ENGINEER.
   1) For mixer capacity of 1 cubic yard or smaller, mix at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer.
   2) For mixer capacity larger than 1 cubic yard, increase mixing time by 15 seconds for each additional 1 cubic yard.
   3) Provide sufficient number of mixers, including reserve mixers, so that concrete placement operations will proceed uninterrupted and each area is completely cast before material achieves initial set.

B. Concrete and Mortar Placement, General:
   1. Reference Drawing 00-31 [Engineer to specify] for typical section showing concrete rebuild placement.
   2. Use bonding procedure recommended by material manufacturer.
      a. If saturated-surface-dry condition is required, soak concrete surface at least 4-hours prior to concrete or mortar placement.
   3. Convey concrete from mixer to place of deposit in manner such that no segregation or loss of materials occurs. If pumping, minimize length of pipeline.
   4. Place concrete continuously until rebuild section is completed, with no cold joints.
      a. Do not allow concrete to disturb or displace reinforcing bars, floor drains, or other embedments.
      b. Dispose of concrete that has partially set prior to placement or that has been contaminated by foreign material.

C. Concrete Placement, Top- and Vertical-Surface Rebuilds:
   1. Place concrete as near as possible to its final position to avoid segregation due to re-handling or flowing.
   2. Avoid or minimize vertical fall. Do not allow concrete to fall vertical distance greater than 4-feet from point of discharge to point of deposit.
   3. Place concrete at rate so that concrete is plastic and flows readily into corners of forms and into spaces around reinforcing bars.
   4. Consolidate concrete in accordance with requirements herein, except for self-consolidating concrete and unless otherwise specified by material manufacturer.
      a. Concrete shall be consolidated by mechanical vibrators. The vibrators shall be internal type and shall at all times be adequate in number of units and power of each unit to properly consolidate all concrete as specified in ACI 309. The frequency shall be not less than 8000 cycles per minute when the vibrator is submerged in concrete.
      b. The duration of vibration shall be limited to the time necessary to produce satisfactory consolidation without causing objectionable segregation. In consolidating each layer of concrete, the vibrator shall be operated in a near vertical position, be inserted at uniformly spaced locations no farther apart than the visible effectiveness of vibrator and the vibrating head shall be allowed to penetrate under the action of its own weight.
      c. Do not use vibrators to transport concrete.
      d. If internal vibrators will not fit in formed rebuild void, external vibration of forms is permitted.

D. Concrete Placement, Overhead Rebuilds:
   1. Place concrete as near as possible to its final position.
   2. Consolidate concrete with metal rod, taking care to fill corners and around reinforcing bars and to avoid segregation.
E. Mortar Placement, Trowel-Applied Rebuilds:
1. Apply mortar firmly with trowel.
2. Place mortar in lifts if recommended by material manufacturer. Where multiple lifts are used, score surface of lift with trowel to roughen surface for application of subsequent lift. Allow lift to reach final set before placing subsequent lift.
3. Allow surfaces to remain exposed to become firm and then finish to smooth surface with wood or sponge float.

F. Cold-Weather Placement:
1. Protect concrete work from physical damage or reduced strength due to frost, freezing, or low temperatures. Comply with ACI 306R and as follows.
   a. When air temperature has fallen or is expected to fall below 40 degrees F, uniformly heat water and aggregates before mixing to obtain concrete mixture temperature of not less than 50 degrees F and not more than 80 degrees F at point of placement. Mix water and aggregates together before adding cement. Do not add cement if temperature of water/aggregate mixture exceeds 70 degrees F.
   b. Do not use frozen materials or materials containing ice or snow.
   c. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix design.

G. High Evaporation Conditions:
1. When high evaporative conditions necessitate protection of concrete immediately after placing or finishing, make provisions in advance of concrete placement for windbreaks, shading, fogging, sprinkling, ponding, or wet covering.

H. Hot-Weather Placement
1. Protect concrete work from physical damage or reduced strength due to rapid evaporation or overheating of concrete. Refer to ACI 305R for hot-weather conditions that may adversely affect concrete placement, finishing, and curing. Do not allow temperature of concrete at time of placement to exceed 95 degrees F. When hot-weather conditions exist, use 1 or more of following procedures:
   a. Place concrete at night or early in morning.
   b. Cool ingredients before mixing to maintain concrete temperature below 95 degrees F at time of placement. Chilled mixing water or chopped ice may be used to control temperature; include water equivalent of ice in mixing water quantity. Use liquid nitrogen to cool concrete at CONTRACTOR’s option.
   c. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   d. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.
   e. Provide windbreaks or sunshades, or both.
   f. Cool pump pipelines by shading, running cool water over, or other means as necessary.

I. Mass Concreting
1. Protect concrete work from physical damage or reduced strength due to thermal effects of mass concreting, per ACI 207.1R.

3.13 FINISHING AND CURING

A. Finishing Top Surfaces:
1. Float and broom finish:
   a. Float finish: Consolidate surface with power-driven float or by hand floating if area is small or inaccessible to power driven float. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with uniform, smooth, granular texture.
   b. Medium-Broom Finish: Apply medium-broom finish, perpendicular to traffic flow, on top surfaces subjected to vehicular or pedestrian traffic.
c. Do not wet concrete surfaces or add cement.

2. Tined Finish:
   a. Texture and tine freshly placed pavement as soon as possible after floating.
   b. Use a rake with individual 1/8-inch wide tines spaced uniformly 5/8-inches on center. For machine work, use a 10-foot rake drawn transversely across the full pavement width without overlapping passes.

3. Float and trowel finish:
   a. Float finish: Consolidate surface with power-driven float or by hand floating if area is small or inaccessible to power driven float. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with uniform, smooth, granular texture.
   b. Trowel finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
   c. Do not wet concrete surfaces or add cement.

4. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

5. Hot-Weather Conditions: Fog surface with water if hot, dry, or windy conditions cause moisture loss approaching 0.2 pounds per square foot per hour, as estimated by Figure 4.2 in ACI 305R, before or during finishing operations.

B. Finishing Formed Surfaces:
   1. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas addressed. All fins, runs, drips or projections shall be removed from surfaces which remain exposed. Form marks and chamfer edges shall be smoothed by grinding and/or dry rubbing. Remove fins and other projections exceeding 1/2-inch.

C. Concrete Curing:
   1. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Maintain concrete above 55 degree F and in moist condition for at least 7 days after placing.
      a. For polymer-modified and silica-fume-modified materials, follow curing regimen recommended by manufacturer or developed in preconstruction testing.
      b. Protect concrete from falling below 55 degrees F with insulating blankets or heated enclosures.
   2. Unformed Top Surface: Begin curing immediately after finishing concrete. Use water-saturated, moisture-retaining cover, or other approved procedures.
      a. Place cover in widest practicable width, with sides and ends lapped at least 12-inches.
      b. Seal sides and ends of cover by holding down with soil, concrete pieces, or some other weight, or by using waterproof tape or adhesive.
      c. Immediately repair holes or tears in cover during curing period using cover material and waterproof tape.
      d. Re-wet concrete surface at least twice daily as necessary to ensure that surface remains moist.
   3. Unformed Vertical and Overhead Surfaces: Apply 2 coats of curing compound uniformly in continuous operation by power spray or roller according to manufacturer's written instructions and recommended coverage rate. Recoat areas subjected to heavy rainfall within 3-hours after initial application. Maintain continuity of coating and repair damage during curing period.
   4. Formed Surfaces:
      a. Maintain form surfaces in moist condition.
      b. Mois ture cure concrete after forms are stripped to achieve 7-day total cure period.

D. Stripping of Forms and Removal of Shoring:
1. Strip forms 24-hours minimum after concrete is placed unless otherwise directed by Contract Documents, OWNER and/or ENGINEER.
2. Remove shoring 24-hours minimum after concrete is placed and after rebuild concrete has achieved minimum compressive strength of 75 percent of the specified 28-day compressive strength, unless otherwise directed by Contract Documents, OWNER and/or ENGINEER.

3.14 DEFECTIVE CONCRETE REBUILD

A. Rebuild defective areas designated by OWNER and/or ENGINEER. Remove and replace concrete that cannot be repaired to satisfaction of OWNER and/or ENGINEER.

B. Surface defects on exposed surfaces include:
   1. Voids, such as spalls, air bubbles, honeycomb, rock pockets, and form-tie voids, more than 1/2-inch in any dimension in solid concrete but not less than 1 inch deep.
   2. Cracks at least 1/8 inch wide. Notify OWNER and/or ENGINEER of cracks that penetrate through section.
   3. Fins and other projections exceeding 1/2-inch.
   4. High or low spots in repaired areas that create areas of standing water that are at least 1/2-inch deep and at least 9 square feet in area.

C. Rebuild defects on concealed surfaces that affect concrete's durability and structural performance as determined by OWNER and/or ENGINEER.

D. As soon as possible, cut out spalls, air bubbles, honeycombs, rock pockets, and voids. Make edges of cuts perpendicular to concrete surface. Clean voids and fill with rebuild mortar according to manufacturer's recommendations. Use polymer- or silica fume-modified, cementitious, non-sag mortar that is specifically intended for this application. Use one of the following:
   1. SikaTop 123 Plus; Sika Corporation.
   2. Verticoat Supreme; Euclid Chemical Company.
   3. Approved Equal.

E. Fill cracks with high-molecular-weight methacrylate or low-viscosity methyl methacrylate. Use one of the following:
   1. SikaPronto 19 TF; Sika Corporation.
   2. Approved Equal.

F. After concrete has gained sufficient strength to be unaffected by grinding, grind off fins, other projections, and high areas.

3.15 CLEANING

A. Remove and legally dispose of concrete and steel debris, abrasive blast materials, and excess materials.
### TABLE 1: QUALITY CONTROL TESTING

<table>
<thead>
<tr>
<th>Rebuild Material</th>
<th>Quality Assurance Testing</th>
<th>Quality Control Material Testing</th>
<th>Additional Items (1/placement or material type)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compression Strength (ASTM C39)</td>
<td>Slump (ASTM C143) or Slump flow (ASTM C1611)</td>
<td>Unit Weight (ASTM C138)</td>
</tr>
<tr>
<td>Proprietary Rebuild Material</td>
<td>1 set / 75 cu. ft. 1 set = 6 cylinders (2 - 3 days, 2 - 7 days, 2 - 28 days)</td>
<td>1 test / placement 1 test / material</td>
<td>1 test / placement 1 test / material</td>
</tr>
<tr>
<td>Ready-Mix Rebuild Material</td>
<td>1 set / 20 cu. yd. min* 1 set = 6 cylinders (2 - 3 day, 2 - 7 days, 2 - 28 days)</td>
<td>1 test / truck*</td>
<td>1 test / truck</td>
</tr>
</tbody>
</table>

* 1 additional set/test for each time water is added to mix on-site
Table 2: Concrete Cover for Reinforcement

<table>
<thead>
<tr>
<th>Reinforcement Type</th>
<th>Min. Cover (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Floor slabs and walls not exposed to weather and not in contact with the ground, and not at surfaces exposed to water.</td>
<td></td>
</tr>
<tr>
<td>1.) No. 11 bars or smaller</td>
<td>3/4</td>
</tr>
<tr>
<td>2.) No. 14 and No. 18 bars</td>
<td>1-1/2</td>
</tr>
<tr>
<td>B. Beams, girders and columns principal reinforcement, ties, stirrups or spirals not exposed to weather or water</td>
<td>1-1/2</td>
</tr>
<tr>
<td>C. Formed concrete exposed to weather or at surfaces exposed to water</td>
<td></td>
</tr>
<tr>
<td>1.) No. 5 bars and smaller</td>
<td>1-1/2</td>
</tr>
<tr>
<td>2.) No. 6 bars and larger</td>
<td>2</td>
</tr>
<tr>
<td>D. Unformed concrete in contact with soil above water table</td>
<td>3</td>
</tr>
<tr>
<td>E. Formed concrete in contact with soil above water table</td>
<td>2</td>
</tr>
<tr>
<td>F. Unformed concrete in contact with soil below water table</td>
<td>4</td>
</tr>
<tr>
<td>G. Formed concrete in contact with soil below water table</td>
<td>3</td>
</tr>
</tbody>
</table>
3.17 DRAWINGS

A. The following figures represent typical or representative conditions and may not be indicative of in-situ conditions. The ENGINEER should review the conditions as necessary for applicability.

Engineer to review Series 600 of Standard Details in Section 34 of HRSD Design and Construction Standards for applicability and inclusion:

1. Standard Detail 626: Removal of Unsound Concrete – Typical Section
2. Standard Detail 627: Concrete Rebuild – Typical Section
3. Standard Detail 628: Concrete Rebuild to Provide Minimum Cover – Typical Section
4. Standard Detail 629: Removal of Unsound Concrete – Typical Corner Section
5. Standard Detail 630: Concrete Rebuild – Typical Corner Section
6. Standard Detail 631: Reinforcing Section Loss Table
7. Standard Detail 632: Lap Splice Plan – Option 1
8. Standard Detail 633: Lap Splice Lengths – Option 1
9. Standard Detail 634: Mechanical Splice – Option 2 (Typical Removal Section)
10. Standard Detail 635: Mechanical Splice – Option 2 (Typical Rebuild Section)
14. Standard Detail 639: Supplemental Reinforcement Requirements
15. Standard Detail 640: Adhesive-Grouted Dowel Layout
16. Standard Detail 641: Typical Concrete Rebuild Section at Embed Plate
17. Standard Detail 642: Shallow Depth (2” Max.) Concrete Rebuild – Horizontal
18. Standard Detail 643: Shallow Depth (2” Max.) Concrete Rebuild – Vertical
19. Standard Detail 644: Partial-Depth Core Hole Concrete Rebuild
20. Standard Detail 645: Full-Depth Core Hole Concrete Rebuild

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
A. Section includes:
   1. Supply and installation of embedded galvanic anodes encapsulated in concrete rebuilds or encasements.

1.2 RELATED SECTIONS
A. Following Work items are related to Work in this Specification, but are specified in other Specifications:
   1. Section 03700: Concrete Rebuild

1.3 DEFINITIONS
A. Anode – The electrode in electrolysis at which negative ions are discharged, positive ions are formed, or other oxidizing reactions occur.
B. Carbonation – The conversion of calcium ions in hardened cementitious materials to calcium carbonate by reaction with atmospheric carbon dioxide.
C. Cathode – The electrode at which chemical reduction occurs.
D. Cathodic Protection – A form of corrosion protection for reinforced concrete wherein a sacrificial metal is caused to corrode in preference to the reinforcement, thereby protecting the reinforcement from corrosion.
E. Conductivity – The degree to which a specified material conducts electricity.
F. Electrical Resistivity – A measure of the resistance of a material to flow of electric current.
G. Galvanic Corrosion – Accelerated corrosion of a metal because of an electrical contact with a more noble metal or nonmetallic conductor in a corrosive electrolyte.
H. Reinforcement Continuity – A condition in reinforced concrete in which the reinforcing steel is sufficiently interconnected to provide a path for electrical current.
I. Saturated Surface-Dry – Condition of an aggregate particle or other porous solid when the permeable voids are filled with water and no water is on the exposed surfaces.

1.4 REFERENCE STANDARDS
   1. American Concrete Institute (ACI):
      a. 222R-01: Protection of Metals in Concrete Against Corrosion
   2. ASTM International (ASTM):
      a. A1064: Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

1.5 SUBMITTALS
A. Pre-Construction: Submitted prior to start of Work
   1. Product Data / Safety Data
      a. For each type of manufactured material and product indicated, including:
         1) Galvanic Anodes.
         2) Conductive Embedding Mortar.
2. Samples: Two galvanic anodes proposed for use.
3. Certification: From anode manufacturer that Installer is trained and approved to install anodes.

1.6 QUALITY ASSURANCE AND QUALITY CONTROL

A. Qualifications:
   1. CONTRACTOR and/or subcontractor certified by anode manufacturer as trained and approved for anode installation.

B. Quality Control and Assurance Inspection:
   1. Quality Assurance Inspections are to be performed at critical steps throughout the rebuild process. Unless indicated otherwise, the OWNER, ENGINEER and/or Quality Assurance Representative shall perform inspections to verify conformance with Contract Documents.
   2. CONTRACTOR’s Quality Control Supervisor shall perform initial inspections and correct any items not in conformance with requirements herein and Contract Documents prior to requesting Quality Assurance Inspection.
   3. Typical quality control and assurance inspection points are listed below. Quality Assurance Inspection Hold Points are indicated in bold. Do not proceed with Work that may make hold point inspections difficult or impossible to perform until inspection has been completed and deficiencies corrected, unless OWNER and/or ENGINEER waives specific inspection requirements.

a. Quality Assurance Checklist

   1) ________ Review and approval of Submittals for conformance with specification requirements.
   2) ________ Reinforcing steel continuity is verified.
   3) ________ Proposed layout and spacing of galvanic anodes.
   4) ________ Installation of galvanic anodes as specified.
   5) ________ Continuity achieved between installed galvanic anodes and reinforcement.
   6) ________ Mixing and placement of conductive embedding mortar (if required).

1.7 DELIVERY, STORAGE AND HANDLING

A. Delivery, store, and handle materials according to manufacturer’s recommendations and in such manner as to prevent damage to materials and structure.

B. Remove and replace materials that cannot be installed within stated shelf life.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain materials through one source from single manufacturer.

B. Discrete Galvanic Anodes in Concrete Rebuilds:
1. Alkali-activated, Type 1A, consisting of zinc in compliance with ASTM B418 Type II cast around steel tie wires and encased in a highly alkaline cementitious shell with a pH of 14 or greater. The cementitious shell shall contain no chlorides or other corrosive constituents as per ACI Guideline No. 222R-01. Anodes shall be supplied with integral tie wires for tying to the reinforcing steel. Use one of following unless otherwise specified by OWNER and/or ENGINEER:
   a. HRSD System #1: Low-to-Moderate Corrosion:
      1) Galvashield XP (Zinc Mass = 60g); Vector Corrosion Technologies.
      2) Galvashield XPT (Zinc Mass = 60g); Vector Corrosion Technologies.
      3) Sika FerroGard 650 (Zinc Mass = 65g); Sika Corporation.
      4) Sentinel Silver Galvanic Anodes (Zinc Mass = 100g); Euclid Chemical Company.
      5) Approved Equal.
   b. HRSD System #2: Moderate-to-High Corrosion:
      1) Galvashield XP2 (Zinc Mass = 100g); Vector Corrosion Technologies.
      2) Galvashield XP4 (Zinc Mass = 160g); Vector Corrosion Technologies.
      3) Sika FerroGard 670 (Zinc Mass = 105g); Sika Corporation.
      4) Sentinel Gold Galvanic Anodes (Zinc Mass = 200g); Euclid Chemical Company.
      5) Approved Equal.

C. Distributed Galvanic Anodes in Concrete Rebuilds:
   1. Alkali-activated consisting of zinc in compliance with ASTM B418 Type II cast around steel tie wires and encased in a highly alkaline cementitious shell with a pH of 14 or greater. The anode unit shall include FRP reinforcing and shall contain no chlorides or other corrosive constituents as per ACI Guideline No. 222. Anodes shall be supplied with integral tie wires for tying to the reinforcing steel. Use one of following unless otherwise specified by OWNER and/or ENGINEER:
      a. HRSD System #3: Low Corrosion:
         1) GalvanoDIE DAS (Zinc Weight = 0.25 lb/ft); Vector Corrosion Technologies.
         2) Approved Equal.
      b. HRSD System #4: Moderate Corrosion:
         1) GalvanoDIE DAS (Zinc Weight = 0.60 lb/ft); Vector Corrosion Technologies.
         2) Approved Equal.
      c. HRSD System #5: High Corrosion:
         1) GalvanoDIE DAS (Zinc Weight = 1.20 lb/ft); Vector Corrosion Technologies.
         2) Approved Equal.

D. Drilled-In Galvanic Anodes
   1. Alkali-activated, Type 2A, consisting of zinc in compliance with ASTM B418 Type II cast around steel tie wires and encased in a highly alkaline cementitious shell with a pH of 14 or greater. The cementitious shell shall contain no chlorides or other corrosive constituents as per ACI Guideline No. 222. Anodes shall be supplied with integral tie wires for tying to the reinforcing steel. Use one of following unless otherwise specified by OWNER and/or ENGINEER:
      a. HRSD System #6: Low-to-Moderate Corrosion:
         1) Galvashield CC65; Vector Corrosion Technologies.
         2) Approved Equal.
      b. HRSD System #7: Moderate-to-High Corrosion:
         1) Galvashield CC100; Vector Corrosion Technologies.
         2) Approved Equal.
      c. HRSD System #8: Congested Reinforcement:
         1) Galvashield CC135; Vector Corrosion Technologies.
         2) Approved Equal.
E. Galvanic Anode Spacing:
   1. The location and spacing of galvanic anodes shall be determined by the OWNER, ENGINEER and/or Quality Assurance Representative based on field conditions and existing configuration and density of reinforcing steel. The steel density ratio is defined as the ratio of the steel reinforcing surface area to the concrete surface area. Reference Contract Documents or OWNER and/or ENGINEER for specific spacing requirements. The following are minimum requirements unless specified elsewhere:
      a. Discrete Galvanic Anodes
         1) HRSD System #1: Low-to-Moderate Corrosion:
            a) Steel Density ≤ 1.0; Spacing ≤ 18-inches on-center (o.c.).
            b) Steel Density > 1.0; Spacing ≤ 12-inches o.c.
         2) HRSD System #2: Moderate-to-High Corrosion:
            a) Spacing ≤ 12-inches o.c.
      b. Distributed Galvanic Anodes
         1) HRSD System #3: Low Corrosion:
            a) Steel Density ≤ 1.0; Spacing (ties) ≤ 18-inches o.c.
            b) Steel Density > 1.0; Spacing (ties) ≤ 12-inches o.c.
         2) HRSD System #4: Moderate Corrosion:
            a) Spacing (ties) ≤ 12-inches o.c.
         3) HRSD System #5: High Corrosion:
            a) Spacing (ties) ≤ 6-inches o.c.
      c. Drilled-In Galvanic Anodes
         1) HRSD System #6: Low-to-Moderate Corrosion:
            a) Steel Density ≤ 1.0; Spacing ≤ 18-inches o.c.
            b) Steel Density > 1.0; Spacing ≤ 12-inches o.c.
         2) HRSD System #7: Moderate-to-High Corrosion:
            a) Spacing ≤ 12-inches o.c.
         3) HRSD System #8: Congested Reinforcement:
            a) Spacing to be determined by OWNER and/or ENGINEER.

F. Conductive Embedding Mortar
   1. Conductive embedding mortar shall be compatible with galvanic anodes to be used and accepted for use by anode manufacturer. Use one of the following:
      a. Galvashield Embedding Mortar; Vector Corrosion Technologies.
      b. Eucopatch; Euclid Chemical Company.
      c. SikaRepair 222 or 223; Sika Corporation.
      d. Approved Equal.

G. Epoxy for Distributed Galvanic Anode
   1. Epoxy shall be 100% solids, non-conductive unless otherwise specified. Use one of the following:
      a. Sikadur 32, Hi-Mod; Sika Corporation.
      b. Approved Equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Prepare substrate and rebuild area in accordance with Section XXXX [Engineer to specify].
   1. Remove sufficient concrete at anode locations to permit anode installation.
   2. Clean exposed reinforcing steel of rust, mortar, and other inhibiting materials to provide sufficient electrical connection and mechanical bond.
B. Install galvanic anodes in accordance with requirements herein with spacing as specified by the Contract Documents, OWNER and/or ENGINEER. Anode spacing will vary with changes in the reinforcing steel density, the level of chloride in the concrete, and the corrosivity of the local environment. Representative spacing requirements are provided herein and are based on existing conditions and exposure. Reference Drawing 01-08 through 01-14 [Engineer to specify] for representative discrete and distributed galvanic anode layout, spacing and installation requirements.

C. Provide minimum 1-1/2 inch concrete cover over anodes unless otherwise specified by OWNER and/or ENGINEER.

D. Electrically connect anodes to clean reinforcing bars.
   1. Wrap anode wires around reinforcing bar and twist tight to allow no free movement.
   2. Confirm electrical continuity of reinforcing steel in removal area and of anodes with reinforcing steel by measuring DC resistance with a multi-meter. Resistance shall be less than 1 ohm.
   3. If continuity of reinforcing steel is not acceptable, add additional steel tie wires or supplemental reinforcing until continuity is acceptable.
   4. If continuity of anode to reinforcing steel is not acceptable, modify wrapping of anode tie wires until acceptable.
   5. If continuity cannot be achieved after implementing additional measures as specified above, notify OWNER and/or ENGINEER for additional direction.

E. Install conductive embedding mortar (if required).

F. Install concrete rebuild material per Section XXXX [Engineer to specify], exercising care to avoid disturbing anodes.

3.2 INSTALLATION OF DISCRETE GALVANIC ANODES

A. Discrete galvanic anodes shall be installed along the perimeter of the repair or interface with spacing as specified.

B. Position anodes as close to rebuild perimeter as possible. Locate at intersections of bars if possible.

C. Position anodes to provide at least 1-1/2 inches of clear cover. If necessary, position anodes next to, or underneath, reinforcing bars.

D. Provide at least 1-inch clearance between anodes and existing concrete substrate sufficient to allow repair material to encase anode.

E. Electrically connect anodes to clean reinforcing bars as close as possible to edge of removal area.
   1. Confirm electrical continuity of reinforcing steel in removal area and of anodes with reinforcing steel by measuring DC resistance with a multi-meter. Resistance shall be less than 1 ohm.

F. Encapsulate anodes in conductive embedding mortar and fill gaps between anodes and concrete substrate with conductive mortar as recommended by anode manufacturer. Encapsulation of anodes with conductive embedding mortar is not required for anodes to be placed within concrete material with measured resistivity values less than 15,000 ohm-cm.

G. Pre-soak anodes prior to placement of concrete rebuild material. Do not soak anodes for greater than 20 minutes unless otherwise specified by anode manufacturer.

H. Install concrete rebuild material per Section XXXX [Engineer to specify], exercising care to avoid disturbing anodes.

3.3 INSTALLATION OF DISTRIBUTED GALVANIC ANODES
A. Distributed galvanic anodes shall be installed along the perimeter of the repair, or at locations as specified by Contract Documents, OWNER and/or ENGINEER.

B. Position anodes to provide at least 1-1/2 inches of clear cover.

C. Provide at least 1-inch clearance between anodes and existing concrete substrate sufficient to allow repair material to encase anode.

D. Electrically connect anodes to clean reinforcing bars. Space ties at locations as specified by Contract Documents, OWNER and/or ENGINEER. At a minimum, spacing shall be in accordance with requirements herein.
   1. Confirm electrical continuity of reinforcing steel in removal area and of anodes with reinforcing steel by measuring DC resistance with a multi-meter. Resistance shall be less than 1 ohm.

E. Encapsulate anode wires and reinforcing steel at connection points with 100% solids, non-conductive, epoxy coating.

F. Install concrete rebuild material with resistivity values less than 15,000 ohm-cm, unless otherwise approved by OWNER and/or ENGINEER, per Section XXXX [Engineer to specify], exercising care to avoid disturbing anodes.

3.4 INSTALLATION OF DRILLED-IN GALVANIC ANODES

A. General
   1. Reference Drawing 01-11 [Engineer to specify] for plan and section details of typical drilled-in galvanic anode installations.
   2. Using a rebar location device (pachometer or equivalent), locate all existing reinforcing steel within the area designated for protection and clearly mark reinforcing layout on exterior concrete surface for examination by OWNER and/or ENGINEER.
      a. In areas where known, or potential, embedded conduit or other obstructions may be present, utilize ground penetrating radar (GPR) or other means for determining the location of rebar and embedded obstructions.
   3. Drill a minimum of four 1/2-inch diameter holes at rebar locations to verify continuity of existing underlying reinforcing steel. It is recommended that locations be consistent with presumed reinforcing steel connection (tie-in) points to the furthest extent possible. Continuity shall be measured using DC resistance with a multi-meter. Continuity measurements shall be deemed acceptable for resistance of 1 ohm or less. Should resistance exceed 1 ohm, OWNER and/or ENGINEER to determine recommended course of action.
   4. Based on layout of located rebar and embedded obstructions, OWNER and/or ENGINEER to designate locations for anode placement and rebar connection.
      a. Anodes shall be installed 4-inches (min) from reinforcing grid designated for protection unless otherwise specified by Anodes shall be installed 4-inches (min) from reinforcing grid designated for protection unless otherwise specified by ENGINEER.
   5. Drill anode unit holes to specified diameter and depth in accordance with manufacturer recommendations based on anode unit size. Do not enlarge holes.
   6. Thoroughly clean reinforcing steel connection and anode drilled-hole locations utilizing a stiff wire brush, or equivalent. Remove dust, debris and contaminants utilizing compressed air or pressurized water.
   7. Connection to reinforcing steel shall be made using manufacturer approved methods and shall utilize manufacturer specified connection kit units (if applicable). Continuity shall be measured using DC resistance with a multi-meter. Continuity measurements shall be deemed acceptable for resistance of 1 ohm or less.
   8. Saturate Surface Dry (SSD) drilled holes for 2-hours (min) prior to installation of anodes and conductive embedding mortar.
      a. Pre-soak anode units as required by manufacturer.
   9. Install conductive embedding mortar into bottom two-thirds (by depth) of drilled SSD anode unit holes, unless otherwise specified by manufacturer.
10. Install anode units by slowly pressing units into the embedding mortar, allowing the mortar to fill the annular space around the units. Ensure no air voids exist between the unit anode and parent concrete. Ensure minimum anode unit concrete cover depth of 3/4-inch.
   a. Interconnect anode unit wiring with reinforcing steel connection wiring and place wiring securely into saw-cut grooves. Connect wiring in accordance with manufacturer recommendations and utilizing manufacturer recommended installation kits (if applicable). Top off anode unit holes and fill saw-cut grooves with embedding mortar.
   b. Wet cure embedding mortar for minimum 24-hours and as recommended by manufacturer.

B. For Series Connection
   1. A single circuit shall contain no more than 10 anode units.
   2. Drill two (min) 1/2-inch reinforcing steel connection holes per string of anodes.
   3. Saw-cut a single continuous groove approximately 1/4-inch wide by 1/2-inch deep into the concrete along the proposed anode series arrangement to interconnect reinforcing steel connection holes with the anode connection holes.

C. For Individual Connection
   1. Drill one 1/2-inch rebar connection hole per anode unit location.
   2. Saw-cut a groove approximately 1/4-inch wide by 1/2-inch deep into the concrete to interconnect the reinforcing steel connection hole with the anode connection hole.

3.5 DRAWINGS

A. The following figures represent typical or representative conditions and may not be indicative of actual field conditions. The OWNER and/or ENGINEER should review the conditions as necessary for applicability. [Engineer to review Series 600 of Standard Details in Section 34 of HRSD Design and Construction Standards for applicability and inclusion]
   1. Standard Detail 600: Installation of Discrete Galvanic Anodes
   2. Standard Detail 601: Installation of Distributed Galvanic Anodes
   3. Standard Detail 602: Distributed Galvanic Anodes at Top of Wall
   4. Standard Detail 603: Installation of Drilled-In Galvanic Anodes
   5. Standard Detail 604: Conductive Mortar Bridge for Use with High Resistivity Repair Mortars
   6. Standard Detail 605: Typical Galvanic Anode Layout
   7. Standard Detail 606: Typical Galvanic Anode Connections

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
A. Section includes:

1.2 RELATED SECTIONS
A. The following are related to Work in this Section, but are specified in other Sections:
   1. Section 07900 – Joint Sealant and Expansion Joint Systems

1.3 DEFINITIONS
A. Catalyst – A substance that increases the rate of a chemical reaction.
B. Elongation – The degree to which a material may be bent, stretched or compressed before it ruptures.
C. Hydrophillic – Having a tendency to react with, mix with, dissolve in or be wetted by water.
D. Hydrophobic – Having a tendency to repel or fail to mix with water.
E. Viscosity – A measure of a fluid’s resistance to flow.

1.4 REFERENCE STANDARDS
A. Reference Standards (Refer to the latest edition):
      b. ASTM D93: Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester
      c. ASTM D638 Standard Test Method for Tensile Properties of Plastics
      d. ASTM D1622: Standard Test Method for Apparent Density of Rigid Cellular Plastics
      e. ASTM D2196: Standard Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational Viscometer
      f. ASTM D2369: Standard Test Methods for VOLATILE CONTENT OF COATINGS
      g. ASTM D2842: Standard Test Method for Water Absorption of Rigid Cellular Plastics
      h. ASTM D3278: Standard Test Methods for FLASH POINT OF LIQUIDS BY SMALL SCALE Closed-Cup Apparatus
      i. ASTM D3574: Standard Test Methods for Flexible Cellular Materials – Slab, Bonded, and Molded Urethane Foams
      j. ASTM D4016: Standard Method for Viscosity and Gel Time of Chemical Grouts by Rotational Viscometer
      k. ASTM D4659: Standard Test Method for Polyurethane Raw Materials: Determination of Specific Gravity of Isocyanates
      m. ASTM D6286: Standard Guide for Selection of Drilling Methods for Environmental Site Characterization
n. ASTM D8109: Standard Test Method for Viscosity and Gel Time of Chemical Grouts by Rotational Viscometer
o. ASTM D8109: Standard Guide for Waterproofing Repair of Concrete by Chemical Grout Crack Injection
q. ASTM F2304: Standard Practice for Sealing of Sewers Using Chemical Grouting
r. ASTM F2414: Standard Practice for Sealing Sewer Manholes Using Chemical Grouting
s. ASTM F2454: Standard Practice for Sealing Lateral Connections and Lines from the Mainline Sewer Systems by the Lateral Packer Method, Using Chemical Grouting

2. International Concrete Repair Institute (ICRI):
   a. Guideline No. 340.1 Guide for the Selection of Grouts to Control Leakage in Concrete Structures

3. U.S. Army Corps of Engineers:
   a. Manual No. 1110-1-3500 Chemical Grouting

1.5 SUBMITTALS

A. CONTRACTOR shall provide the following submittals, specific to this Section, to OWNER for review and/or approval:
   1. Pre-Award Submittals: Submitted as part of the Bid Process.
      a. CONTRACTOR and Subcontractor qualifications:
         1) Include CONTRACTOR and individual certifications, licenses, work experience and related documentation.
         2) Include evidence that company has a minimum of 3-years experience in application of specified materials. Submit list of at least three completed Projects of similar scope and size, including:
            a) Project Name.
            b) Owner’s Name.
            c) Owner’s Representative’s Name, Address and Contact Information.
            d) Description of Work.
            e) Product(s) / Material(s) Used.
            f) Project Manager / Supervisor.
            g) Total cost of Work.
            h) Start and Completion Date.
      b. Intent to Warrant and Sample Warranty:
         1) Copy of warranty, stating obligations, remedies, limitations, and exclusions.
   2. Pre-Construction Submittals: Submitted prior to Work.
      a. Product Data / Safety Data: Material manufacturer’s literature including written instructions for evaluating, preparing and treating substrate, technical data including tested physical and performance properties, installation instructions and safety data.
      b. Letter from Manufacturer indicating that specific products and auxiliary products are recommended for the intended application and exposures on Project. Based on mockups, include specific recommendations for surface preparation and installation for Project.
      c. Quality Control Forms:
         1) To be submitted as part of Quality Control System.
      d. Product Samples.
      e. Proposed layout of drilled holes for injection, estimated volume of material based on known conditions, etc.
   3. During Construction: Submitted at specified intervals during construction.
      a. Quality Control Documentation (weekly or as requested).
      b. Quality Assurance Documentation.
   4. Closeout Documents: Submitted upon Project completion and prior to final payment.
      a. Final Warranty.
b. Submit a letter from the material manufacturer indicating that a representative portion of all major steps in the Work were inspected by the manufacturer and that all that work was performed in accordance with the manufacturer’s recommendations and instructions.

c. Record Documentation.
   1) Includes as-built documentation and records of work completed such as red-lines drawings, specifications, etc.

d. Construction Photos

e. Quality Control Documentation.

1.6 QUALITY CONTROL AND ASSURANCE REQUIREMENTS

A. Installer Qualifications:
   1. Approved, authorized, or licensed by the material manufacturer to install specified product and/or system, and eligible to receive material manufacturer’s warranty.
   2. Must have documented installations of specified materials in local area in use for minimum of 3 years.
      a. Employ foreman with minimum 3-years of experience as foremen on similar projects to be on-site at all times.
      b. Employ only personnel who have been trained, or approved, by the material manufacturer in writing as being qualified to perform the Work covered herein.

B. Quality Control:
   1. General:
      a. Verify existing conditions and details prior to installation of materials. Notify OWNER of conditions found to be different than those indicated in Contract Documents. OWNER will review situation and inform CONTRACTOR and Applicator of changes.
      b. Inspect all materials upon receipt to verify product and condition.
      c. Inspect to verify that specified storage conditions for materials are provided
      d. Do not use or retain contaminated, outdated, or improperly stored materials. Do not use materials from previously opened containers.
      e. Make available all locations and phases of the work for periodic and/or required observation and/or inspection by OWNER, OWNER’s designated representative and/or Quality Assurance Inspector.
         1) The CONTRACTOR shall provide necessary access, support, ventilation, egress, safety and other means required.
      f. Provide daily quality control reports to OWNER on a weekly basis, or as requested. Submit reports in a Portable Document Format (PDF). At a minimum, Quality Control Report’s shall include:
         1) Project Identification.
         2) Date and Time(s).
         3) Atmospheric and Ambient Conditions.
         4) Inspector and Foreman Identification.
         5) Number of Workers On-Site.
         6) Work Area(s).
         7) Work Scope Performed.
         8) Work Progress.
         9) Product Data (Name, Lot, Exp.).
         10) Substrate and Application Conditions.
         11) Quality Control Inspections.
         12) Quality Assurance Inspections (Internal and By Others).
         13) Other Pertinent Information.
      g. The methods of construction shall be in accordance with requirements of the Contract Documents and best trade practices unless otherwise permitted by OWNER.
C. Inspection by OWNER, OWNER’s designated representative or Quality Assurance Inspector does not limit the CONTRACTOR’s responsibilities for inspection, quality workmanship or quality control as specified herein or as required by the Manufacturer’s instructions.

D. Mockups: For each material and/or system to be installed, prepare and install to a representative location designated by OWNER to demonstrate quality of materials, execution and effectiveness.
   1. Material manufacturer’s representative and Quality Assurance Inspector shall observe mockup and approve, in writing, preparation, execution and installation.
   2. If Quality Assurance Inspector determines mockup does not comply with requirements, modify mockup or construct new mockup until mockup is approved. Do not proceed with Work until mockup is approved.
   3. Approved mockup will be acceptance standard for remainder of Work.
   4. Mockup requirements will be waived by OWNER and/or ENGINEER where multiple locations and/or applications are not required and/or practicable.

E. Quality Assurance Testing and Inspection:
   1. Quality assurance observation and inspection will be performed by qualified Quality Assurance Inspector’s to be provided by OWNER.
      a. Refer to Contract Documents for general quality assurance reporting requirements.
      b. Observation and/or inspection frequency may be increased or decreased at OWNER’s discretion.
      c. Quality assurance observation and inspection includes, but is not limited to:
         1) Crack and/or joint preparation, routing, etc.
         2) Installation of crack and/or joint surface sealer, overlay, etc. required to retain required pressures during installation.
         3) Proposed locations and installation techniques of injection port placements.
         4) Verification of materials to be installed.
         5) Installation of injection materials.
         6) Water testing to verify functionality of installed materials.
      d. Inspection reports shall include date when material(s) was installed, name of installer, material lot/batch number, location(s)/mapping of installed material, volume of product installed and related information.
      e. Where Quality Assurance Inspector determines Work does not comply with requirements, CONTRACTOR shall remedy non-conformance by means of replacement, additional application and/or other suitable means at CONTRACTOR’s expense.

F. Inspection Hold Points:
   1. The Quality Assurance Inspector shall conduct hold point inspections. The CONTRACTOR is required to coordinate such hold points in the Work with OWNER or its designated representative such that inspections can be performed on a scheduled basis. CONTRACTOR shall provide OWNER a minimum 48-hour advanced notice for required quality assurance hold point inspections.
   2. Refer to Checklist’s herein for typical chemical grout Quality Control/Assurance checklist for cementitious and soil applications. OWNER and/or their designated representative may modify the contents of Quality Control/Assurance checklists as required based on Project needs, changes, constraints, etc.

G. Identification and Resolution of Conflicts
   1. It shall be the responsibility of the CONTRACTOR to notify OWNER of any conflicts, obstructions, discrepancies and similar items related to Contract Document content, specifications, instructions, field conditions, weather, etc. promptly upon discovery by means of a formally submitted Request for Information (RFI).
1.7 WARRANTY

A. CONTRACTOR & Manufacturer Joint Warranty, include:
   1. Labor and materials for remediation to address non-performing, defective and/or otherwise
      non-conforming materials and/or installations. Non-performance, defects and/or
      conformance includes, but is not limited to:
      a. Material defects of installed product identified at the time of installation and/or at a
         later date.
      b. Loss of moisture sealing/retaining abilities.
      c. Failure to adequately seal cracks and/or joint at area(s) of Work that were intended to
         be sealed.
   2. Remediation shall include, but is not limited to:
      a. Installation of additional materials to address unsealed portions of Work.
      b. Installation of alternate materials to achieve intended function of original installation
         material.
   3. Warranty Period: 1 year (min) from date of Project Completion.

1.8 DELIVERY, STORAGE AND HANDLING

A. Adhere to requirements herein and applicable requirements within the Contract Documents.
B. Deliver, store, and handle materials according to manufacturer's recommendations and in such
   manner as to prevent damage to materials and structure.
C. Deliver materials to Project site in original containers with seals unbroken, labeled with:
   1. Product name or title of material.
   2. Manufacturer’s stock/batch number
   3. Date of manufacture and shelf life, or expiration date.
   4. Application and mixing instructions.
   5. Handling instructions and precautions.
   6. Hazardous material identification label
D. Keep materials dry and do not allow materials to be exposed to moisture during transportation,
   storage, handling, or installation. Reject and remove from Site new materials which exhibit
   evidence of moisture during application or which have been exposed to moisture.
E. Store materials in original, undamaged containers in a clean, dry, protected location on raised
   platforms with weather-protective coverings, within temperature range required by
   manufacturer. Protect stored materials from direct sunlight. Manufacturer’s standard packaging
   and covering are not considered adequate weather protection.
F. Limit stored materials on structures to safe loading of structure at time materials are stored, and
   to avoid permanent deck deflection.
G. Handle and store materials to prevent damage.
H. Conspicuously mark damaged or opened containers, expired materials and/or diluted materials
   and remove from site as soon as possible.
I. Dispose materials in accordance with local, state and federal laws, rules and regulations.

1.9 CLEANING

A. At end of each workday, clean site and work areas and place rubbish, containers, rags, and other
   discarded materials in appropriate disposal containers.
B. Clean off excess grout and/or material as Work progresses by methods and with cleaning
   materials approved in writing by the manufacturer. Exercise care to avoid damage to adjacent
   surfaces, equipment, etc. Remedy surfaces stained, marred, or otherwise damaged during Work.
C. At conclusion of Work, clean up debris and surplus materials and remove from site.
1.10 SAFETY
A. Adhere to requirements herein and applicable requirements within the Contract Documents.
B. The CONTRACTOR is required to attend a safety briefing with OWNER prior to Work.
C. The CONTRACTOR shall ensure OWNER and CONTRACTOR personnel are aware of any hazards peculiar to the jobsite.
   1. Provide and/or identify location(s) of available first aid stations, eye wash stations and pertinent safety equipment.
   2. Provide contact information of responsible personnel and emergency phone numbers.
   3. Obtain contact information for OWNER stakeholders and pertinent OWNER site personnel.
   4. Determine and communicate evacuation routes.
D. Keep all work areas clean and safe.
E. Obey all plant rules and regulations.
F. The CONTRACTOR shall conduct all work covered by this section in accordance with all pertinent OSHA regulations.

1.11 CHANGES IN WORK
A. During Work, existing conditions may be encountered which are not known or are at variance with the Contract Documents. Such conditions may interfere with Work and may consist of damage or deterioration of substrate or installed materials that could jeopardize integrity or performance of the material(s) and/or system(s).
B. Notify OWNER of conditions that may interfere with proper execution of Work or jeopardize integrity of new material(s) and/or system(s) prior to proceeding with Work.

PART 2 - PRODUCTS
2.1 PRODUCTS AND MATERIALS
A. General:
   1. Source Limitations: Obtain product(s) through one source from single manufacturer, or from sources approved by material manufacturer.
   2. Material Compatibility: Provide materials that are compatible with one another and with concrete substrates under conditions of service and application, as demonstrated by material manufacturer based on testing on similar projects, mockups inspection and testing for this project and field experience.
B. Hydrophilic Polyurethane Chemical Grout (For Cementitious Substrate):
   1. General
      a. Utilizes existing moisture to initiate expansive properties of material.
      b. For use as a reactive expanding sealer/filler to seal and waterproof moving and non-moving cracks, joints, voids and/or other openings in actively leaking and/or saturated cementitious substrates.
      c. For use to seal large openings, cracks and/or joints through the injection of material into saturated oakum or open-celled foam and backer rod to form an impermeable gasket.
      d. Not for use as a structural epoxy-resin sealer.
   2. HRSD System #1: Hydrophilic Polyurethane Chemical Grout; Medium Viscosity (500 – 750 cps); High Elongation ( > 300%):
      a. For primary use to seal most conventional and larger crack widths where high elongation properties are desired.
      b. Not recommended for use to seal hairline cracking and/or thick cementitious substrates where hairline cracking may exist within its matrix.
      1) Products:
         a) Sikafix HH; Sika Corporation.
b) Dural Aqua-Fil; Euclid Chemical.
c) AV-330 Safeguard; Avanti
d) ST-526 Poly-Foam Ultra Injection Resin; Strata-Tech, Inc.
e) Approved Equal.

3. HRSD System #2: Hydrophilic Polyurethane Chemical Grout; Low Viscosity (250 – 450 cps); Elongation ( > 100%):
   a. For primary use to seal conventional and hairline crack widths.
   b. Recommended for thick cementitious substrates where hairline cracking may exist within its matrix.
      1) Products:
         a) De Neef Sealfoam PURe; GCP Applied Technologies Inc.
         b) Hydro Gel SX; Prime Resins, Inc.
         c) Prime Flex 900 XLV; Prime Resins, Inc.
         d) Approved Equal.

4. Auxiliary Materials:
      1) Used as a fibrous filler reinforcement material with polyurethane chemical grout to seal cracks, joints and other openings exceeding 1/4-inch (W).
      2) Use one of the following:
         a) De Neef Dry Oakum by GCP Applied Technologies Inc.
         b) Approved Equal.
   b. Open-Cell Polyethylene or Polyester Foam: Sheet, backer rod or other shapes.
      1) Used as a filler and reinforcement material with polyurethane chemical grout to seal cracks, joints and other openings exceeding 1/4-inch (W).
   c. Injection Ports: As recommended by manufacturer.
   d. Surface Sealer / Filler / Hydraulic Cement: As recommended by manufacturer.

C. Hydrophobic Polyurethane Chemical Foam Grout (For Cementitious Substrate):
   1. General:
      a. Utilizes a catalyst (activator) to initiate expansive properties of material.
      b. For use as a reactive expanding sealer/filler to seal and waterproof moving and non-moving cracks, joints, voids and/or other openings in cementitious substrates that are not actively leaking during installation.
      c. For use to seal large openings, cracks and/or joints through the injection of material into saturated oakum or open-celled foam and backer rod to form an impermeable gasket.
      d. Not for use as a structural epoxy-resin sealer.
   2. HRSD System #3: Hydrophobic Polyurethane Chemical Grout; Medium Viscosity (450 – 650 cps); High Elongation:
      a. For primary use to seal most conventional and larger crack widths where high elongation properties are desired.
      b. Not recommended for use to seal hairline cracking and/or thick cementitious substrates where hairline cracking may exist within its matrix.
      1) Products:
         a) De Neef Flex LV PURe; GCP Applied Technologies Inc.
         b) Sikafix HH LV; Sika Corporation.
         c) Dural Aqua-Dam; Euclid Chemical.
         d) Prime Flex 940; Prime Resins, Inc.
         e) AV-248 Flexseal; Avanti.
         f) Resfoam HB 45; MAPEI.
         g) Approved Equal.
   3. HRSD System #4: Hydrophobic Polyurethane Chemical Grout; Low Viscosity (100 – 450 cps):
      a. For primary use to seal conventional and hairline crack widths.
      b. Recommended for thick cementitious substrates where hairline cracking may exist within its matrix.
1) Products:
   a) De Neef Flex SLV PUR; GCP Applied Technologies Inc.
   b) AV-248-LV Flexseal LV; Avanti.
   c) Prime Flex 920; Prime Resins, Inc.
   d) Approved Equal.

4. Auxiliary Materials:
      1) Used as a fibrous filler reinforcement material with polyurethane chemical grout to
         seal cracks, joints and other openings exceeding 1/4-inch (W).
      2) Use one of the following:
         a) De Neef Dry Oakum; GCP Applied Technologies Inc.
         b) Approved Equal.
   b. Open-Cell Polyethylene or Polyester Foam: Sheet, backer rod or other shapes.
      1) Used as a filler and reinforcement material with polyurethane chemical grout to
         seal cracks, joints and other openings exceeding 1/4-inch (W).
   c. Injection Ports: As recommended by manufacturer.
   d. Surface Sealer / Filler: As recommended by manufacturer.

D. Hydrophobic Polyurethane Chemical Foam Grout (For Soils):
   1. General:
      a. For use as a reactive expanding sealer/filler to stabilize loose sand or soils.
   2. HRSD System #5: Hydrophobic Polyurethane Chemical Grout; Ultra-Low Viscosity (≤ 50
cps):
      a. Products:
         1) De Neef Soil PUR; GCP Applied Technologies Inc.
         2) Prime Flex 910; Prime Resins, Inc.
         3) AV-550 Soil Strengthener; Avanti.
         4) Approved Equal.

PART 3 - EXECUTION

3.1 GENERAL
   A. Coordinate Work with applicable stakeholders to ensure that continuous installation is achieved.
      Coordinate with:
      1. OWNER or OWNER’s designated representative.
      2. ENGINEER.
      4. Other trades to avoid or minimize Work in immediate vicinity of Work in progress or
         completed Work.

3.2 EXAMINATION
   A. CONTRACTOR shall examine and verify existing dimensions, conditions and details prior to
      installation of materials. CONTRACTOR shall report to OWNER, in writing, any conditions
      that would adversely affect the performance of the material and/or system to be installed
      and which cannot be put into an acceptable condition by the preparatory work specified herein.
   B. Do not proceed with affected Work until concerns have been dispositioned and clear direction is
      provided.
   C. Installation of material and/or system indicates acceptance of conditions.

3.3 WORK CONDITIONS
   A. Environmental Limitations: Install materials when existing and forecast weather conditions and
      substrate conditions permit materials to be installed according to manufacturer’s written
      instructions and warranty requirements.
B. Maintain adequate ventilation during preparation and placement.

3.4 PROTECTION

A. General:
1. Protect adjacent surfaces and surrounding site.
2. Protect prepared substrates, cracks and joints from windborne and local debris and/or contaminants.
3. Protect finished Work from damage.
4. Remove protective measures upon completion of Work.
5. Restore surfaces and site to condition prior to Work, to satisfaction of OWNER and at no additional cost to OWNER.

3.5 EQUIPMENT

A. Provide equipment that is capable of injecting materials at the minimum pressures recommended by the material manufacturer.

B. Pumps used for pressure injection shall be capable of providing pressures at the injection gun or nozzle as recommended by the material manufacturer.
1. The gun shall be fitted with a liquid filled gauge for measuring the injection pressure.
2. Check valves shall be placed in the hoses at the proper locations to prevent backflow.

3.6 SURFACE & SITE PREPARATION

A. Cementitious:
1. Prepare surfaces in general accordance with the manufacturer’s specifications and requirements.
2. Locate cracks and/or similar openings to be sealed.
3. For cracks with active moisture as evident by dampness, weeping or flowing), plug, fill and/or seal to reduce and/or eliminate active moisture prior to installation of injection material. Methods include, but are not limited to:
   a. Application of hydraulic cement.
   b. Installation oakum (dry or saturated with chemical grout) or appropriate filler.
   c. Other methods as recommended by OWNER and/or ENGINEER.
4. For cracks and joints greater than 1/4-inch (W):
   a. Install oakum, open cell foam or equivalent material to reinforce large openings during application of injection material.
5. Mark proposed locations of injection points for review by OWNER and/or ENGINEER.
6. Clean out cracks and openings to be sealed with compressed air to remove dust, debris, contamination, etc.
7. Drill holes along the side of the crack and/or opening to be sealed in accordance with manufacturer requirements.
   a. Size holes to be 5/8-inch diameter unless otherwise specified by manufacturer.
   b. Drill holes at a 45-degree angle to intersect cracks midway through the substrate.
   c. Clean dust and debris from drilled holes and adjacent surfaces.
8. Clean surfaces of substrates at material injection port and sealing locations to remove dust and debris.
9. Install injection ports and/or packers as appropriately spaced intervals along the crack to permit adequate material coverage and verify coverage during injection.
10. (As Required) Seal substrate surfaces to be injected to prevent release of injection material and ensure adequate pressure retention.
11. Pump water through injection ports to verify appropriate pathway(s) have been achieved between cracks, joints and/or ports.
12. Verify substrate moisture content meets manufacturer requirements to ensure activation of materials.
B. Soils:
1. Prepare site in general accordance with the manufacturer’s specifications and requirements.
2. Identify and clearly mark perimeter of soils to be stabilized.
3. Mark proposed locations of injection points with proposed depth of injection for review by OWNER and/or ENGINEER. Layout of injection points should consider:
   a. Underground utilities.
   b. Soil type, porosity and related existing conditions.
   c. Depth of soils to be stabilized.
   d. Targeted voids, depressions, etc.
   e. Intervals and procedures of installation.
   f. Application methods and equipment.
   g. Adjacent structures, equipment and related items.
4. Drill holes for injection points:
   a. Size holes in accordance with manufacturer recommendations.

3.7 MIXING AND INSTALLATION
A. General
1. Mixing:
   a. Refer to Manufacturer’s written instructions for mixing requirements specific to each material and/or application. Unless otherwise specified, the following minimum requirements shall apply:
      1) Verify environment and substrate is suitable for mixing operations and installation. Unless otherwise specified by manufacturer:
         a) Do not allow materials to unintentionally come into direct contact with moisture.
         b) Do not install materials when temperatures are above 90-degrees (and rising).
         c) Do not install materials if substrates conditions are not favorable and/or appropriate preparation requirements have not been achieved.
      2) Verify substrates, cracks, joints, etc. have been properly moisture-conditioned.
      3) Thoroughly mix material using a low-speed drill with a mixing paddle.
         a) Introduce catalyst (if required) at manufacturer recommended consistencies.
         b) Hand mixing is not permitted.
   4) Place mixed material in appropriate device and/or storage for immediate application.

2. Installation
   a. Cementitious:
      1) Pressure-inject materials with appropriate equipment at designated port locations
         a) Pressure of injected materials should vary based on configuration, crack/joint size, depth and other factors.
      2) Begin pressure injection at the lowest port location and continue until material is observed at an adjacent port.
         a) CONTRACTOR may continue installation from port before immediately moving to an adjacent port based on their expertise and experience.
         b) If material is not observed, drill additional holes and install additional ports.
         c) If liquid material is observed leaking from cracks or joints for more than 30 seconds, compress oakum, or another appropriate material, into the opening to aid the material’s gel time as a dam.
      3) Close port and begin injection at adjacent port(s) moving upwards until all ports are filled.
      4) Following installation and material cure:
         a) Remove injection ports.
         b) Mechanically remove injection material protruding from cracks and/or joints.
         c) Ground flush any surfacers, sealers and/or other products used along the length of injection.
   b. Soils:
1) Pressure-inject materials with appropriate equipment at designated drilled (or similar) injection locations
   a) Pressure of injected materials should vary based on configuration, soil type, depth and other factors.
2) Begin pressure injection at pre-identified locations and progress in accordance with the approved installation plan and procedure.
3) Continue installation until all injection locations have been addressed.
   a) For injection requiring higher than anticipated pressure to create travel of materials, or for injection where the anticipated volume of material to be injected is lower, notify OWNER and/or ENGINEER. Identify and implement additional measures to ensure adequate stabilization of soils including, but not limited to:
      (1) Drilling of additional holes and injection of additional material at reduced spacing’s.

3.8 FINAL INSPECTION

   A. CONTRACTOR shall arrange for a final inspection with OWNER to determine whether Work meets the requirements of the Contract Documents. Testing includes, but is not limited to:
      1. Drilling of pilot holes to verify presence of soil stabilization material (1 per 100SF (max)).
      2. Review of material volume installed.
CHECKLIST 1: CEMENTITIOUS CHEMICAL GROUT INJECTION

Project

Inspector

Task

Location

Quality Assurance Hold points are indicated in Bold

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<tr>
<th>Date</th>
<th>Initials</th>
<th>Task</th>
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<tbody>
<tr>
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<td>1. Required submittals have been provided to OWNER for review and have been accepted.</td>
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<td>2. Existing conditions, surfaces and related items relevant to work tasks have been examined and accepted. Deficiencies, obstructions, abnormalities and/or constraints have been communicated to OWNER and/or ENGINEER and appropriately resolved.</td>
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<td>3. Cracks and/or joints to be injected and sealed have been marked and reviewed by the OWNER, ENGINEER and/or Quality Assurance Inspector.</td>
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<td>4. Injection layout and plan have been reviewed by the OWNER, ENGINEER and/or Quality Assurance Inspector.</td>
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<td>5. Product/Material manufacturer has reviewed Work, substrates and conditions. Manufacturer has verified selected material(s) is suitable for application.</td>
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<td>6. OWNER property including, but not limited to, equipment, components, structures, etc. have been adequately protected.</td>
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<td>7. Active water has been mitigated, reduced and/or appropriately addressed by approved means and methods.</td>
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<td>8. Injection port holes have been drilled at specified angle and depth for application.</td>
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<td>9. Overlays, crack sealer and/or related items have been applied to dam materials (as required).</td>
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<td>10. Application equipment has been inspected and is ready for use.</td>
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<td>11. Material(s) are mixed in accordance with manufacturer requirements. Required catalyst(s) concentrations have been introduces (as required).</td>
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<td>12. Material(s) are injected at specified locations in accordance with the approved plans, specifications and manufacturer requirements. Application shall be observed by OWNER, ENGINEER and/or Quality Assurance Inspector.</td>
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<td>13. Required mockups have been performed, observed, reviewed and approved (if required).</td>
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<td>14. OWNER, ENGINEER and/or Quality Assurance Inspector has verified installation.</td>
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<td>15. Excess materials have been removed and/or cleaned from surfaces; overlays and/or sealers have been removed.</td>
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<td>16. Final inspection (field testing, in-service testing, etc.).</td>
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## CHECKLIST 2: SOIL CHEMICAL GROUT INJECTION

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**END OF SECTION**
SECTION 07900
JOINT SEALANTS AND EXPANSION JOINT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes:
   1. Surface preparation, installation, and quality control requirements of sealant in control joints, construction joints, and cracks in concrete.
   2. Specification of expansion and control joint systems.

1.2 RELATED SECTIONS
A. The following are related to Work in this Section, but are specified in other Sections:
   1. Section 09900 – Protective Coatings

1.3 DEFINITIONS
A. Adhesion – The bonding of one material to another (sealant to a substrate).
B. Adhesive Failure – Failure that occurs when a sealant pulls away from the surface or substrate to which it was bonded.
C. Bond Breaker – Material such as tape or backer rod designed to prevent three-sided adhesion.
D. Backer Rod – Flexible foam used behind sealant to increase elasticity, control the thickness and configuration of the sealant and provide a bond breaker to prevent three-sided adhesion.
E. Class 12.5 Sealant – A sealant that, when tested for adhesion or cohesion under cyclic movement per ASTM C719 will withstand an increase and decrease of at least 12.5% of the joint width as measured at the time of application.
F. Class 25 Sealant – A sealant that, when tested for adhesion or cohesion under cyclic movement per ASTM C719 will withstand an increase and decrease of at least 25% of the joint width as measured at the time of application.
G. Class 35 Sealant – A sealant that, when tested for adhesion or cohesion under cyclic movement per ASTM C719 will withstand an increase and decrease of at least 35% of the joint width as measured at the time of application.
H. Class 50 Sealant – A sealant that, when tested for adhesion or cohesion under cyclic movement per ASTM C719 will withstand an increase and decrease of at least 50% of the joint width as measured at the time of application.
I. Class 100/50 Sealant – A sealant that, when tested for adhesion or cohesion under cyclic movement per ASTM C719 will withstand an increase of at least 100% of the joint width and decrease of 50% of the joint width as measured at the time of application.
J. Coefficient of Expansion – The amount a material increases and decreases in size with temperature changes.
K. Cohesion – The molecular attration (internal strength) that holds the body of a sealant or adhesive together.
L. Cohesion Failure – Failure that occurs when the sealant fails to hold together.
M. Elastomeric – A material having the property of returning to its original shape and position.
N. Elongation – The lengthening or stretching ability of a sealant to accommodate movement.
O. Grade NS – A non-sag or gun grade sealant.
P. Grade P – A pourable of self-leveling sealant.

Q. Hardness – The ability of a sealant to resist surface penetration by a blunt probe.

R. Joint – A longitudinal or lateral opening that occurs when any two building surfaces meet. Within concrete, joints (cracks) also propagate at locations where movement and/or internal stresses occur.
   1. Static Joint – Fixed, non-moving, non-working joints not subject to extreme thermal changes.
   2. Dynamic Joint – Moving joints that experience expansion and contraction from thermal changes.

S. Modulus – Ratio between stress and strain classified as low, medium and high. Low modulus material stretches more easily.

T. Primer – A material applied to joint faces to improve the adhesion of sealants.

U. Substrate – The surface(s) to which a sealant is applied and bonded to.

V. Three-Sided Adhesion – Adhesion of sealant to a substrate on three sides. In dynamic joints, subsequent movement from three sides often causes adhesive failure, cohesive failure or both.

W. Tooling – Application technique to force a material against a backing and the surfaces of a joint to provide a smooth finished look and provide better adhesion to the substrate.

X. Type M – A multi-component sealant.

Y. Type S – A single component sealant.

Z. Use A – A sealant that meets the bond requirements when tested on aluminum specimens.

AA. Use G – A sealant that meets the bond requirements when tested on glass specimens.

BB. Use I – A sealant that meets the bond requirements when tested in immersion.

CC. Use M – A sealant that meets the bond requirements when tested on mortar specimens.

DD. Use O – A sealant that meets the bond requirements when tested on substrates other than standard substrates (glass, aluminum & mortar).

EE. Use NT – A sealant designed for use in non-traffic areas.

FF. Use T – A sealant designed for use in pedestrian and vehicular traffic areas.

1.4 REFERENCE STANDARDS

A. Reference Standards (Refer to the latest edition):
      a. ASTM C661: Standard Test Method for Indentation Hardness of Elastomeric-Type Sealant by Means of a Durometer
      c. ASTM C711: Standard Test Method for Low-Temperature Flexibility and Tenacity of One-Part, Elastomeric, Solvent-Release Type Sealants
      d. ASTM C717: Standard Terminology of Building Seals and Sealants
      e. ASTM C719: Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement
      g. ASTM C734: Standard Test Method for Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
      i. ASTM C794: Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
1.5 SUBMITTALS

A. CONTRACTOR shall provide the following submittals, specific to this Section, to OWNER for review and/or approval:

1. Pre-Award Submittals: Submitted as part of the Bid Process.
   a. CONTRACTOR and Subcontractor qualifications:
      1) Include CONTRACTOR and individual certifications, licenses, work experience and related documentation.
      2) Include evidence that company has a minimum of 5-years continuous experience in application of specified materials. Submit list of at least five completed Projects of similar scope and size, including:
         a) Project Name.
         b) Owner’s Name.
         c) Owner’s Representative’s Name, Address and Contact Information.
         d) Description of Work.
         e) Sealant(s) Used.
         f) Project Manager / Supervisor.
         g) Total cost of Sealant Work.
         h) Start and Completion Date.
b. Intent to Warrant and Sample Warranty.
   1) Copy of warranty, stating obligations, remedies, limitations, and exclusions.
2. Pre-Construction Submittals: Submitted prior to Work.
   a. Product Data / Safety Data: Sealant manufacturer’s literature including written
      instructions for evaluating, preparing and treating substrate, technical data including
      tested physical and performance properties, installation instructions and safety data.
      Include:
      1) Temperature ranges for storage and application of materials, and special cold-
         weather application requirements or limitations.
      2) Manufacturer’s recommendations for substrate cleaner and substrate primer for
         specific substrate surface and conditions.
      3) Manufacturer’s color card showing range of colors available for each product
         exposed to view.
   b. Letter from Manufacturer indicating that specific sealant products and auxiliary
      products are recommended for control joint and crack types and exposures on Project.
      Based on mockups, include specific recommendations for surface preparation and
      primers for Project.
   c. Quality Control Forms.
      1) To be submitted as part of Quality Control System.
   d. Product Samples.
3. During Construction: Submitted at specified intervals during construction.
   a. Quality Control Documentation (weekly or as requested).
   b. Quality Assurance Documentation.
4. Closeout Documents: Submitted upon Project completion and prior to final payment.
   a. Final Warranty.
      b. Submit a letter from the sealant manufacturer indicating that a representative portion of
         all major steps in the sealant work were inspected by the manufacturer and that all that
         work was performed in accordance with the manufacturer’s recommendations and
         instructions.
      c. Record Documentation.
         1) Includes as-built documentation and records of work completed such as red-lines
            drawings, specifications, etc.
   d. Construction Photos.
   e. Quality Control Documentation.

1.6 QUALITY CONTROL AND ASSURANCE REQUIREMENTS

A. Installer Qualifications:
   1. Approved, authorized, or licensed by sealant manufacturer to install sealant and eligible to
      receive sealant manufacturer’s warranty.
   2. Must have documented installations of specified materials in local area in use for minimum
      of 5 years.
      a. Employ foreman with minimum 5-years of experience as foremen on similar projects to
         be on-site at all times.
      b. Employ only personnel who have been trained, or approved, by the Sealant
         Manufacturer in writing as being qualified to perform the sealant Work covered herein.

B. Quality Control:
   1. General:
      a. Verify existing dimensions and details prior to installation of materials. Notify
         OWNER of conditions found to be different than those indicated in Contract
         Documents. OWNER will review situation and inform CONTRACTOR and Applicator
         of changes.
      b. Inspect all materials upon receipt to verify product and condition.
      c. Inspect to verify that specified storage conditions for materials are provided
d. Do not use or retain contaminated, outdated, or improperly stored materials. Do not use materials from previously opened containers.

e. Make available all locations and phases of the work for periodic and/or required observation and/or inspection by OWNER, OWNER’s designated representative and/or Quality Assurance Inspector.
   1) The CONTRACTOR shall provide necessary access, support, ventilation, egress, safety and other means required.

f. Provide daily quality control reports to OWNER on a weekly basis, or as requested. Submit reports in a Portable Document Format (PDF). At a minimum, Quality Control Report’s shall include:
   1) Project Identification.
   2) Date and Time(s).
   3) Atmospheric and Ambient Conditions.
   4) Inspector and Foreman Identification.
   5) Number of Workers On-Site.
   6) Work Area(s).
   7) Work Scope Performed.
   8) Work Progress.
   9) Product Data (Name, Lot, Exp.).
   10) Substrate Conditions.
   11) Quality Control Inspections.
   12) Quality Assurance Inspections (Internal and By Others).
   13) Other Pertinent Information.

g. The methods of construction shall be in accordance with requirements of the Contract Documents and best trade practices unless otherwise permitted by OWNER.

C. Inspection by OWNER, OWNER’s designated representative or Quality Assurance Inspector does not limit the CONTRACTOR’s responsibilities for inspection, quality workmanship or quality control as specified herein or as required by the Manufacturer’s instructions.

D. Mockups: For each sealant material and/or system to be installed, prepare and install sealant to a representative location designated by OWNER to demonstrate aesthetic affects, quality of materials and execution.
   1. Sealant manufacturer’s representative and Quality Assurance Inspector shall observe mockup and approve, in writing, preparation and installation.
   2. Quality Assurance Inspector may perform adhesion adhesion tests of sealant as part of acceptance.
   3. If Quality Assurance Inspector determines mockup does not comply with requirements, modify mockup or construct new mockup until mockup is approved. Do not proceed with Work until mockup is approved.
   4. Approved mockup will be acceptance standard for remainder of Work.
   5. Approved mockup may become part of completed Work, if appropriate.

E. Quality Assurance Testing and Inspection:
   1. Quality assurance testing and inspection will be performed by qualified Quality Assurance Inspector’s to be provided by OWNER.
      a. Refer to Contract Documents for general quality assurance and testing reporting requirements.
      b. Testing and/or inspection frequency may be increased or decreased at OWNER’s discretion.
   2. Field-Adhesion Testing: Quality Assurance Inspector will perform non-destructive and destructive field adhesion tests on sealant in accordance with ASTM C1521; sealant manufacturer’s representative shall observe testing as requested by OWNER or CONTRACTOR.
      a. Non-Destructive Testing:
         1) Procedure:
a) Depress center of sealant bead with probing tool to depth of 50 percent of bead width; or
b) Depress sealant bead near substrate bond-line until it appears visually that sealant is about to fail in cohesive; or
c) Apply uniform pressure with roller no more than one-half sealant bead in width, to create depression that represents approximately 50 percent of sealant deflection; advance roller along centerline of sealant bead; and note anomalies in sealant performance.

2) Record anomalies in sealant performance, if failures are adhesive or cohesive, and maximum surface depression as percent of joint or crack width.
3) Perform test every 12 inches for first 10 linear feet of joint or crack; if no test failure is observed, test every 24 inches thereafter.

b. Destructive testing, Method A:
1) Cut 6-inch-long tail of sealant loose from substrate.
2) Mark tail 1 inch from adhesive bond.
3) Grasp tail 1 inch from adhesive bond and pull until tail extends to 2 times the specified movement capability of sealant. If sealant has not failed, continue pulling to failure.
4) Record elongation at failure and if failure was adhesive or cohesive.
5) Observe sealant for complete filling of joint or crack with absence of voids, and for joint or crack configuration in compliance with requirements. Record observations and sealant dimensions.
6) Perform test every 100 feet for first 1,000 linear feet of joints and cracks; if no test failure at 2 times movement capability occurs, test every 1,000 feet thereafter.

c. Test reports shall include date when sealant was installed, name of person who installed sealant, test date, test location, and whether primer was used.
d. Immediately after testing, replace failed sealant in test areas. Neatly cut out and remove failed sealant, prepare and prime surfaces, and install new sealant. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
e. Sealant not evidencing adhesive failure from testing or noncompliance with requirements will be considered satisfactory.
f. Where Quality Assurance Inspector determines that sealant has failed adhesively from testing or does not comply with requirements, additional testing will be performed to determine extent of non-conforming sealant. Neatly cut out and remove non-conforming sealant, prepare and prime surfaces, and install new sealant. Perform field adhesion tests on new sealant. Additional testing and replacement of non-conforming sealant shall be at CONTRACTOR’s expense.

F. Inspection Hold Points:
1. The Quality Assurance Inspector shall conduct hold point inspections during the sealant work. The CONTRACTOR is required to coordinate such hold points in the sealant work with OWNER or its designated representative such that inspections can be performed on a scheduled basis. CONTRACTOR shall provide OWNER a minimum 48-hour advanced notice for required quality assurance hold point inspections.
2. Refer to Checklist 1 herein for a typical sealant Quality Control/Assurance checklist. OWNER and/or their designated representative may modify the contents of Quality Control/Assurance checklists as required based on Project needs, changes, constraints, etc.

G. Identification and Resolution of Conflicts
1. It shall be the responsibility of the CONTRACTOR to notify OWNER of any conflicts, obstructions, discrepancies and similar items related to Contract Document content, specifications, instructions, field conditions, weather, etc. promptly upon discovery by means of a formally submitted Request for Information (RFI).

1.7 WARRANTY

A. CONTRACTOR & Manufacturer Joint Warranty, include:
1. Removal and replacement of sealant that does not comply with requirements; that does not remain watertight; that fails in adhesion, cohesion, or general durability; or that deteriorates in manner not clearly specified by submitted sealant manufacturer’s literature as inherent quality of material for application indicated.

2. Removal and replacement of bond breaker materials.
   a. Excessive joint or crack movement caused by structural settlement or errors attributable to design or construction, resulting in stresses in sealant exceeding sealant manufacturer’s written data for sealant elongation or compression.
   b. Deterioration or failure of sealant due to failure of substrate prepared according to requirements.
   c. Mechanical damage caused by individuals, tools, or other outside agents.
   d. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

3. Warranty Period: 3 years (min) from date of Project Completion.

1.8 DELIVERY, STORAGE AND HANDLING

A. Adhere to requirements herein and applicable requirements within the Contract Documents.

B. Deliver, store, and handle materials according to manufacturer's recommendations and in such manner as to prevent damage to materials and structure.

C. Deliver materials to Project site in original containers with seals unbroken, labeled with:
   1. Product name or title of material.
   2. Manufacturer’s stock/batch number
   3. Date of manufacture and shelf life, or expiration date.
   4. Application and mixing instructions.
   5. Handling instructions and precautions.
   6. Hazardous material identification label

D. Keep materials dry and do not allow materials to be exposed to moisture during transportation, storage, handling, or installation. Reject and remove from Site new materials which exhibit evidence of moisture during application or which have been exposed to moisture.

E. Store materials in original, undamaged containers in a clean, dry, protected location on raised platforms with weather-protective coverings, within temperature range required by sealant manufacturer. Protect stored materials from direct sunlight. Manufacturer’s standard packaging and covering are not considered adequate weather protection.

F. Limit stored materials on structures to safe loading of structure at time materials are stored, and to avoid permanent deck deflection.

G. Handle and store materials to prevent damage.

H. Conspicuously mark damaged or opened containers, expired materials and/or diluted materials and remove from site as soon as possible.

I. Dispose materials in accordance with local, state and federal laws, rules and regulations.

1.9 CLEANING

A. At end of each workday, clean site and work areas and place rubbish, empty tubes and containers, rags, and other discarded materials in appropriate containers.

B. Clean off excess sealant or sealant smears as Work progresses by methods and with cleaning materials approved in writing by sealant manufacturer. Exercise care to avoid scratching or damage to surfaces. Remedy surfaces stained, marred, or otherwise damaged during sealant Work.

C. At conclusion of Work, clean up debris and surplus materials and remove from site.
1.10 SAFETY

A. Adhere to requirements herein and applicable requirements within the Contract Documents.

B. The CONTRACTOR is required to attend a safety briefing with OWNER prior to Work.

C. The CONTRACTOR shall ensure OWNER and CONTRACTOR personnel are aware of any hazards peculiar to the jobsite.
   1. Provide and/or identify location(s) of available first aid stations, eye wash stations and pertinent safety equipment.
   2. Provide contact information of responsible personnel and emergency phone numbers.
   3. Obtain contact information for OWNER stakeholders and pertinent OWNER site personnel.
   4. Determine and communicate evacuation routes.

D. Keep all work areas clean and safe.

E. Obey all plant rules and regulations.

F. The CONTRACTOR shall conduct all work covered by this section in accordance with all pertinent OSHA regulations.

1.11 CHANGES IN WORK

A. During Work, existing conditions may be encountered which are not known or are at variance with the Contract Documents. Such conditions may interfere with sealant Work and may consist of damage or deterioration of substrate or installed materials that could jeopardize integrity or performance of the sealant system.

B. Notify OWNER of conditions that may interfere with proper execution of Work or jeopardize integrity of new sealant prior to proceeding with Work.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MATERIALS

A. General:
   1. Source Limitations: Obtain sealants through one source from single manufacturer, or from sources approved by sealant manufacturer.
   2. Material Compatibility: Provide sealants, backings, and other related materials that are compatible with one another and with concrete substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing on similar projects, mockups inspection and testing for this project and field experience.
   3. Color of Exposed Sealant: Selected and approved in writing by OWNER, from sealant manufacturer’s full range.
   4. Primer: Provide manufacturer’s recommended primer for conditions and/or applications requiring primer.

B. Elastomeric Sealants: Comply with ASTM C920
   1. General
      a. Verify sealant compatibility with Coating System Manufacturer for use at areas to be coated.
      b. For joint and/or crack configurations exceeding 1-inch in width or less than 1/4-inch in depth, notify OWNER and/or ENGINEER for further direction.
   2. Polyurethane Sealant:
      a. HRSD System #1: ASTM C920, Type S, Grade NS, Class 35, Use A, G, M, NT, O.
         1) For use as a general purpose sealant in interior, exterior, atmospheric, submerged and/or intermittently submerged environments.
         2) For use with standard construction materials [concrete, metals, fiberglass, wood, masonry, aluminum].
         3) For use in joints and cracks not exceeding 1/2-inch (D).
4) For use in dynamic (movement) joints (Up to 35% expansion/contraction).
5) For use on substrates to be coated.
6) Not for use in chemical containments and/or submerged environments with moderate-to-severe chemical exposure.
   a) Products:
      (1) Sikaflex-1a; Sika Corporation.
      (2) Sikaflex-1c SL; Sika Corporation.
      (3) MasterSeal NP 1; BASF Corporation
      (4) Eucolastic 1NS; Euclid Chemical Company.
      (5) Approved Equal.

b. HRSD System #2: ASTM C920, Type M, Grade NS/P, Class 25 or 50, Use A, G, I, M, NT, O.
   1) For use as a general purpose sealant in interior, exterior, atmospheric, submerged and/or intermittently submerged environments.
   2) For use with standard construction materials [concrete, metals, fiberglass, wood, masonry, aluminum].
   3) For primary use in larger joint configurations and for submerged and intermittently submerged environments.
   4) For use in dynamic (movement) joints.
   5) For use on substrates to be coated.
   6) For use in environments with mild-to-moderate chemical exposure.
      a) Products:
         (1) DynaTrol II; Pecora Corporation.
         (2) Sikaflex-2c NS; Sika Corporation.
         (3) MasterSeal NP 2 with MasterSeal P 173; BASF Corporation
         (4) Approved Equal.

c. HRSD System #3: ASTM C920, Type M, Grade P, Class 25, Use T.
   1) For primary use in horizontal applications with exposure to vehicular and/or pedestrian traffic.
      a) Products:
         (1) DynaTrol II-SG; Pecora Corporation.
         (2) Sikaflex-2c SL; Sika Corporation.
         (3) MasterSeal SL 2; BASF Corporation
         (4) Approved Equal.

3. Polysulfide Sealant: ASTM C920, Type M, Grade NS or P, Class 25, Use A, G, M, NT.
   a. HRSD System #4:
      1) For use with standard construction materials [concrete, metals, fiberglass, wood, masonry, aluminum].
      2) For primary use in atmospheric, submerged and/or intermittently submerged environments exposed to chemicals, fuels, etc.
      3) For use on substrates to be coated.
         a) Products:
            (1) Synthacalk GC2+ NS; Pecora Corporation.
            (2) Tammsflex NS; Euclid Chemical Corporation.
            (3) Tammsflex SL; Euclid Chemical Corporation.
            (4) Approved Equal.

4. Hybrid Polyurethane Sealant (Silyl-Terminated Polyether): ASTM C920, Type S, Grade NS, Class 100/50, Use A, G, M, NT, O.
   a. HRSD System #5:
      1) For use with standard construction materials [concrete, metals, fiberglass, wood, masonry, aluminum].
      2) For use where high movement (flexibility) is required.
      3) For use with vertical applications such as concrete panel and wall systems, window and door frames, reglets, flashing, facades, etc.
      4) For use in joints and cracks no greater than 1-inch (W).
5) For use in above-grade atmospheric environments exposed to weathering.
6) For use on substrates to be coated.
7) Not for use in submerged and intermittently submerged environments and/or environments with chemical exposure.
   a) Products:
      (1) Sikaflex -15 LM; Sika Corporation.
      (2) MasterSeal NP 150; BASF Corporation.
      (3) Approved Equal.

5. Silicone Sealant: ASTM C920, Type S, Grade NS, Class 100/50, Use A, G, M, NT, O.
   a. HRSD System #6:
      1) For use with standard construction materials [concrete, metals, fiberglass, wood, masonry, aluminum].
      2) For primary use in exterior vertical non-structural glazing applications such as building envelopes, concrete panel and wall systems, window and door frames, reglets, flashing, facades, etc.
      3) For use where high movement (flexibility) is required.
      4) For use in above-grade atmospheric environments exposed to weathering.
      5) Not for use where surfaces will be coated.
      6) Not for use in interior, submerged and intermittently submerged environments, environments with chemical exposure, structural glazing applications, below-grade environments, confined spaces, wet- or frost-laden environments and/or with building materials that outgas or bleen oils, plasticizers or solvents.
         a) Products:
            (1) Sikasil WS-290; Sika Corporation.
            (2) Dowsil 790 Silicone Building Sealant; The DOW Chemical Company.
            (3) Spectrem 1; Tremco Incorporated.
            (4) Approved Equal.

   a. HRSD System #7:
      1) General purpose for use with most substrates found in interior and exterior applications.
      2) For primary use over substrates such as vinyl, aluminum, wood, porcelain, etc. in interior and/or controlled environments with minimal movement characteristics.
      3) For use on substrates to be coated.
      4) Not for use in industrial environments.
         a) Products:
            (1) DAP Alex Plus; DAP Inc.
            (2) Tremflex 834; Tremco Incorporated.
            (3) AC-20 +Silicone; Pecora Corporation.
            (4) Approved Equal.

7. Auxiliary Materials:
   a. General: Sealant-backer materials, primers, surface cleaners, masking tape, and other materials recommended by sealant manufacturer, that are non-staining and compatible with substrate.
   b. Backer materials: Polyethylene, closed-cell backer-rod, or as recommended by sealant manufacturer.

C. Expansion and Control Joint Systems
   1. General:
      a. Verify joint system compatibility with Coating System Manufacturer (CSM) for use at areas to be coated.

   2. Flexible Polyolefin Rubber Sealant System:
      a. HRSD System #8:
         1) For use with standard construction materials [concrete, metals, masonry]
         2) For use in crack and joint widths up to 4-inches, unless noted otherwise.
3) For use in static and movement joints.
4) For use in submerged, intermittently submerged and atmospheric environments.
5) May be used in conjunction with elastomeric joint sealant systems.
6) For long-term use with exposure to water, lime, seawater, sewage and bitumen.
7) For short-term use with exposure to light fuel oil, diesel, diluted alkali, diluted mineral acids, ethanol and methanol.
   a) Products:
      (1) Sikadur Combiflex SG System by Sika Corporation.
      (2) Approved Equal.
3. Submersible Joint Systems for Limited Chemical Exposure: Cellular Polyurethane Foam with Impregnated Hydrophobic 100% Acrylic Coated with Chemically Resistant Silicone; ± 25% Movement.
   a. HRSD System #9:
      1) For use with standard construction materials [concrete, metals, masonry, aluminum]
      2) For use in joint widths between 1-inch and 4-inches.
      3) For primary use in submerged and intermittently submerged environments.
      4) May be used in non-submerged environments as a continuation from the submerged system.
      5) For use in submerged environment with chloride levels less than 5 ppm.
      6) Not for use in areas subjected to high chemical concentrations and/or potential chemical exposure.
         a) Products:
            (1) Submerseal by Emseal LLC.
               (a) Allowable depth and hydrostatic head pressures:
                  • 1-inch joint; 2-1/8 inches (D); 30 ft. head
                  • 2-inch joint; 3-inches (D); 20 ft. head
                  • 3-inch joint; 3-1/2 inches (D); 15 ft. head
                  • 4-inch joint; 4-3/4 inches (D); 10 ft. head
            (b) Approved Equal.
   a. HRSD System #10:
      1) For use with standard construction materials [concrete, metals, masonry, aluminum]
      2) For use in joint widths between 1-inch and 4-inches.
      3) For use in submerged, intermittently submerged and non-submerged environments.
      4) For use in areas subjected to high chemical concentrations and/or potential chemical exposure.
         a) Products:
            (1) Chemseal by Emseal LLC.
               (a) Maximum hydrostatic head pressure = 5 ft.
               (b) Joint width (W) to depth (D) ratios:
                  • 1-inch (W) = 2-inch (D).
                  • 1-1/2 inch (W) = 2-3/8 (D).
                  • 2-inch (W) = 2-1/2 inch (D).
                  • 2-1/2 inch (W) = 2-3/4 inch (D).
                  • 3-inch (W) = 2-3/4 inch (D).
                  • 4-inch (W) = 3-1/2 inch (D).
                  • Refer to manufacturer’s current product data sheets for additional sizes and to validate joint sizing requirements.
            (2) Approved Equal.
PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate Work with applicable stakeholders to ensure that continuous, watertight, sealant installation is achieved. Coordinate with:
   1. OWNER or OWNER’s designated representative.
   2. ENGINEER.
   4. Other trades to ensure that Work done by other trades is complete and ready to receive sealant.
   5. Other trades to avoid or minimize Work in immediate vicinity of sealant Work in progress or completed Work.

3.2 EXAMINATION

A. CONTRACTOR shall examine and verify existing dimensions, conditions and details prior to installation of materials. CONTRACTOR shall report to OWNER, in writing, any conditions that would adversely affect the appearance or performance of the sealant system to be installed and which cannot be put into an acceptable condition by the preparatory work specified herein.
   1. Verify dimensions of joints at the project site by field measurement so that proper sealant profiles will be accurately maintained.
   2. Verify that areas and conditions under which Work is to be performed permit proper and timely completion of Work.

B. Do not proceed with affected Work until concerns have been dispositioned and clear direction is provided.

C. Installation of sealant system indicates acceptance of surfaces and conditions.

3.3 WORK CONDITIONS

A. Environmental Limitations: Install sealant when existing and forecast weather conditions permit sealant to be installed according to sealant manufacturer’s written instructions and warranty requirements.
   1. Do not install sealant when ambient or substrate temperature is below 40 degrees F or is expected to fall below 40 degrees F within 12 hours of installation unless otherwise permitted by manufacturer.
   2. Do not proceed with installation during inclement weather except for temporary work necessary to protect structure and installed materials. Remove temporary work and Work that becomes damaged by moisture.

B. Maintain adequate ventilation during preparation and placement.

C. Newly placed concrete surfaces shall be cured as recommended by sealant manufacturer prior to sealant application, unless otherwise approved by OWNER and/or OWNER’s designated representative.

3.4 PROTECTION

A. General:
   1. Protect adjacent surfaces and surrounding site from staining, damage, or debris from sealant Work.
      a. Mask off surfaces (as required).
   2. Protect prepared cracks and joints from windborne and local debris and/or contaminants.
   3. Protect fresh sealants from windborne and local debris, liquids and contaminants.
   4. Protect finished Work from damage.
   5. As necessary, prevent access to Work areas or provide “Wet Sealant” signs to protect newly sealed cracks and joints.
   6. Remove masking and other protective measures upon completion of Work.
7. Restore surfaces and site to condition prior to sealant Work, to satisfaction of OWNER and at no additional cost to OWNER.

3.5 SURFACE PREPARATION

A. General:
   1. For premanufactured sealant joint systems (HRSD System #8, #9 and #10), refer to Manufacturer’s written instructions for surface preparation requirements.
   2. For elastomeric sealants, refer to Manufacturer’s written requirements and instructions below for surface preparation requirements.

B. Prepare surfaces and install sealant per sealant manufacturer’s written recommendations and approved mockup procedures.

C. Notify sealant manufacturer and/or OWNER upon discovery of damaged or deteriorated concrete surfaces that may inhibit proper installation of sealant system for further direction prior to installation.

D. Remove existing sealant, backer rod and other foreign material from joints and cracks.

E. Rout joints and cracks to square or rectangular cross-section satisfying width (W) and depth (D) dimensions shown in Figure 1 [Engineer to Specify].

F. Clean substrate immediately before installing sealant, to comply with sealant manufacturer’s written instructions.
   1. Clean by wire brushing, grinding, blast-cleaning, mechanical-abrading, or combination of methods to produce clean, sound substrate capable of developing optimum bond with sealant.
   2. Remove laitance and form-release agents from joint and crack surfaces.
   3. Remove foreign material that could interfere with adhesion of sealant, including dirt, dust, existing sealant, oil, grease, and surface coatings.
   4. Provide dry substrate; prevent wetting of substrate prior to sealant installation.
   5. Remove loose particles remaining after cleaning operations by vacuuming or blowing out joints and cracks with oil-free, compressed air.

G. Install masking tape on adjacent surfaces to prevent permanent staining or damage due to contact with sealant or cleaning methods to remove sealant smears. Install masking tape on sides of joints and cracks where sealant will be recessed. Remove tape immediately after tooling sealant, without disturbing sealant.

3.6 INSTALLATION

A. General:
   1. For premanufactured sealant joint systems (HRSD System #8, #9 and #10), refer to Manufacturer’s written instructions for installation requirements.
   2. For elastomeric sealants, refer to Manufacturer’s written requirements and instructions below for installation requirements.

B. Prime substrate where recommended by sealant manufacturer.
   1. Apply primer per sealant manufacturer’s written instructions.
   2. Confine primer to areas of sealant bond; do not allow spillage or migration onto adjoining surfaces.
   3. Limit priming to areas that will be covered with sealant in same day. Unless recommended otherwise by sealant manufacturer, re-prime areas exposed for more than 24 hours.

C. Install sealant in routed and un-routed cracks to completely fill crack configuration.

D. Install backer rod in conventional joints and routed cracks greater than 1/2-inch (W).
   1. Backer rod shall be sized approximately 25% larger than joint/crack width, but not less than 10% larger than the smallest width along the joint/crack.
   2. As required, utilize various backer rod sizes for joints and cracks with varying widths.
3. The use of multiple backer rods to fill joint/crack widths at any point along the joint/crack is not permitted.

E. Install sealant in conventioned joints and routed cracks greater than 1/2-inch (W) to produce uniform, cross-sectional shape and depth; to directly contact and fully wet joint or crack sides; and to completely fill recesses in joint or crack configuration up to the backer rod.

1. Mix multi-component sealants per manufacturer’s written instructions.

2. For non-sag sealants:
   a. Install sealant flush with surface.
   b. Immediately after sealant application and before skinning or curing begins, tool joint or crack with slightly concave surface, compressing sealant into joint or crack to form smooth, uniform sealant bead; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint or crack. Do not use tooling agent.

3. For pourable self-leveling sealants on horizontal surfaces:
   a. Install sealant slightly below the surface.
   b. Immediately after sealant application and before skinning or curing begins, lightly tool joint or crack, compressing sealant into joint or crack to form smooth, uniform sealant bead; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint or crack. Do not use tooling agent.

4. Remove excess sealant from surfaces adjacent to joints and cracks.

3.7 FINAL INSPECTION

A. CONTRACTOR shall arrange for a final inspection with OWNER to determine whether sealant Work meets the requirements of the Contract Documents.

CHECKLIST 1: SEALANT INSTALLATION

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**END OF SECTION**
SECTION 09900
PROTECTIVE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Examination, preparation and application requirements for protective coatings applied over various substrates, components, elements, etc.
   3. General requirements for material storage handling, mixing, disposal and related items.

1.2 RELATED SECTIONS

A. Following Work items are related to Work in this Specification, but are specified in other Specifications:
   1. Section 07900 – Joint Sealant and Expansion Joint Systems

1.3 DEFINITIONS & ABBREVIATIONS

A. Abrasive – Material used for blast cleaning such as sand, shot or grit.
B. Abrasive Blast Cleaning – Surface preparation of substrates by abrasive propelled at high speed.
C. Applicator – CONTRACTOR and/or individual applying the coating system.
D. Bug Holes – Small cavities resulting from entrapment of air bubbles in the surface of formed concrete during placement and compaction.
E. Coating System Manufacturer (CSM) – The approved coating system manufacturer(s) for materials and/or systems to be installed.
F. Dew Point – Temperature of a given air/water vapor mixture at which condensation starts.
G. Dry Film Thickness (DFT) – Thickness of cured coating film.
H. Drying Time – Time interval between application and curing of material.
I. Feather Edging – Reducing the thickness along the edge of a material.
J. Field Coat – The application, or completion of application, of the coating system after installation of the surface at the site of work.
K. Hold Point – A mandatory verification point requiring approval.
L. Holiday – A discontinuity, skip or void in a coating or coating system film that exposes the substrate.
M. Honeycomb – Segregated condition of hardened concrete generally resulting from poor consolidation of concrete mixtures.
N. Hydroblast – High pressure water jetting that may be utilized to clean and/or prepare substrates.
O. Incompatibility – Inability of a coating to perform well over existing substrates or over another coating because of bleeding, poor bonding or lifting.
P. Immersion – A service condition in which the substrate to be coated is below the waterline or submerged in water, wastewater or liquid materials at least intermittently.
Q. Laitance – A layer of weak, non-durable concrete containing cement fines.
R. Mil – A unit of measure equal to 0.001 inch.
S. Overspray – Dry spray that failed to strike the intended surface.

T. Pinhole – A small diameter discontinuity in a coating or coating system film.

U. Pot Life – Time interval after mixing of components during which the coating can be satisfactorily applied.

V. Quality Assurance Inspector – Certified and/or qualified individual(s) responsible for inspecting and/or testing Work such as conditions, materials, installations, applications, etc. to verify Work is performed in accordance with applicable specifications and requirements.

W. Surfacer (Resurfacer / Filler) Material – A layer of cementitious and/or resin-base material used to fill or restore surface continuity to worn, or damaged, concrete surfaces.

X. Saturated Surface Dry (SSD) – Concrete surface condition where the surface is saturated, or damp, without the presence of standing water.

Y. Shelf Life – Maximum storage time for which a material may be stored without losing its usefulness.

Z. Shop Coat – One or more coats applied in a shop or plant prior to shipment to the site of the work, where the field or finishing coat(s) is applied.

AA. Spreading (Coverage) Rate – Area covered by a unit volume of coating material at a specific thickness.

BB. Stripe Coat – A separate application of coating material applied by brush to areas where coating thickness and coverage is difficult to achieve and/or where additional protection is required such as edges, welds, pits, nuts, bolts, washers, etc.

CC. Tie-Coat – An intermediate coat used to bond different types of coatings. Coatings used to improve the adhesion of a succeeding coat.

DD. Touch-Up Coating – The application of coated areas of coated surfaces to repair marks, scratches and areas where the coating has been damaged or deteriorated to restore the coating film to an unbroken condition.

EE. Volatile Organic Compound (VOC) – The portion of the coating that is a compound of carbon, is photochemically reactive, and evaporates during drying or curing.

FF. Wet Film Thickness (WFT) – The coating films thickness immediately following application.

1.4 REFERENCE STANDARDS

A. Reference Standards (Refer to the latest edition):
   1. American National Standards Institute (ANSI):
      a. ANSI/ASC 29.4: Abrasive Blasting Operations – Ventilation and Safe Practice
      b. ANSI/NSF 61: Drinking Water System Components Health Effects
      c. ANSI B74.18: Grading of Certain Abrasive Grain on Coated Abrasive Material
      d. ASTM D16: Standard Terminology for Paint, Related Coatings, Materials, and Applications
      b. ASTM D16: Standard Terminology for Paint, Related Coatings, Materials, and Applications
      c. ASTM D610: Standard Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces
      d. ASTM D2200 (SSPC VIS1): Pictorial Surface Preparation Standards for Painting Steel Surfaces
      e. ASTM D3960: Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
      f. ASTM D4227: Standard Practice for Qualification of Coating Applicators for Concrete
g. ASTM D4258: Standard Practice for Surface Cleaning Concrete for Coatings
h. ASTM D4259: Standard Practice for Abrading Concrete
i. ASTM D4262: Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces
j. ASTM D4263: Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
k. ASTM D4414: Standard Practice for Measurement of Wet Film Thickness by Notch Gages
l. ASTM D4417: Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
m. ASTM D4541: Standard Test Methods for Pull-Off Strength of Coatings On Metal Substrates Using Portable Adhesion Testers
n. ASTM D4787: Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates
o. ASTM D5043: Standard Practice for Field Identification of Coatings
p. ASTM D5162: Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates
q. ASTM D5367: Standard Practice for Evaluating Coatings Applied over Surfaces Treated with Inhibitors Used to Prevent Flash Rusting of Steel when Water or Water/Abrasive Blasted
s. ASTM D6237: Standard Guide for Painting Inspectors (Concrete and Masonry Substrates)
t. ASTM D7088: Resistance to Hydrostatic Pressure for Coatings Used in Below Grade Applications Applied to Masonry
w. ASTM F1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

3. International Concrete Repair Institute (ICRI):
   a. ICRI Technical Guideline No. 03732: Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays

4. National Association of Corrosion Engineers (NACE):
   b. NACE Publication 6F-163: Surface Preparation of Steel or Concrete Tank/Interiors
   c. NACE Publication 6G-164 A: Surface Preparation Abrasives for Industrial Maintenance Painting
   d. NACE Standards: January 1988 Edition of the National Association of Corrosion Engineers, TPC.
   e. NACE SP0188: Standard Practice – Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
   f. NACE SP0288: Standard Recommended Practice, Inspection of Linings on Steel and Concrete
   g. NACE SP0892: Standard Recommended Practice, Linings Over Concrete in Immersion Service
   h. NACE Publication TPC2: Coatings and Linings for Immersion Service
   i. NACE SP0178: Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service

5. National Association of Pipe Fabricators (NAPF):
   a. NAPF 500-03: Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings
   b. NAPF 500-03-04: Abrasive Blast Cleaning for Ductile Iron Pipe
   c. NAPF 500-03-05: Abrasive Blast Cleaning for Cast Ductile Iron Fittings
6. Occupational Safety and Health Administration (OSHA):
   b. OSHA 1915.35: Standards – 29CFR - Painting

7. Painting and Decorating Contractors of America (PDCA):
   a. PDCA P1: Touch-Up Painting and Damage Repair: Financial Responsibility and Definition of a Properly Painted Surface

8. Society for Protective Coating (SSPC):
   a. SSPC Paint Application Specification No. 1
   b. SSPC AB 1: Mineral and Slag Abrasives
   c. SSPC PA 1: Shop, Field, and Maintenance Painting of Steel
   d. SSPC PA 2: Measurement of Dry Coating Thickness with Magnetic Gages
   e. SSPC PA 9: Measurement of Dry Coating Thickness on Cementitious Substrates Using Ultrasonic Gages
   f. SSPC PA Guide 1: Guide for Illumination of Industrial Painting Project
   g. SSPC PA Guide 3: A Guide to Safety in Paint Application
   h. SSPC PA Guide 6: Guide for Containing Debris Generated During Paint Removal Operations
   i. SSPC PA Guide 11: Guide for Coating Concrete
   j. SSPC SP1: Solvent Cleaning
   k. SSPC SP2: Hand Tool Cleaning
   l. SSPC SP3: Power Tool Cleaning
   m. SSPC SP5: White Metal Blast Cleaning
   n. SSPC SP6: Commercial Blast Cleaning
   o. SSPC SP7: Brush-Off Blast Cleaning
   p. SSPC SP 10: Near-White Blast Cleaning
   q. SSPC SP11: Power Tool Cleaning to Bare Metal
   r. SSPC SP12: Surface Preparation and Cleaning of Steel and Other Hard Materials by High and Ultra-High Pressure Water Jetting Prior to Recoating
   s. SSPC SP13: Surface Preparation of Concrete
   t. SSPC TR2: Wet Abrasive Blast Cleaning
   u. SSPC TU-3: Overcoating
   v. SSPC Guide 15: Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates
   w. SSPC V2: Systems and Specifications: Steel Structures Painting Manual, Volume 2
   x. SSPC VIS 1: Visual Standard for Abrasive Blast Cleaned Steel
   y. SSPC VIS 3: Visual Standard for Power and Hand – Tool Cleaned Steel
   z. SSPC VIS 4: Visual Standards (Waterjetting)
   aa. SSPC VIS 5: Visual Standards (Wet Abrasive Blast Cleaning)

9. Water Pollution Control Federation (WPCF):

1.5 SUBMITTALS

A. CONTRACTOR shall provide the following submittals, specific to this Section, to OWNER for review and/or approval:

1. Pre-Award Submittals: Submitted as part of Bid
   a. CONTRACTOR and subcontractor qualifications:
      1) Include CONTRACTOR and individual certifications, licenses, work experience and related documentation.
      2) Include evidence that company has a minimum of 5-years continuous experience in application of specified materials. Submit list of at least five completed Projects of similar scope and size, including:
         a) Project Name.
         b) Owner’s Name.
         c) Owner’s Representative’s Name, Address and Contact Information.
d) Description of Work.
e) Coatings Used.
f) Project Manager / Supervisor.
g) Total cost of Coating Work.
h) Start and Completion Date (Projected/Actual).

b. Intent to Warrant(s).
c. Letter and/or certifications from CSM(s) specifying that the CONTRACTOR and/or subcontractor are an approved applicator of their materials.

2. Pre-Construction Submittals: Submitted prior to Work.
   a. Product Data / Safety Data Sheets of all products and materials to reside, or be used, on-site. At a minimum, data sheets should include:
      1) Performance Criteria.
      2) Surface Preparation Requirements.
      3) Detailing Requirements (Terminations, Transitions, Etc.).
      4) Storage, Mixing and Application Instructions.
      5) Thinning Instructions and Requirements.
      6) VOC Data.
      7) Safety Data and Requirements.
   b. Letter from Coating System Manufacturer (CSM) indicating that material(s) are appropriate for the specified application.
      1) Include CSM permitted cleaning and thinner solutions (if applicable)
      2) Include any additional CSM permissions in conflict with requirements herein and/or not indicated on CSM’s data sheets and/or instructions.
   c. Quality Control Forms:
      1) To be submitted as part of Quality Control System
      2) Include inspections, holdpoints, testing, etc.
   d. Product Samples: 5” x 7” (min) Samples for each color and material to be applied, with texture to simulate actual conditions, on representative samples of actual substrate.
      Include:
      1) Color samples.
      2) Stepped and cut samples defining each separate coat, including primers.

3. During Construction: Submitted at specified intervals during construction.
   a. Quality Control Documentation (weekly or as requested).
   b. Quality Assurance Documentation performed by CONTRACTOR.

4. Closeout Documents: Submitted upon Project completion and prior to final payment.
   a. Submit a letter from the CSM indicating that a representative portion of all major steps in the coating Work were inspected by the CSM and that all that work was performed in accordance with the CSM’s recommendations and instructions.
   b. Record Documentation
      1) Provide as-built documentation and records of work completed including red-lined drawings, specifications, etc. indicating work performed, materials, dimensions, locations, etc.
   c. Construction Photos (electronic).
   d. Quality Control Documentation.
   e. Warranty(s).

1.6 QUALITY CONTROL AND ASSURANCE REQUIREMENTS

A. Qualifications: CONTRACTOR and Subcontractor’s performing coating activities shall satisfy the following qualifications and requirements at a minimum:
   1. Qualified and Certified in accordance with requirements as specified herein this specification.CSM Qualified and/or certified applicator.
   2. At least 5-years of continuous experience in the removal, preparation and application of specified, or equivalent, coating materials.
      a. Employ site superintendent and/or foreman with minimum 5-years of experience as foremen on similar projects to be on-site at all times.
b. Employ only personnel who have been trained, or approved, by the CSM in writing as being qualified to perform the coating system work covered herein.

B. Quality Control:
   1. General: The following identifies general quality control responsibilities for the CONTRACTOR performing coating Work. Refer to sections herein and the Contract Documents for additional quality control requirements:
      a. Verify existing dimensions and details prior to substrate preparation and installation of materials. Notify OWNER of conditions found to be different than those indicated in Contract Documents. OWNER will review situation and inform CONTRACTOR of recommended changes.
      b. Ensure inspection tools and/or testing equipment are calibrated prior to use.
      c. Do not use or retain contaminated, outdated, or diluted materials for coating. Do not use materials from previously opened containers.
      d. Use only products of the approved CSM(s) in accordance with the Contract Documents. Provide the same products for repairs as for original coating work, unless otherwise specified and/or approved by OWNER.
      e. Inspection by Quality Assurance Inspector(s) does not limit the CONTRACTOR’s responsibilities for inspection, quality workmanship. Material compatibility and/or quality control as specified herein or as required by the CSM(s) instructions.
         1) Make available all locations and phases of the work for periodic and/or required observation and/or inspection by OWNER, OWNER’S designated representative and/or Quality Assurance Inspector.
         2) Provide necessary access, support, ventilation, egress, safety and other means required to perform and/or validate Work.
      f. Provide daily quality control reports to OWNER on a weekly basis, or as otherwise requested by OWNER. Submit reports in Portable Document Format (PDF). At a minimum, quality control reports shall include:
         1) Project Identification.
         2) Date and Time(s).
         3) Atmospheric and Ambient Conditions.
         4) Inspector and Foreman Identification.
         5) Number of Workers On-Site.
         6) Work Area(s).
         7) Work Scope Performed.
         8) Work Progress.
         9) Quality Control Inspections.
            a) Material(s), Batch No(s).
            b) Location(s)
         10) Quality Assurance Inspections (Internal and By Others).
         11) Other Pertinent Information.
      g. The methods of construction shall be in accordance with requirements of the Contract Documents and best trade practices unless otherwise permitted by OWNER.

C. Mockups: For each material and/or system to be installed, prepare surface and apply coating system to a representative location designated by OWNER to demonstrate aesthetic affects and quality of materials and execution. Leave portion of prepared surface and each coating layer exposed to view. Adhere to recognized hold points for review by Quality Assurance Inspector.
   1. CSM and Quality Assurance Inspector shall observe mockup Work and approve, in writing, applicable hold points and final installation.
   2. Quality Assurance Inspector may perform field adhesion tests of coatings as part of acceptance.
   3. If Quality Assurance Inspector determines mockup does not comply with requirements, modify mockup or construct new mockup until mockup is approved. Do not proceed with Work until mockup is approved.
   4. Approved mockup will be the acceptance standard for remainder of Work.
5. Approved mockup may become part of completed Work, if appropriate.

D. Quality Assurance Testing and Inspection:

1. Quality Assurance Inspections are to be performed at critical steps throughout the Work process. Unless indicated otherwise by OWNER, the Quality Assurance Inspector shall perform inspections.
   a. Refer to Table 1 herein for typical quality assurance testing and inspection requirements.
      1) Specific quality assurance inspection and testing requirements shall be determined based on the specific application. CONTRACTOR shall include applicable quality assurance inspection and testing requirements and hold points in their quality control system. CONTRACTOR shall coordinate with OWNER and/or OWNER’s Quality Assurance Inspector as required to verify applicable requirements.
   b. Refer to Checklist’s 1 and 2 herein for typical Quality Control/Assurance requirements and inspection activities with representative hold points. Checklist may be modified based on specific application and/or scope requirements.
      1) Hold Points are indicated in bold and represent required quality assurance inspection and/or testing. Do not proceed with Work that may make hold point inspections difficult or impossible to perform until inspection has been completed and deficiencies corrected.
      2) The CONTRACTOR is required to coordinate hold points with OWNER or its designated representative such that inspections and testing can be performed on a scheduled basis. CONTRACTOR shall provide OWNER and/or Quality Assurance Inspector a minimum 48-hour advanced notice for required quality assurance hold point inspections and testing.
   c. CONTRACTOR shall reapply coating in areas disturbed by inspection and/or testing at no cost to OWNER.
   d. If inspected Work is unacceptable, OWNER and/or Quality Assurance Inspector will determine remedy. CONTRACTOR shall remove and replace unacceptable coating or perform other remedial actions at no cost to OWNER. CONTRACTOR may, at own expense, perform additional measurements and testing to determine limits of areas with unacceptable coating.

2. Quality Assurance Inspection and Testing to be performed by CONTRACTOR (if required as part of the Bid Process) shall adhere to requirements as specified herein and in the Contract Documents.
   a. CONTRACTOR Quality Assurance Inspectors for all aspects of coating Work shall be NACE level III certified.
   b. CONTRACTOR Quality Assurance Inspectors shall be from a third-party company with no affiliation with the CONTRACTOR.
   c. CONTRACTOR shall provide documentation for all inspection equipment showing the date when last calibrated and by the company that performed the calibration. All equipment shall be calibrated within the previous 12 months from the date of use, unless otherwise permitted by manufacturer and OWNER. If a difference in readings is discovered between CONTRACTOR and OWNER or Quality Assurance Inspector inspection equipment, all parties shall verify their equipment is free from damage and is in proper working condition.

1.7 WARRANTY

A. Contractor Warranty:

1. Repair or replace coating that does not comply with requirements; that fails in adhesion, cohesion, or general durability; that cracks, checks, fades, or chalks; where visible rust occurs; or that deteriorates in manner not clearly specified by submitted CSM’s data as inherent quality of material for application indicated.
2. Coating re-work shall closely match color of existing coating. Extend new coating to reveals, surface edges, or other natural termination points to minimize differences in appearance between new and existing coating.

3. Warranties Coverage:
   a. Adhesive or cohesive failure of existing coating that remains in place.
   c. Providing access to warranty Work.
   d. Materials

4. Warranty Period: 1 year after quality assurance acceptance of completed system. Warranty periods extending beyond 1 year are desirable and will be considered during bid evaluation.
   a. An annual follow-up inspection shall be conducted following 12 months of service after acceptance of the coating work. Service is identified as exposure to the intended environment(s) for which the coating was selected for (Example: Interior tank wall service = Exposure to process liquids for which tank is used for). Owner, CONTRACTOR’s representative and a representative of the CSM shall attend this follow-up inspection.

B. Coating Manufacturer Warranty:
   1. Submit a written material warranty, executed by the CSM, agreeing to repair or replace coatings materials that fail within specified warranty period. Failures include, but are not limited to, water penetration through the coating, blistering and/or peeling of the coating.
   2. Warranty Period: 3 years of service after acceptance of the coating work. Warranty periods extending beyond 3 years are desirable and will be considered during bid evaluation.

1.8 DELIVERY, STORAGE AND HANDLING

A. Adhere to requirements herein and applicable requirements within the Contract Documents.

B. Deliver materials to Project site in original containers with seals unbroken, labeled with:
   1. Product name or title of material.
   2. Manufacturer’s stock/batch number.
   3. Date of manufacture and shelf life, or expiration date.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Application and mixing instructions.
   6. Handling instructions and precautions.
   7. Hazardous material identification label.

C. Store materials in original, undamaged containers and, if permitted, partially-used materials tightly covered containers in clean, dry, well-ventilated, protected location on raised platforms with weather-protective coverings, within temperature range required by coating manufacturer. Protect stored materials from direct sunlight, heat, sparks, and flames.

D. Limit stored materials on structures to safe loading of structure at time materials are stored, and to avoid permanent deck deflection.

E. Handle and store materials to prevent damage.

F. Conspicuously mark damaged or opened containers, containers with contaminated materials, diluted materials and/or expired materials and remove from site as soon as possible.

G. Empty containers used on job shall have labels cancelled and shall be clearly marked.

H. Dispose materials in accordance with Federal Register 40 CFR 262.

1.9 CLEANING

A. At end of each workday at a minimum, clean site and work areas and place rubbish, empty cans, rags, and other discarded materials in appropriate containers.
B. After completing coating Work, clean spillage, overspray, and spatter from adjacent surfaces using cleaning agents and procedures recommended by manufacturer of affected surface. Exercise care to avoid scratching or damage to surfaces. Repair surfaces stained, marred, or otherwise damaged during coating Work.

C. Upon completion of coating work the CONTRACTOR shall remove surplus materials, protective coverings, and accumulated rubbish, and thoroughly clean all surfaces and repair any overspray or other coating-related damage.

1.10 SAFETY

A. Adhere to requirements herein and applicable requirements within the Contract Documents.

B. The CONTRACTOR is required to attend a safety briefing with OWNER prior to Work.

C. The CONTRACTOR shall ensure OWNER and CONTRACTOR personnel are aware of any hazards peculiar to the jobsite.
   1. Provide and/or identify (if available) location(s) of first aid stations, eye wash stations and pertinent safety equipment
   2. Provide contact information of responsible personnel and emergency phone numbers.
   3. Obtain contact information for OWNER stakeholders and pertinent OWNER site personnel.
   4. Determine and communicate evacuation routes.

D. Keep all work areas clean and safe.

E. Obey all plant rules and regulations.

F. Barricade and/or establish appropriate labeled boundaries to prevent entry to Work location by individuals whom do not have a business need to enter.
   1. Establish appropriate sound and/or material exposure/hazard boundaries (as required).
   2. Hang appropriate hazard labels and/or communicate applicable hazards to appropriate OWNER personnel.
   3. Ensure appropriate contact information is clearly displayed and/or communicated such that individuals may contact responsible personnel to communicate hazards and/or permit access.

G. The CONTRACTOR shall conduct all work covered by this section in accordance with all pertinent OSHA regulations.

1.11 CHANGES IN WORK

A. It shall be the responsibility of the CONTRACTOR to notify OWNER of any conflicts, obstructions, discrepancies, damage, deterioration and similar items at variance with the Contract Document content, specifications, instructions, field conditions, weather, etc. that could jeopardize integrity or performance of coating systems promptly upon discovery by means of a formally submitted Request for Information (RFI).

B. CONTRACTOR shall submit proposed changes relating to Work including but not limited to scope, execution, materials, schedule, etc. to OWNER by means of a formally submitted RFI.
PART 2 - PRODUCTS

2.1 PRODUCTS AND MATERIALS

A. Source Limitations: For each coating system, obtain materials through one source from single coating manufacturer, or from sources approved by CSM(s).

B. Material Compatibility: Provide sealants, surfacers, primers, intermediate coats, finish coats, and related materials that are compatible with one another and substrates indicated under conditions of application and service, as demonstrated by CSM based on testing and field experience. Compatibility shall be verified as part of the bid process.

C. Material Quality: Provide CSM(s) quality coating materials that are factory formulated and are recommended by CSM for application indicated. Material containers not displaying CSM(s) product identification are not acceptable.

D. Material Color Requirements:
   1. General:
      a. All coating applications requiring multiple coats, stripe coating and/or similar multi-stage applications shall be required to vary colors with each respective coat. Final finish color shall be approved by OWNER.
   2. For Metallic Surfaces:
      a. Immersion
         1) Prime Coat: Red
         2) Intermediate Coat: Beige
         3) Finish Coat: Gray
         4) Or OWNER approved color combination.
      b. Atmospheric
         1) Prime Coat: Red
         2) Intermediate Coat: White
         3) Finish Coat: Selected by OWNER
         4) Or OWNER approved color combination.
E. Use one of following systems or approved equal:

1. HRSD System #1: Acrylic Latex; For Interior & Exterior Concrete, CMU and Brick Substrates Exposed to Weathering Only; For Aesthetics; Breathable; Not for Exposure to Corrosive Chemicals, Immersion and/or Constant Wet/Dry Conditions:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>FILLER/ SURFACER</th>
<th>DFT (MIL)</th>
<th>BASE COAT</th>
<th>DFT (MIL)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Sanitile 100</td>
<td>10 – 12</td>
<td>Carbocrylic 3359 DTM</td>
<td>3</td>
<td>Carbocrylic 3359 DTM</td>
<td>3</td>
<td>16 – 18</td>
</tr>
<tr>
<td>PPG</td>
<td>Pitt-Glaze 16-90</td>
<td>10 – 13</td>
<td>N/A</td>
<td>N/A</td>
<td>Perma-Crete 4-110</td>
<td>6 – 7.2</td>
<td>16 – 20.2</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Heavy Duty Block Filler</td>
<td>10 – 18</td>
<td>Sher-Cryl</td>
<td>3 – 3.7</td>
<td>Sher-Cryl</td>
<td>3 – 3.7</td>
<td>16 – 25.4</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Envirofill Series 130</td>
<td>10</td>
<td>N/A</td>
<td>N/A</td>
<td>W.B. Tneme-Crete Series 180</td>
<td>6 – 8</td>
<td>16 – 18</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

2. HRSD System #2: Elastomeric Acrylic; For Interior and Exterior Concrete, CMU, and Brick Substrates Exposed to Weathering and Requiring Flexibility; For Aesthetics; Breathable; Not for Exposure to Corrosive Chemicals, Immersion and/or Constant Wet/Dry Conditions:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PRIMER COAT</th>
<th>DFT (MIL)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Flexxide Elastomer 100</td>
<td>6 – 8</td>
<td>Flexxide Elastomer 100</td>
<td>6 – 8</td>
<td>12 – 16</td>
</tr>
<tr>
<td>Induron</td>
<td>AC 403 Acrylic Elastomeric Coating</td>
<td>6 – 8</td>
<td>AC 403 Acrylic Elastomeric Coating</td>
<td>6 – 8</td>
<td>12 – 16</td>
</tr>
<tr>
<td>PPG</td>
<td>Perma-Crete Pitt-Flex 4-110XI</td>
<td>6 – 7</td>
<td>Perma-Crete Pitt-Flex 4-110XI</td>
<td>6 – 7</td>
<td>12 – 14</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Loxon XP</td>
<td>6 – 8</td>
<td>Loxon XP</td>
<td>6 – 8</td>
<td>12 – 16</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Enviro-Crete Series 156</td>
<td>6 – 8</td>
<td>Enviro-Crete Series 156</td>
<td>6 – 8</td>
<td>12 – 16</td>
</tr>
</tbody>
</table>

APPROVED EQUAL
3. HRSD System #3: Cycloaliphatic Amine Epoxy; For Interior and Exterior Concrete, CMU, Brick and Ferrous Metal Substrates Exposed to Weathering, Intermittent Wetting and/or Mildly Corrosive Environments; For Protection:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>BASE COAT</th>
<th>DFT (MIL)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Carboguard 890</td>
<td>6 – 8</td>
<td>Carboguard 890</td>
<td>6 – 8</td>
<td>12 – 16</td>
</tr>
<tr>
<td>International</td>
<td>Devoe Bar-Rust 231</td>
<td>6 – 8</td>
<td>Devoe Bar-Rust 231</td>
<td>6 – 8</td>
<td>12 – 16</td>
</tr>
<tr>
<td>PPG</td>
<td>Amerlock 2 / 400</td>
<td>6 – 8</td>
<td>Amerlock 2 / 400</td>
<td>6 – 8</td>
<td>12 – 16</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Dura-Plate 235</td>
<td>6 – 8</td>
<td>Dura-Plate 235</td>
<td>6 – 8</td>
<td>12 – 16</td>
</tr>
<tr>
<td>Tnemec</td>
<td>H.S. Epoxy Series 104</td>
<td>6 – 8</td>
<td>H.S. Epoxy Series 104</td>
<td>6 – 8</td>
<td>12 – 16</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

4. HRSD System #4: Cycloaliphatic Amine Epoxy; For Interior and Exterior Concrete, CMU, Brick and Ferrous Metal Substrates Exposed to Weathering and/or Mildly Corrosive Environments:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Carboguard 890</td>
<td>6 – 8</td>
<td>6 – 8</td>
</tr>
<tr>
<td>International</td>
<td>Devoe Bar-Rust 231</td>
<td>6 – 8</td>
<td>6 – 8</td>
</tr>
<tr>
<td>PPG</td>
<td>Amerlock 2 / 400</td>
<td>6 – 8</td>
<td>6 – 8</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Dura-Plate 235</td>
<td>6 – 8</td>
<td>6 – 8</td>
</tr>
<tr>
<td>Tnemec</td>
<td>H.S. Epoxy Series 104</td>
<td>6 – 8</td>
<td>6 – 8</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

5. HRSD System #5: Surfacer and Reinforced Epoxy; For Concrete Substrates with Loss of Concrete ≤ 1/2-inch; For Submerged and Intermittently Submerged Environments; For Exposure to Process Chemicals, H₂S and MIC; For Exposure to Abrasives:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>FILLER/SURFACER</th>
<th>DFT (IN)</th>
<th>PRIMER COAT</th>
<th>DFT (MIL)</th>
<th>BASE COAT</th>
<th>DFT (MIL)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Carboguard 510SG</td>
<td>1/2 max</td>
<td>N/A</td>
<td>N/A</td>
<td>Plasite 4500S</td>
<td>30 (min)</td>
<td>Plasite 4500S</td>
<td>30 (min)</td>
<td>1/2” (max) + 60 mil (min)</td>
</tr>
<tr>
<td>International</td>
<td>Ceilcote Corocrete 400MP</td>
<td>1/2 (max)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Enviroline 376F60 Glass Reinf. Epoxy</td>
<td>60 (min)</td>
<td>1/2” (max) + 65 mil (min)</td>
</tr>
<tr>
<td>Sauereisen</td>
<td>Restokrete Substrate Resurfacer No. F-121</td>
<td>1/2 (max)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Sewergard 210S</td>
<td>30 (min)</td>
<td>1/2” (max) + 60 mil (min)</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Duraplate 2300</td>
<td>1/2 (max)</td>
<td>N/A</td>
<td>N/A</td>
<td>Duraplate 5900</td>
<td>30 (min)</td>
<td>Duraplate 5900</td>
<td>30 (min)</td>
<td>1/2” (max) + 60 mil (min)</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Mortarclad 218</td>
<td>1/2 (max)</td>
<td>N/A</td>
<td>N/A</td>
<td>Perma-Glaze Series 435</td>
<td>30 (min)</td>
<td>Perma-Glaze Series 435</td>
<td>30 (min)</td>
<td>1/2” (max) + 60 mil (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL
6. HRSD System #6: Surfacer and Reinforced Epoxy (Spray or Trowel); For Concrete Substrates with Loss of Concrete ≤ 1/2-inch; For Submerged and Intermittently Submerged Environments; For Exposure to Process Chemicals, H₂S and MIC; For Exposure to Abrasives:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>SURFACER</th>
<th>DFT (IN)</th>
<th>BASE COAT</th>
<th>DFT (IN)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Carboguard 510SG</td>
<td>1/2</td>
<td>Plasite 5371</td>
<td>1/8</td>
<td>Plasite 4500S</td>
<td>20 (min)</td>
<td>1/2” (max) + 1/8” (min) + 20 mil (min)</td>
</tr>
<tr>
<td>Sauereisen</td>
<td>Restokrete Substrate</td>
<td>1/2</td>
<td>Sewergard 210T</td>
<td>1/8</td>
<td>Sewergard Glaze</td>
<td>20 (min)</td>
<td>1/2” (max) + 1/8” (min) + 20 mil (min)</td>
</tr>
<tr>
<td></td>
<td>Resurfacer No. F-121</td>
<td>(max)</td>
<td>or 210S</td>
<td>(min)</td>
<td>210GL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Duraplate 2300</td>
<td>1/2</td>
<td>Duraplate 5900</td>
<td>1/8</td>
<td>Duraplate 5900</td>
<td>20 (min)</td>
<td>1/2” (max) + 1/8” (min) + 20 mil (min)</td>
</tr>
<tr>
<td></td>
<td>(max)</td>
<td></td>
<td>DP Mortar</td>
<td>(min)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tnemec</td>
<td>Mortarclad 218</td>
<td>1/2</td>
<td>Perma-Shield H₂S</td>
<td>1/8</td>
<td>Perma-Glaze</td>
<td>20 (min)</td>
<td>1/2” (max) + 1/8” (min) + 20 mil (min)</td>
</tr>
<tr>
<td></td>
<td>(max)</td>
<td></td>
<td>Series 434</td>
<td>(min)</td>
<td>Series 435</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

APPROVED EQUAL

7. HRSD System #7: Surfacer and Reinforced Epoxy (Fast Cure); For Concrete Substrates with Loss of Concrete ≤ 1/2-inch; For Submerged and Intermittently Submerged Environments; For Exposure to Process Chemicals, H₂S and MIC; For Exposure to Abrasives:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>SURFACER</th>
<th>DFT (IN)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raven Lining Systems</td>
<td>Raven 755</td>
<td>1/2</td>
<td>Raven 405 FS/UFS</td>
<td>1/8</td>
<td>1/2” (max) + 1/8” (min)</td>
</tr>
<tr>
<td>Sauereisen</td>
<td>Restokrete Substrate</td>
<td>1/2</td>
<td>Sewergard 210FS</td>
<td>1/8</td>
<td>1/2” (max) + 1/8” (min)</td>
</tr>
<tr>
<td></td>
<td>Resurfacer No. F-121</td>
<td>(max)</td>
<td></td>
<td>(min)</td>
<td></td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Duraplate 2300</td>
<td>1/2</td>
<td>Duraplate 6100</td>
<td>1/8</td>
<td>1/2” (max) + 1/8” (min)</td>
</tr>
<tr>
<td></td>
<td>(max)</td>
<td></td>
<td>DP Mortar</td>
<td>(min)</td>
<td></td>
</tr>
</tbody>
</table>

APPROVED EQUAL

8. HRSD System #8: Surfacer and Polyurethane; For Concrete Substrates with Loss of Concrete ≤ 1/2-inch; For Submerged, Intermittently Submerged and Exterior Environments; For Substrates Requiring Flexibility; Not for Substrates in Abrasive Environments:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>SURFACER</th>
<th>DFT (IN)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Carboguard 510SG</td>
<td>1/2</td>
<td>Reactamine 760</td>
<td>100 (min)</td>
<td>1/2” (max) + 100 mil (min)</td>
</tr>
<tr>
<td>International</td>
<td>Ceilcote Corocrete 400MP</td>
<td>1/2</td>
<td>Polibrid 705E</td>
<td>100 (min)</td>
<td>1/2” (max) + 100 mil (min)</td>
</tr>
<tr>
<td>Sauereisen</td>
<td>Restokrete Substrate</td>
<td>1/2</td>
<td>Conoflex Urethane No. 381</td>
<td>100 (min)</td>
<td>1/2” (max) + 100 mil (min)</td>
</tr>
<tr>
<td></td>
<td>Resurfacer No. F-121</td>
<td>(max)</td>
<td></td>
<td>(min)</td>
<td></td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Duraplate 2300</td>
<td>1/2</td>
<td>Poly-Cote 115</td>
<td>100 (min)</td>
<td>1/2” (max) + 100 mil (min)</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Mortarclad 218</td>
<td>1/2</td>
<td>Elasto-Shield Series 406</td>
<td>100 (min)</td>
<td>1/2” (max) + 100 mil (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL
9. HRSD System #9: Surfacer and Polyurethane; For Concrete Substrates with Loss of Concrete ≤ 1/2-inch; For Submerged, Intermittently Submerged and Exterior Environments; For Substrates Requiring Flexibility; Not for Substrates in Abrasive Environments:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>SURFACER</th>
<th>DFT (IN)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Carboguard 510SG</td>
<td>1/2 (max)</td>
<td>Reactamine 760</td>
<td>60 (min)</td>
<td>1/2” (max) + 60 mil (min)</td>
</tr>
<tr>
<td>International</td>
<td>Ceilcote Corcrete 400MP</td>
<td>1/2 (max)</td>
<td>Polibrid 705E</td>
<td>60 (min)</td>
<td>1/2” (max) + 60 mil (min)</td>
</tr>
<tr>
<td>PPG</td>
<td>Restokrete Substrate Resurfacer No. F-121</td>
<td>1/2 (max)</td>
<td>Amerthane 490</td>
<td>60 (min)</td>
<td>1/2” (max) + 60 mil (min)</td>
</tr>
<tr>
<td>Sauereisen</td>
<td>Restokrete Substrate Resurfacer No. F-121</td>
<td>1/2 (max)</td>
<td>Conoflex Urethane No. 381</td>
<td>60 (min)</td>
<td>1/2” (max) + 60 mil (min)</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Duraplate 2300</td>
<td>1/2 (max)</td>
<td>Poly-Cote 115</td>
<td>60 (min)</td>
<td>1/2” (max) + 60 mil (min)</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Mortarclad 218</td>
<td>1/2 (max)</td>
<td>Elasto-Shield Series 406</td>
<td>60 (min)</td>
<td>1/2” (max) + 60 mil (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

10. HRSD System #10: Reinforced Epoxy (Spray or Trowel); For Concrete Substrates with Loss ≤ 1/4-inch; For Submerged and Intermittently Submerged Environments; For Exposure to Process Chemicals, H2S and MIC; For Exposure to Abrasion:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>BASE COAT</th>
<th>DFT (IN)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Plasite 5371</td>
<td>1/8 (min)</td>
<td>Plasite 4500S</td>
<td>20 (min)</td>
<td>1/8” (min) + 20 mil (min)</td>
</tr>
<tr>
<td>Sauereisen</td>
<td>Sewergard 210T or 210S</td>
<td>1/8 (min)</td>
<td>Sewergard Glaze 210GL</td>
<td>20 (min)</td>
<td>1/8” (min) + 20 mil (min)</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Duraplate 5900 DP Mortar</td>
<td>1/8 (min)</td>
<td>Duraplate 5900</td>
<td>20 (min)</td>
<td>1/8” (min) + 20 mil (min)</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Perma-Shield H2S Series 434</td>
<td>1/8 (min)</td>
<td>Perma-Glze Series 435</td>
<td>20 (min)</td>
<td>1/8” (min) + 20 mil (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

11. HRSD System #11: Reinforced Epoxy (Fast Cure); For Concrete Substrates with Loss ≤ 1/4-inch; For Submerged and Intermittently Submerged Environments; For Exposure to Process Chemicals, H2S and MIC; For Exposure to Abrasion:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>FINISH COAT</th>
<th>DFT (IN)</th>
<th>TOTAL DFT (IN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raven Lining Systems</td>
<td>Raven 405 FS/UFS</td>
<td>1/8 (min)</td>
<td>1/8 (min)</td>
</tr>
<tr>
<td>Sauereisen</td>
<td>Sewergard 210FS</td>
<td>1/8 (min)</td>
<td>1/8 (min)</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Duraplate 6100 DP Mortar</td>
<td>1/8 (min)</td>
<td>1/8 (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL
12. HRSD System #12: Crystalline Cementitious Surfacer and Waterproofing; For Concrete Substrates with Loss of Concrete ≤ 7/16-inches; For Submerged, Intermittently Submerged and Atmospheric Environments; For Exposure to Mild Chemicals and Abrasives:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PATCHING &amp; REPAIR</th>
<th>SURFACER</th>
<th>DFT (IN)</th>
<th>FINISH COAT</th>
<th>DFT (IN)</th>
<th>TOTAL DFT (IN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xypex</td>
<td>Patch’N Plug</td>
<td>Megamix I</td>
<td>≤ 3/8</td>
<td>Concentrate</td>
<td>1/16</td>
<td>7/16 (max)</td>
</tr>
<tr>
<td></td>
<td>APPROVED EQUAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13. HRSD System #13: Crystalline Cementitious Surfacer and Waterproofing; For Concrete Substrates with Loss of Concrete ≤ 2-inches; For Submerged, Intermittently Submerged and Atmospheric Environments; For Exposure to Mild Chemicals and Abrasives:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PATCHING &amp; REPAIR</th>
<th>SURFACER</th>
<th>DFT (IN)</th>
<th>FINISH COAT</th>
<th>DFT (IN)</th>
<th>TOTAL DFT (IN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xypex</td>
<td>Patch’N Plug</td>
<td>Megamix II</td>
<td>3/8 &lt; x ≤ 2</td>
<td>Concentrate</td>
<td>1/16</td>
<td>2 (max)</td>
</tr>
<tr>
<td></td>
<td>APPROVED EQUAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

14. HRSD System #14: Epoxy; For Concrete Shop Floors; For Interior Environments; For Exposure to Heavy Loading:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PRIMER COAT</th>
<th>DFT (MIL)</th>
<th>BASE COAT</th>
<th>DFT (MIL)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armorpoxy</td>
<td>ArmorPoxy II</td>
<td>3</td>
<td>N/A</td>
<td>N/A</td>
<td>ArmorUltra ARM707X</td>
<td>5</td>
<td>8 (min)</td>
</tr>
<tr>
<td>Armorpoxy</td>
<td>Per CSM Req.</td>
<td>6</td>
<td>ArmorUltra ARM707X</td>
<td>5</td>
<td>ArmorUltra ARM707X</td>
<td>12</td>
<td>23 (min)</td>
</tr>
<tr>
<td>PPG</td>
<td>NU-KLAD IMP</td>
<td>TBD</td>
<td>N/A</td>
<td>N/A</td>
<td>NU-KLAD SL</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>PPG</td>
<td>MegaSeal HSPC Primer</td>
<td>TBD</td>
<td>MegaSeal HDSL</td>
<td>60 (min)</td>
<td>MegaSeal TF or MegaSeal HPU (Optional)</td>
<td>TBD</td>
<td>60 (min)</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>ArmorSeal 1000HS</td>
<td>TBD</td>
<td>N/A</td>
<td>N/A</td>
<td>ArmorSeal 1000HS</td>
<td>5 – 10</td>
<td>5 – 10</td>
</tr>
<tr>
<td></td>
<td>APPROVED EQUAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15. HRSD System #15: Polyurethane; For Concrete Shop Floors; For Interior and Exterior Environments; For Exposure to Heavy Loading:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PRIMER / SEALER</th>
<th>DFT (MIL)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPG</td>
<td>MegaSeal TF</td>
<td>TBD</td>
<td>MegaSeal HPU</td>
<td>3 – 5</td>
<td>3 – 5</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>33 Epoxy Primer / Sealer</td>
<td>TBD</td>
<td>HS Polyurethane</td>
<td>2 – 3</td>
<td>2 – 3</td>
</tr>
<tr>
<td></td>
<td>APPROVED EQUAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
16. HRSD System #16: Reinforced Epoxy; For Concrete and Ferrous Metal Substrates; For Submerged and Intermittently Submerged Environments; For Exposure to Process Chemicals, H₂S and MIC; For Exposure to Abrasives:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PRIMER COAT</th>
<th>DFT (MIL)</th>
<th>BASE COAT</th>
<th>DFT (MIL)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Per CSM Requirements</td>
<td>TBD</td>
<td>Plasite 4500S</td>
<td>30 (min)</td>
<td>Plasite 4500S</td>
<td>30 (min)</td>
<td>60 mil (min)</td>
</tr>
<tr>
<td>International</td>
<td>Ceilcote 680M Concrete Primer</td>
<td>5 – 6</td>
<td>N/A</td>
<td>N/A</td>
<td>Enviroline 376F60 Glass Reinf. Epoxy</td>
<td>60 (min)</td>
<td>60 mil (min)</td>
</tr>
<tr>
<td>Sauereisen</td>
<td>Per CSM Requirements</td>
<td>TBD</td>
<td>N/A</td>
<td>N/A</td>
<td>Sewergard 210S</td>
<td>60 (min)</td>
<td>60 mil (min)</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Per CSM Requirements</td>
<td>TBD</td>
<td>Duraplate 5900</td>
<td>30 (min)</td>
<td>Duraplate 5900</td>
<td>30 (min)</td>
<td>60 mil (min)</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Per CSM Requirements</td>
<td>TBD</td>
<td>Perma-Glaze Series 435</td>
<td>30 (min)</td>
<td>Perma-Glaze Series 435</td>
<td>30 (min)</td>
<td>60 mil (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

17. HRSD System #17: Reinforced Epoxy; For Concrete and Ferrous Metal Substrates; For Submerged and Intermittently Submerged Environments; For Exposure to Process Chemicals, H₂S and MIC; For Exposure to Abrasives:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PRIMER COAT</th>
<th>DFT (MIL)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Per CSM Requirements</td>
<td>TBD</td>
<td>Plasite 4500S</td>
<td>30 (min)</td>
<td>30 (min)</td>
</tr>
<tr>
<td>International</td>
<td>Ceilcote 662 Flakeline (For Concrete Only)</td>
<td>5 – 6</td>
<td>Enviroline 376F60 Glass Reinf. Epoxy</td>
<td>30 (min)</td>
<td>35 (min)</td>
</tr>
<tr>
<td>Sauereisen</td>
<td>Per CSM Requirements</td>
<td>TBD</td>
<td>Sewergard 210S</td>
<td>30 (min)</td>
<td>30 (min)</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Per CSM Requirements</td>
<td>TBD</td>
<td>Duraplate 5900</td>
<td>30 (min)</td>
<td>30 (min)</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Per CSM Requirements</td>
<td>TBD</td>
<td>Perma-Glaze Series 435</td>
<td>30 (min)</td>
<td>30 (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

18. HRSD System #18: Glass Flake Reinforced Amine Epoxy; For Submerged and Intermittently Submerged Ferrous Metal; For Exposure to Mild Chemicals; For Exposure to Abrasives:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>STRIPE COAT</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Carboguard 890GF</td>
<td>Carboguard 890GF</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>International</td>
<td>Ceilcote 662 Flakeline</td>
<td>Ceilcote 662 Flakeline</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>PPG</td>
<td>Amerlock 2/400GF</td>
<td>Amerlock 2/400GF</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Sher-Glass FF Glass Flake Reinforced Epoxy</td>
<td>Sher-Glass FF Glass Flake Reinforced Epoxy</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

APPROVED EQUAL
19. HRSD System #19: Polyurethane; For Concrete and Ferrous Metal Substrates; For Submerged, Intermittently Submerged and Exterior Environments; For Substrates Requiring Flexibility; Not for Substrates in Abrasive Environments:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PRIMER COAT</th>
<th>DFT (MIL)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Per CSM Requirements</td>
<td>TBD</td>
<td>Reactamine 760</td>
<td>100 (min)</td>
<td>100 (min)</td>
</tr>
<tr>
<td>International</td>
<td>Per CSM Requirements</td>
<td>TBD</td>
<td>Polibrid 705E</td>
<td>100 (min)</td>
<td>100 (min)</td>
</tr>
<tr>
<td>PPG</td>
<td>Amerlock 2/400</td>
<td>4 (min)</td>
<td>Amerthane 490</td>
<td>100 (min)</td>
<td>104 (min)</td>
</tr>
<tr>
<td>Sauereisen</td>
<td>ConoPrime No. 502</td>
<td>TBD</td>
<td>Conoflex Urethane No. 381</td>
<td>100 (min)</td>
<td>100 (min)</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Duraplate 235</td>
<td>4 (min)</td>
<td>Poly-Cote 115</td>
<td>100 (min)</td>
<td>104 (min)</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Per CSM Requirements</td>
<td>TBD</td>
<td>Elasto-Shield Series 406</td>
<td>100 (min)</td>
<td>100 (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

20. HRSD System #20: Polyurethane; For Concrete and Ferrous Metal Substrates; For Submerged, Intermittently Submerged and Exterior Environments; For Substrates Requiring Flexibility; Not for Substrates in Abrasive Environments:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PRIMER COAT</th>
<th>DFT (MIL)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Bitumastic 300M</td>
<td></td>
<td>Bitumastic 300M</td>
<td>20 (min)</td>
<td>20 (min)</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Hi-Mil Sher-Tar Epoxy</td>
<td></td>
<td>Hi-Mil Sher-Tar Epoxy</td>
<td>20 (min)</td>
<td>20 (min)</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Hi-Build Tneme-Tar Series 46H-413</td>
<td></td>
<td>Hi-Build Tneme-Tar Series 46H-413</td>
<td>20 (min)</td>
<td>20 (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

21. HRSD System #21: Coal-Tar Epoxy; For Concrete and Ferrous Metal Substrates; For Below-grade and Submerged Environments; For Exposure to Mild Chemicals and Abrasives:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>STRIPE COAT</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Bitumastic 300M</td>
<td>Bitumastic 300M</td>
<td>20 (min)</td>
<td>20 (min)</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Hi-Mil Sher-Tar Epoxy</td>
<td>Hi-Mil Sher-Tar Epoxy</td>
<td>20 (min)</td>
<td>20 (min)</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Hi-Build Tneme-Tar Series 46H-413</td>
<td></td>
<td>Hi-Build Tneme-Tar Series 46H-413</td>
<td>20 (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL
22. HRSD System #22: Reinforced Epoxy Liner System; For Chemical Containment; For Concrete and Ferrous Metal Substrates; For Exposure to Caustic, Ferric Chloride, Polymers and Mild Chemicals:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PRIMER COAT</th>
<th>DFT (MIL)</th>
<th>BASE COAT</th>
<th>DFT (MIL)</th>
<th>BLEND / BROADCAST COAT</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Per CSM Requirements</td>
<td>TBD</td>
<td>Semstone 140</td>
<td>30 (min)</td>
<td>20/40 Mesh Aggregate</td>
<td>Semstone 140</td>
<td>30 (min)</td>
<td>60 (min)</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Epoxoprime Series 201</td>
<td>4 – 6</td>
<td>Power-Tread Series 237</td>
<td>63 (min)</td>
<td>30/50 Mesh Aggregate</td>
<td>Tneme-Glaze Series 281</td>
<td>6 – 8</td>
<td>73 (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

23. HRSD System #23: Reinforced Epoxy Novolac Liner System with Fiberglass Mat; For Chemical Containment; For Concrete and Ferrous Metal Substrates; For Exposure to Sulfuric Acid, Sodium Bisulfite and Organic Chemicals:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>BASE COAT</th>
<th>DFT (MIL)</th>
<th>BLEND / BROADCAST COAT</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Semstone 145</td>
<td>30 (min)</td>
<td>20/40 Mesh Aggregate</td>
<td>Semstone 145</td>
<td>30 (min)</td>
<td>60 (min)</td>
</tr>
<tr>
<td>International</td>
<td>Devran 124</td>
<td>30 – 40</td>
<td>20/40 Mesh Aggregate</td>
<td>Devran 124</td>
<td>30 – 40</td>
<td>60 (min)</td>
</tr>
<tr>
<td>PPG</td>
<td>Amerlock Sealer &amp; Novaguard 840</td>
<td>30 (min)</td>
<td>20/40 Mesh Aggregate</td>
<td>Novaguard 840</td>
<td>30 (min)</td>
<td>60 (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

24. HRSD System #24: Epoxy Novolac Liner System with Fiberglass Mat; Interior and Exterior Concrete and Ferrous Metal Elements Exposed to Acids, Sodium Bisulfite, Organic Chemicals and Solvents:

<table>
<thead>
<tr>
<th>MANUF.</th>
<th>PRIMER COAT</th>
<th>DFT (MIL)</th>
<th>BASE COAT</th>
<th>DFT (MIL)</th>
<th>BLEND / BROADCAST COAT</th>
<th>REINF.</th>
<th>SATURANT</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Semstone 110</td>
<td>5 – 20</td>
<td>Semstone 145</td>
<td>25–35</td>
<td>20/40 Mesh Aggregate</td>
<td>1.5 oz. Fiberglass Reinf. Mat</td>
<td>Per CSM Requirements</td>
<td>Semstone 145</td>
<td>90–100</td>
<td>130 (min)</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Corobond 100 Epoxy Primer / Sealer</td>
<td>4 – 8</td>
<td>Core-Cote HCR Epoxy (Clear)</td>
<td>65</td>
<td>Type M Aggregate</td>
<td>1.0 oz. Glass Mat</td>
<td>Core-Cote HCR Epoxy (Clear)</td>
<td>Core-Cote HCR FF Flake Filled Epoxy</td>
<td>20</td>
<td>130 (min)</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Epoxoprime Series 201</td>
<td>12</td>
<td>Chem bloc Series 239 SC Mortar</td>
<td>80</td>
<td>Per CSM Requirements</td>
<td>3/4 Chopped Strand Fiberglass</td>
<td>Chem bloc Series 239 (12 mils DFT)</td>
<td>Tneme-Glaze Series 282</td>
<td>24</td>
<td>128 (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL
25. HRSD System #25: Reinforced Epoxy Vinyl Ester Liner System with Fiberglass Mat; For Chemical Containment; For Concrete and Ferrous Metal Substrates; For Exposure to a Wide Range of Chemicals:

<table>
<thead>
<tr>
<th>MANUF.</th>
<th>PRIMER COAT</th>
<th>DFT (MIL)</th>
<th>BASE COAT</th>
<th>DFT (MIL)</th>
<th>BROADCAST COAT</th>
<th>DFT (MIL)</th>
<th>REINF.</th>
<th>SATURANT</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Semstone 800 Series Primer</td>
<td>TBD</td>
<td>Semstone 870</td>
<td>25–35</td>
<td>20/40 Mesh Aggregate</td>
<td>1.5 oz. Fiberglass Reinf. Mat</td>
<td>Per CSM Requirements</td>
<td>Semstone 870</td>
<td>90–100</td>
<td>125 (min)</td>
<td></td>
</tr>
<tr>
<td>International</td>
<td>Ceilcote 380 Primer</td>
<td>5</td>
<td>Ceilcote 6640</td>
<td>80</td>
<td>Per CSM Requirements</td>
<td>1.5 oz. Fiberglass Reinf. Mat</td>
<td>Per CSM Requirements</td>
<td>Ceilcote Flakeline 242</td>
<td>25</td>
<td>110 (min)</td>
<td></td>
</tr>
<tr>
<td>PPG</td>
<td>Polyspec PE-310</td>
<td>TBD</td>
<td>PermaRez 300</td>
<td>50–60</td>
<td>F-5 Powder</td>
<td>24 oz woven roving</td>
<td>PermaRez 300 (25 mil DFT)</td>
<td>PermaRez 300</td>
<td>50-60</td>
<td>125 (min)</td>
<td></td>
</tr>
<tr>
<td>Sauereisen</td>
<td>VE Prime No. 550</td>
<td>5–10</td>
<td>VEMatte No. 470</td>
<td>63</td>
<td>Per CSM Requirements</td>
<td>1.5 oz. Fiberglass Reinf. Mat</td>
<td>VEMatte No. 470 (63 mils DFT)</td>
<td>VEGlaze No. 472</td>
<td>10</td>
<td>141 (min)</td>
<td></td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Corobond Vinyl Ester Primer</td>
<td>4 .5</td>
<td>Core-Cote VEN (Clear)</td>
<td>65</td>
<td>Type M Aggregate</td>
<td>1.0 oz. Glass Mat</td>
<td>Core-Cote VEN (Clear), 30 mils DFT</td>
<td>Core-Cote VEN FF Flake Filled</td>
<td>20</td>
<td>119.5 (min)</td>
<td></td>
</tr>
<tr>
<td>Tnemec</td>
<td>Epoxoprime Series 201</td>
<td>12</td>
<td>Chembloc Series 239 SC Mortar</td>
<td>80</td>
<td>Per CSM Requirements</td>
<td>3/4 Chopped Fiberglass</td>
<td>Chembloc Series 239 (12 mil DFT)</td>
<td>Tnemec-Glaze Series 282</td>
<td>12</td>
<td>116 (min)</td>
<td></td>
</tr>
</tbody>
</table>

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26. HRSD System #26: Amine Cured Epoxy Novolac; For Ferrous Metals; For Interior, Exterior, Submerged and Intermittently Submerged Environments; For Exposure to H₂S, Acids, Sodium Bisulfite, Polymers and Other Chemicals:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>STRIPE COAT</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Plasite 4550S</td>
<td>Plasite 4550S</td>
<td>30 (min)</td>
<td>30 (min)</td>
</tr>
<tr>
<td>International</td>
<td>Envirole 225</td>
<td>Envirole 225</td>
<td>30 (min)</td>
<td>30 (min)</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Core-Cote HCR FF</td>
<td>Core-Cote HCR FF</td>
<td>30 (min)</td>
<td>30 (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL
27. HRSD System #27: Zinc, Cycloaliphatic Amine Epoxy and Polyurethane; For Ferrous Metal Substrates; For Exterior Environments; For Exposure to Atmosphere, Weathering, UV and Mildly Corrosive Environments:

<table>
<thead>
<tr>
<th>MANUF.</th>
<th>PRIMER COAT</th>
<th>DFT (MIL)</th>
<th>STRIPE COAT</th>
<th>BASE COAT</th>
<th>DFT (MIL)</th>
<th>STRIPE COAT</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbone</td>
<td>Carbozinc 859</td>
<td>3–5</td>
<td>Carboguard 890</td>
<td>Carboguard 890</td>
<td>5–6</td>
<td>Carbothane 134 HG</td>
<td>Carbothane 134 HG</td>
<td>3</td>
<td>11–14</td>
</tr>
<tr>
<td>International</td>
<td>Cathacoat 302H</td>
<td>3–4</td>
<td>Devoe Bar-Rust 231</td>
<td>Devoe Bar-Rust 231</td>
<td>5–8</td>
<td>Devthane 379</td>
<td>Devthane 379</td>
<td>3</td>
<td>11–15</td>
</tr>
<tr>
<td>PPG</td>
<td>Amercoat 68 HS</td>
<td>3–5</td>
<td>Amerlock 2/400</td>
<td>Amerlock 2/400</td>
<td>5–8</td>
<td>Amershield</td>
<td>Amershield</td>
<td>3–4</td>
<td>11–17</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Zinc Clad III</td>
<td>3–5</td>
<td>Dura-Plate 235 M-P Epoxy</td>
<td>Dura-Plate 235 M-P Epoxy</td>
<td>5–8</td>
<td>Acrolon 7300 Polyurethane</td>
<td>Acrolon 7300 Polyurethane</td>
<td>3–5</td>
<td>11–18</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Hi-Build Epoxoline II Series N66HS or Tneme-Fascure Series 161HS</td>
<td>3–3.5</td>
<td>Hi-Build Epoxoline II Series N66HS or Tneme-Fascure Series 161HS</td>
<td>5–10</td>
<td>Endura-Shield II Series 1075</td>
<td>Endura-Shield II Series 1075</td>
<td>3–5</td>
<td>11–18.5</td>
<td></td>
</tr>
</tbody>
</table>

APPROVED EQUAL

28. HRSD System #28: Cycloaliphatic Amine Epoxy and Polyurethane; For Ferrous Metal Substrates; For Exterior Environments; For Exposure to Atmosphere, Weathering, UV and Mildly Corrosive Environments:

<table>
<thead>
<tr>
<th>MANUF.</th>
<th>PRIMER COAT</th>
<th>DFT (MIL)</th>
<th>STRIPE COAT</th>
<th>BASE COAT</th>
<th>DFT (MIL)</th>
<th>STRIPE COAT</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbeone</td>
<td>Carboguard 890</td>
<td>5–6</td>
<td>Carboguard 890</td>
<td>Carboguard 890</td>
<td>5–6</td>
<td>Carbothane 134 HG</td>
<td>Carbothane 134 HG</td>
<td>3</td>
<td>13–15</td>
</tr>
<tr>
<td>International</td>
<td>Devoe Bar-Rust 231</td>
<td>5–8</td>
<td>Devoe Bar-Rust 231</td>
<td>Devoe Bar-Rust 231</td>
<td>5–8</td>
<td>Devthane 379</td>
<td>Devthane 379</td>
<td>3</td>
<td>13–19</td>
</tr>
<tr>
<td>PPG</td>
<td>Amerlock 2/400</td>
<td>5–8</td>
<td>Amerlock 2/400</td>
<td>Amerlock 2/400</td>
<td>5–8</td>
<td>Amershield</td>
<td>Amershield</td>
<td>3–4</td>
<td>13–20</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Dura-Plate 235 M-P Epoxy</td>
<td>5–8</td>
<td>Dura-Plate 235 M-P Epoxy</td>
<td>Dura-Plate 235 M-P Epoxy</td>
<td>5–8</td>
<td>Acrolon 7300 Polyurethane</td>
<td>Acrolon 7300 Polyurethane</td>
<td>3–5</td>
<td>13–21</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Hi-Build Epoxoline II Series N66HS or Tneme-Fascure Series 161HS</td>
<td>5–10</td>
<td>Hi-Build Epoxoline II Series N66HS or Tneme-Fascure Series 161HS</td>
<td>5–10</td>
<td>Endura-Shield II Series 1075</td>
<td>Endura-Shield II Series 1075</td>
<td>3–5</td>
<td>13–25</td>
<td></td>
</tr>
</tbody>
</table>

APPROVED EQUAL

{Project Name}  
Protective Coatings  
09900-20  
{Month, Year}
29. HRSD System #29: Aluminum Filled Epoxy Mastic; For Aluminum and Galvanized Steel Substrates; For Interior and Exterior Environments; For Exposure to Atmosphere, UV, Weathering and Mildly Corrosive Environments:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>STRIPE COAT</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Carbomastic 15</td>
<td>Carbomastic 15</td>
<td>5 – 10</td>
<td>5 – 10</td>
</tr>
<tr>
<td>International</td>
<td>Devoe Bar-Rust 231 Epoxy Mastic Aluminum</td>
<td>Devoe Bar-Rust 231 Epoxy Mastic Aluminum</td>
<td>5 – 8</td>
<td>5 – 8</td>
</tr>
<tr>
<td>PPG</td>
<td>Amerlock 400 AL</td>
<td>Amerlock 400 AL</td>
<td>5 – 8</td>
<td>5 – 8</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Epoxy Mastic Aluminum II</td>
<td>Epoxy Mastic Aluminum II</td>
<td>5 – 6</td>
<td>5 – 6</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

30. HRSD System #30: Silicone Hybrid; For Ferrous Metal and Stainless Steel Substrates; For High Temperature Exposures ≤ 1000°:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PRIMER COAT</th>
<th>BASE COAT</th>
<th>DFT (MIL)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Per CSM Requirements</td>
<td>Thermaline 4900</td>
<td>1.5 – 2</td>
<td>Thermaline 4900</td>
<td>1.5 – 2</td>
<td>3 – 4</td>
</tr>
<tr>
<td>International</td>
<td>Per CSM Requirements</td>
<td>Intertherm 1875</td>
<td>1 – 2</td>
<td>Intertherm 1875</td>
<td>1 – 2</td>
<td>3 – 4</td>
</tr>
<tr>
<td>PPG</td>
<td>Per CSM Requirements</td>
<td>Hi-Temp 500 V</td>
<td>2 – 2.5</td>
<td>Hi-Temp 500 V</td>
<td>2 – 2.5</td>
<td>4 – 5</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Per CSM Requirements</td>
<td>Heat-Flex Hi-Temp 500</td>
<td>2 – 2.5</td>
<td>Heat-Flex Hi-Temp 500</td>
<td>2 – 2.5</td>
<td>4 – 5</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Per CSM Requirements</td>
<td>Endura-Heat Series 1552</td>
<td>2 – 3</td>
<td>Endura-Heat Series 1552</td>
<td>2 – 3</td>
<td>4 – 6</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

31. HRSD System #31: Silicone Acrylic; For Ferrous Metal and Stainless Steel Substrates; For High Temperature Exposures ≤ 500°:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PRIMER COAT</th>
<th>BASE COAT</th>
<th>DFT (MIL)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Per CSM Requirements</td>
<td>Thermaline 4700</td>
<td>2</td>
<td>Thermaline 4700</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>International</td>
<td>Per CSM Requirements</td>
<td>Intertherm 50</td>
<td>1</td>
<td>Intertherm 50</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>PPG</td>
<td>Per CSM Requirements</td>
<td>PPG Hi-Temp 1000 V</td>
<td>1.5 – 2</td>
<td>PPG Hi-Temp 1000 V</td>
<td>1.5 – 2</td>
<td>3 – 4</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Per CSM Requirements</td>
<td>Heat-Flex Hi-Temp 1000</td>
<td>1.5 – 2</td>
<td>Heat-Flex Hi-Temp 1000</td>
<td>1.5 – 2</td>
<td>3 – 4</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Per CSM Requirements</td>
<td>Endura-Heat Series 1556</td>
<td>2 – 3</td>
<td>Endura-Heat Series 1556</td>
<td>2 – 3</td>
<td>4 – 6</td>
</tr>
</tbody>
</table>

APPROVED EQUAL
32. HRSD System #32: Epoxy Urethane; For FRP Substrates; For Exterior and Intermittently Submerged Environments; For Exposure to Atmosphere, Weathering, UV and Mildly Corrosive Environments:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>STRIPE COAT</th>
<th>PRIMER COAT</th>
<th>DFT (MIL)</th>
<th>STRIPE COAT</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Carbocrylic 120</td>
<td>Carbocrylic 120</td>
<td>2 – 3</td>
<td>Carbocryl 120</td>
<td>Carbocryl 120</td>
<td>2 – 3</td>
<td>5 – 8</td>
</tr>
<tr>
<td>International</td>
<td>Devran 201H</td>
<td>Devran 201H</td>
<td>2 – 3</td>
<td>Devtran 379</td>
<td>Devtran 379</td>
<td>3</td>
<td>5 – 6</td>
</tr>
<tr>
<td>PPG</td>
<td>Pittguard 97-145</td>
<td>Pittguard 97-145</td>
<td>4 – 7</td>
<td>Durethane DTM</td>
<td>Durethane DTM</td>
<td>3 – 5</td>
<td>7 – 12</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Macropoxy 646</td>
<td>Macropoxy 646</td>
<td>5 – 10</td>
<td>Acrolon 7300 Polyurethane</td>
<td>Acrolon 7300 Polyurethane</td>
<td>3 – 6</td>
<td>8 – 16</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Chembuild Series</td>
<td>Chembuild Series</td>
<td>4 – 6</td>
<td>Endura-Shield II Series</td>
<td>Endura-Shield II Series</td>
<td>3 – 5</td>
<td>7 – 11</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

33. HRSD System #33: For FRP Substrates; For Interior, Exterior and Submerged Environments; For Exposure to Weathering and Mildly Corrosive Environments:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PRIMER COAT</th>
<th>DFT (MIL)</th>
<th>STRIPE COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Carbocrylic 120</td>
<td>2 – 3</td>
<td>Carbocryl 120</td>
<td>2 – 3</td>
<td>5 (min)</td>
</tr>
<tr>
<td>International</td>
<td>Devran 201H</td>
<td>2 – 3</td>
<td>Devtran 201H</td>
<td>2 – 3</td>
<td>5 (min)</td>
</tr>
<tr>
<td>PPG</td>
<td>Per CSM Requirements</td>
<td>TBD</td>
<td>Pittguard 97-145</td>
<td>4 – 7</td>
<td>5 (min)</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Per CSM Requirements</td>
<td>TBD</td>
<td>Macropoxy 646 Fast Cure Epoxy</td>
<td>5 – 10</td>
<td>5 (min)</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Chembuild Series</td>
<td>4 – 6</td>
<td>Endura-Shield II Series</td>
<td>3 – 5</td>
<td>7 – 11</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

34. HRSD System #34: Waterborne Acrylic; For PVC and CPVC Substrates; For Interior, Exterior and Intermittently Submerged Environments; For Exposure to Atmosphere, Weathering, UV and Mildly Corrosive Environments:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PRIMER COAT</th>
<th>DFT (MIL)</th>
<th>STRIPE COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Carbocrylic 120</td>
<td>2</td>
<td>Carbocryl 3359 DTM</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>International</td>
<td>Devcryl 1440</td>
<td>2 – 4</td>
<td>Devcryl 1448</td>
<td>3 – 4</td>
<td>5 – 8</td>
</tr>
<tr>
<td>PPG</td>
<td>Pitt-Tech Plus 4020PF</td>
<td>3 – 3.5</td>
<td>Pitt-Tech Plus</td>
<td>2 – 4</td>
<td>5 – 7.5</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>DTM Acrylic Primer</td>
<td>2.5 – 5</td>
<td>DTM Acrylic Coating</td>
<td>3 – 4</td>
<td>5.5 – 9</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Enduratone Series 1028</td>
<td>2 – 3</td>
<td>Enduratone Series 1028</td>
<td>5 – 6</td>
<td>5 – 6</td>
</tr>
</tbody>
</table>

APPROVED EQUAL
35. HRSD System #35: Acrylic Latex ; For Wood Substrates : For Interior and Exterior Environments ; For Exposure to Atmosphere, Weathering and UV Environments:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>PRIMER COAT</th>
<th>DFT (MIL)</th>
<th>BASE COAT</th>
<th>DFT (MIL)</th>
<th>FINISH COAT</th>
<th>DFT (MIL)</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboline</td>
<td>Carbocrylic 120</td>
<td>2 − 3</td>
<td>Carbocrylic 3359 DTM</td>
<td>2 − 3</td>
<td>Carbocrylic 3359 DTM</td>
<td>2 − 3</td>
<td>6 − 9</td>
</tr>
<tr>
<td>International</td>
<td>Devcryl 1440</td>
<td>2 − 4</td>
<td>Devcryl 1448</td>
<td>2 − 4</td>
<td>Devcryl 1448</td>
<td>2 − 4</td>
<td>6 − 12</td>
</tr>
<tr>
<td>Sherwin Williams</td>
<td>Exterior Oil-Based Wood Primer</td>
<td>2 − 3</td>
<td>DTM Acrylic Coating</td>
<td>2.5−4</td>
<td>DTM Acrylic Coating</td>
<td>2.5−4</td>
<td>7 − 11</td>
</tr>
<tr>
<td>Tnemec</td>
<td>Elasto-Grip FC 151-1051</td>
<td>1.5</td>
<td>Tneme-Cryl Series 6</td>
<td>2 − 3</td>
<td>Tneme-Cryl Series 6</td>
<td>2 − 3</td>
<td>6 (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

36. HRSD System #36: Reflective White Elastomeric Acrylic ; For Built-Up Asphalt Roof (BUR), Granular Roll and Liquid Roof Substrates ; For Exterior Environments ; For Exposure to Atmosphere, Weathering and UV:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>SEALANTS</th>
<th>REINFORCEMENT</th>
<th>FILLER</th>
<th>PRIMER(1)</th>
<th>TOP COAT</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITW Polymers</td>
<td>E-Las-Tek #103</td>
<td>Tie-Tex Polyester Cold Process Roofing Fabric</td>
<td>E-Las-Tek #505 Puddle Plaster</td>
<td>Per CSM Requirements</td>
<td>E-Las-Tek #127 Solar One Plus</td>
<td>32 (min)</td>
</tr>
<tr>
<td>Tremco</td>
<td>Per CSM Requirements</td>
<td>Rapid Set Reinforcing Fabric</td>
<td>Per CSM Requirements</td>
<td>Tremprime WB</td>
<td>ICE Coating</td>
<td>32 (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

NOTES:
1) Applicator shall verify required primer(s) based on surface materials, condition, etc.

37. HRSD System #37: 2-Part Polyurethane ; For Built-Up Asphalt Roof (BUR), Granular Roll and Liquid Roof Substrates ; For Exterior Environments ; For Exposure to Atmosphere, Weathering and UV:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>SEALANTS</th>
<th>REINFORCEMENT</th>
<th>FILLER</th>
<th>PRIMER(1)</th>
<th>TOP COAT</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tremco</td>
<td>Per CSM Requirements</td>
<td>AlphaGuard Glass Mat</td>
<td>Per CSM Requirements</td>
<td>AlphaGuard M-Prime or C-Prime</td>
<td>AlphaGuard BIO or MT Top Coat</td>
<td>80 (min)</td>
</tr>
</tbody>
</table>

APPROVED EQUAL

NOTES:
1) Applicator shall verify required primer(s) based on surface materials, condition, etc.
38. HRSD System #38: Aliphatic Polyurethane; For Built-Up Asphalt Roof (BUR), Granular Roll and Liquid Roof Substrates; For Exterior Environments; For Exposure to Atmosphere, Weathering and UV:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>SEALANTS</th>
<th>REINFORCEMENT</th>
<th>FILLER</th>
<th>PRIMER(^{(1)})</th>
<th>TOP COAT</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITW Polymers</td>
<td>ERsystems H.E.R.</td>
<td>Tie-Tex Polyester Cold Process Roofing Fabric</td>
<td>ERsystems Quicke</td>
<td>Polyurethane 300 Aromatic Base Coat</td>
<td>Polyurethane 300 Aliphatic Finish Coat</td>
<td>32 (min)</td>
</tr>
<tr>
<td>Tremco</td>
<td>Per CSM Requirements</td>
<td>Permafab Polyester Reinforcement</td>
<td>GEOGARD Seam Sealer</td>
<td>GEOGARD Base Coat</td>
<td>GEOGARD Finish Coat</td>
<td>32 (min)</td>
</tr>
</tbody>
</table>

**APPROVED EQUAL**

**NOTES:**
1) Applicator shall verify required primer(s) based on surface materials, condition, etc.

39. HRSD System #39: Metallic Pigmented; For Metal Roof Substrates; For Exterior Environments; For Exposure to Atmosphere, Weathering and UV:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>SEALANTS</th>
<th>REINFORCEMENT</th>
<th>FILLER</th>
<th>PRIMER(^{(1)})</th>
<th>TOP COAT</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tremco</td>
<td>Per CSM Requirements</td>
<td>Permafab Polyester Reinforcement</td>
<td>GEOGARD Seam Sealer</td>
<td>N/A</td>
<td>ALUMANATION 301</td>
<td>19 (min)</td>
</tr>
</tbody>
</table>

**APPROVED EQUAL**

**NOTES:**
1) Applicator shall verify required primer(s) based on surface materials, condition, etc.

40. HRSD System #40: Reflective White Elastomeric Acrylic; For Metal Roof Substrates; For Exterior Environments; For Exposure to Atmosphere, Weathering and UV:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>SEALANTS</th>
<th>REINFORCEMENT</th>
<th>FILLER</th>
<th>PRIMER(^{(1)})</th>
<th>TOP COAT</th>
<th>TOTAL DFT (MIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITW Polymers</td>
<td>E-Las-Tek #103 Crack &amp; Joint Sealant</td>
<td>Tie-Tex Polyester Cold Process Roofing Fabric</td>
<td>E-Las-Tek #505 Puddle Plaster</td>
<td>Per CSM Requirements</td>
<td>E-Las-Tek #127 Solar One Plus</td>
<td>17 (min)</td>
</tr>
<tr>
<td>Tremco</td>
<td>SOLARGARD Hybuild</td>
<td>Permafab Polyester Reinforcement</td>
<td>SOLARGARD RD Seam Sealer</td>
<td>SOLARGARD Ruse Primer WB</td>
<td>SOLARGARD D Hybuild</td>
<td>17 (min)</td>
</tr>
</tbody>
</table>

**APPROVED EQUAL**

**NOTES:**
1) Applicator shall verify required primer(s) based on surface materials, condition, etc.
PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate Work with applicable stakeholders to ensure Work is effectively achieved without unintended obstructions, damage, interference, etc. Coordinate with:
   1. OWNER or OWNER’S designated representative.
   2. ENGINEER.
   4. Other trades to ensure that Work done by other trades is complete and ready to receive coating.
   5. Other trades to avoid or minimize Work in immediate vicinity of coating Work in progress or completed Work.

3.2 EXAMINATION

A. CONTRACTOR shall examine substrates under which coating systems will be applied and report to OWNER, in writing, any conditions that would adversely affect the appearance or performance of the coating systems and which cannot be put into an acceptable condition by the preparatory work specified herein. Typical examination includes, but is not limited to:
   1. Verification that Work done by other trades is complete and ready to receive coating.
   2. Verification that areas and conditions under which Work is to be performed permit proper and timely completion of Work.
   3. Verification of compatibility with and suitability of substrates, including existing coatings.

B. Do not proceed with affected Work until unsatisfactory conditions have been dispositioned and clear direction is provided.

C. Known, measurable and/or reasonably identifiable conditions prior to award of contract shall be the CONTRACTOR’s responsibility. Means and methods to control and/or correct such conditions shall come at no cost to OWNER.

3.3 WORK CONDITIONS

A. Newly placed concrete surfaces shall be cured as recommended by the CSM prior to coating application, unless otherwise approved by OWNER and/or OWNER’S designated representative.

B. Apply coatings only when the prevailing environmental conditions are in accordance with the CSM(s) printed instructions. The CONTRACTOR shall be responsible to create and/or control environmental conditions at Work locations including within partially enclosed structures, enclosed structures and similar environments that are not significantly affected by the atmospheric environment.

3.4 PROTECTION

A. General:
   1. Rotating equipment, plant equipment, hardware, hardware accessories, nameplates, data tags, machined surfaces, sprinkler heads, electrical fixtures, and similar coated and/or uncoated items which are within, or in the vicinity of, surfaces to be coated shall be removed and reinstalled, masked and/or protected prior to surface preparation and coating operations.
   2. Mask off surfaces not scheduled to receive coating to protect from spillage and overspray.
   3. Protect Work of other trades from damage.
   4. Protect workers, pedestrians, other personnel, animals, plants, landscaping, adjacent structures, pavement, sidewalks, parked and moving vehicles and/or other elements in surrounding area from exposure to coating Work, including airborne materials and runoff. Correct damage as approved by OWNER, at no cost to OWNER.
5. As necessary, prevent access to Work areas or provide “Wet Paint” signs to protect newly coated surfaces. Aesthetic and/or physical damage from others in locations where adequate barricades and/or warnings are not present shall be corrected at no cost to OWNER.
6. Remove masking and other protective measures at completion of coating Work.
7. Correct damage by cleaning, repairing, replacing, or recoating as approved by OWNER, at no cost to OWNER. Restore damaged elements and components to original condition or better as found prior to start of Work.

B. Wind-Borne Damage: The wind velocity and direction shall be considered as having a major impact on blasting and spraying operations. Use necessary precautions to prevent undue dispersing of material. Use wind screen/overspray nets to minimize the spillage impact on the buildings and Site. CONTRACTOR is responsible for any damage to adjacent surfaces, environment, vehicles, etc.

3.5 SURFACE PREPARATION
A. General: The CONTRACTOR shall clean and prepare substrate(s) in accordance with the CSM’s written instructions. The following requirements herein shall apply:
1. Surfaces to be coated shall be clean and dry excluding cementitious coatings that specifically require saturated conditions. Before applying coatings, oil, grease, dirt, rust, loose mill scale, old weathered coatings, laitance and other foreign substances shall be removed unless specifically stated otherwise herein. Oil and grease shall be removed before mechanical or abrasive blast cleaning is started. Where cleaning is accomplished by blast cleaning, the abrasive used shall be washed, graded and free of contaminants which might interfere with the adhesion of the coatings or cause soluble salt contamination of the substrate.
2. Comply with all local, state and/or federal air quality and/or emission regulations.
   a. (As required) Provide containment, dust collectors and/or other means to control emissions and meet air quality requirements.
3. Schedule cleaning and coating application so dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.
4. Any solvent wash, solvent wipe, or cleaner used, including but not limited to those used for surface preparation in accordance with referenced Steel Structures Painting Council (SSPC) specifications, shall be of the emulsifying type which emits no more than 2.8 lb/gal (340 gms/l) VOCs, contains no phosphates, is biodegradable, removes no zinc, and is compatible with the specified coating material. Clean cloths and clean fluids shall be used for solvent cleaning.
5. Spent blast abrasive shall not be reused.
6. The compressed air used for blast cleaning or blow down cleaning shall be filtered and shall contain no condensed water or oil. Moisture traps shall be cleaned at least once every four hours or more frequently as required to prevent moisture from entering the supply air to the abrasive blasting equipment.
7. Oil separators shall be installed just downstream of compressor discharge valves and at the discharge of the blast pot discharges. These shall be checked on the same frequency as the moisture traps.
8. Regulators, gauges, filters, and separators in good working order shall be in use on all of the compressor air lines to blasting nozzles.
9. An air dryer or desiccant filter drying unit shall be installed which dries the compressed air prior to blast pot connections. This dryer shall be used and maintained for the duration of all surface preparation work.
10. A paper blotter test shall be performed to determine if compressed air used for blast cleaning or other purposes on the project is free of moisture and oil. This should be performed two to three times per shift when in operation.
11. The abrasive blast nozzles used shall be of the venturi or other high velocity type supplied with a minimum of 100 psig air pressure and sufficient volume to obtain the blast cleaning production rates and cleanliness/specified herein.
12. Provide ventilation for airborne particulate evacuation to optimize visibility for both blast cleaning and inspection during surface preparation work.

13. Surface cleanliness of prepared substrates shall be inspected after surface preparation, and prior to application of any coating materials. If steel surfaces are repaired, they shall be re-inspected for surface cleanliness and preparation prior to application of the coating system.

14. Test and record substrate pH using pH indicating papers. pH testing frequency should be performed once every 100 square feet of surface area to be coated.
   a. For dry substrate spray the surface lightly with distilled, de-ionized water from a commercially available spray bottle that has been properly rinsed to preclude any dissolved solids. The spray shall wet the surface to a "shiny" appearance and water shall not run down the wall. Wait 60 seconds to allow chemical equilibria to be established and then test the pH of the water on the surface.

15. Measure soluble salt/conductivity in accordance with SSPC Guide 15:
   a. Conduct 5 measurements per each 1000 SF area at locations selected by OWNER and/or Quality Assurance Inspector.
   b. Maximum threshold shall be 70 micro Siemens/cm.
   c. CONTRACTOR shall be responsible to correct substrates not satisfying the maximum threshold at no cost to OWNER.

16. Conduct chloride testing for immersion surfaces:
   a. Conduct 5 measurements per each 1000 SF area at locations selected by OWNER and/or Quality Assurance Inspector.
   b. Conduct chloride testing using a CHLOR*TEST™ kit or approved equivalent.
   c. Maximum chloride threshold shall be no more than 3.0 ppm.
   d. CONTRACTOR shall be responsible to correct substrates not satisfying the maximum threshold at no cost to OWNER.

B. Cleaning, Substrate Decontamination, and Degreasing of substrates to be coated previously exposed to wastewater splash, spillage, or immersion:

1. Degrease the surfaces prior to blast cleaning. Use alkaline cleaning solutions, steam cleaning, or hot water with detergents, followed by rinsing with clean, potable water, and until all traces of degreasing/cleaning solutions have been removed. Thoroughly rinse surfaces degreased with ample clean potable water.
   a. The CONTRACTOR shall be responsible for cleaning only substrates to be coated and not any adjacent surfaces.

2. Decontamination shall consist of high pressure water cleaning or similar means and methods necessary to remove required contaminates to perform Work.
   a. Decontamination must remove all wastewater solids/residues, scum, all debris such as embedded dirt, and all other substances from substrates to be coated.

3. Remove all debris, wastewater constituents, and spent cleaning water from structures and work areas to be coated by pumping, vacuum cleaning or other appropriate means.
   a. Initial cleaning and removal of wastewater solids/residue, scum and debris from the work area will be performed by OWNER. The purpose of initial cleaning is to provide general cleaning to permit access and improve work habitability. Detailed cleaning of elements, crevices or other areas to be coated is not included in OWNER’s initial cleaning and shall be the responsibility of the CONTRACTOR.

4. A clean substrate prior to surface preparation is achieved when substrate is free of visible oil, grease, dust, chlorides, and any other foreign material etc. when viewed without magnification.
   a. All Immersion Steel surfaces and related areas shall have all metal surfaces cleaned per SSPC-SP WJ-4/NACE WJ-4 at pressures no less than 34 MPa (5,000 psig) and meet SSPC-SP 1 for cleanliness.

C. Touch-Up Coating

1. When performing touch-up coating work related surface preparation, adhere to CSM recommendations and requirements.
2. At a minimum, remove loose, cracked and poorly adhered coatings. Roughen or abrade all intact well-adhered coatings. Feather all exposed edges of existing coatings at periphery of coating removal areas. Roughen or abrade more aggressively 2 inches beyond existing coating removal areas in all directions or until tightly adhered coating is obtained or reached.

D. Metallic Surfaces:
1. General: Metallic surfaces shall be prepared in accordance with the CSM requirements and applicable portions of the SSPC surface preparation specifications. The following minimum requirements shall apply unless specified otherwise:
   a. The profile depth of the surface to be coated shall generally be 20 to 25 percent of the coating dry film thickness as measured by Method C of ASTM D4417.
   b. Blast particle size shall be selected by the CONTRACTOR to produce the specified surface profile.
   c. All weld splatter, slag and sharp metal burrs shall be removed by grinding or other approved means.
   d. The minimum permissible surface preparation for immersed and/or intermittently immersed ferrous metal substrates shall be SSPC SP-10.
   e. Blast cleaning requirements for ductile iron or cast iron substrates, galvanized steel and non-ferrous substrates shall apply unless specified otherwise by CSM(s):
      1) All ductile or cast iron surfaces to be coated shall be abrasive blast cleaned to a clean, gray uniform metal appearance free of variations in color and loose materials.
      2) Non-ferrous metals such aluminum and stainless steel shall be sweep/brush blasted and cleaned to produce a clean surface with complete removal of all corrosion products and contaminants.
      3) Galvanized steel shall be sweep/brush blasted and cleaned to produce a clean surface with complete removal of all corrosion products and contaminants.
   f. Remove all traces of grit, dust, dirt, rust scale, corrosion products and/or embedded abrasive from substrate by a combination of vacuum cleaning, compressed air and/or sweeping in accordance with ISO 8502-3 for a rating of 2, or better, before application of coatings.
   g. Acceptable surface preparation must produce a metal surface pH of 6.0 to 9.0 to be confirmed by surface pH testing.
      1) If after surface preparation, the surface pH remains below 6.0, perform additional waterblasting or cleaning until additional pH testing indicates an acceptable pH level.
   h. Preparation of carbon steel surfaces shall be based upon comparison with SSPC-VIS1 (ASTM D2200).
   i. Surface cleanliness of prepared substrates shall be inspected after surface preparation, and prior to application of any coating materials. If steel surfaces are repaired, they shall be re-inspected for surface cleanliness and preparation prior to application of the coating system.
   j. If, between final surface preparation work and coating system application, contamination of the prepared and cleaned metallic substrates occurs, or if the prepared substrates' appearance darkens or changes color, re-cleaning by water blasting or abrasive blast cleaning shall be required until the specified degree of cleanliness is reclaimed.

E. Concrete Surfaces:
1. Prior to surface preparation Work, ensure concrete substrates are sound with no evidence of surface or underlying deterioration such as spalling, soft material, cracking, erosion, etc. that may require repair or remediation prior to coating preparation Work. Notify OWNER upon discovery. Common methods to identify deterioration include:
   a. Sounding: Using a hammer, chains or similar tools to identify “hollow” sounds which indicate potential areas of deterioration or delamination.
b. Visual Observation.

c. Physical Disturbance: Using tools to disturb the surfaces to identify loose or soft materials.

2. Prior to surface preparation Work, ensure concrete is watertight. Prepare and/or apply CSM recommended hydraulic grout and/or water stop material as required.

3. All concrete surfaces, existing and repaired areas, shall have been cured a minimum of 28 days prior to coating application, unless otherwise approved by CSM(s).

4. Test adhesion of concrete surfaces/substrates prior to application of materials. Perform testing with a DeFelsko PosiTest AT-A adhesion tested with 50mm dollies or approved equivalent. Tests shall be performed every 100 SF, unless otherwise approved by OWNER. Pull tests shall pass a minimum 300 psi. Surfaces/substrates not meeting the required adhesion shall be removed until testing requirements are satisfied at no cost to OWNER. OWNER reserves the right to request additional pull testing upon failure to meet the psi requirements at 1 or more locations.

5. Prepare surfaces to be coated according to coating manufacturer’s written instructions for particular substrate conditions and as specified herein.

6. Surface preparation of concrete substrates can be accomplished using methods such as dry abrasive blast cleaning, high, or ultra-high pressure water blast cleaning in accordance with SSPC-SP-13.

   a. Do not micro-fracture or otherwise damage concrete substrate with removal operations.
   b. Concentrate the air jet at cracks, control and construction joints, and repair perimeter interfaces to ensure that contaminants are removed from these crevices.

7. Open up all bugholes and excessive cavities to expose their complete perimeter. Leaving shelled over, hidden air voids beneath the exposed concrete surface will not be acceptable.

   a. Bugholes, excessive cavities, form-tie holes and similar depressions shall be excavated, prepared and/or filled with CSM’s specified surface filler or repair material prior to coating application. Ensure substrate is dry prior to application.

8. The selected preparation and cleaning method must produce the requirements set forth below:
   a. A clean substrate free of calcium sulfate, loose coarse or fine aggregate, laitance, loose hydrated cement paste, and otherwise deleterious substances.
   b. A concrete surface pH of 9.0 to 12.0. If after surface preparation, the surface pH remains below 9.0, perform additional water blasting, cleaning, or abrasive blast cleaning until additional pH testing indicates an acceptable pH level.

9. Surface profile shall be verified by means of visual inspection and comparison to ICRI 03732 concrete surface profile chips at least once 50 for every square feet of area to be coated.

10. Prepared surfaces shall be even and/or consistent. Grind flat protrusions and bumps to achieve a consistent texture and eliminate potential locations that may result in low material coverage or result in uneven transitions to the surrounding area concrete.

11. Following quality control inspection of surface preparation by the CONTRACTOR and Quality Assurance Inspection by Quality Assurance Inspector and/or OWNER, thoroughly vacuum clean all concrete surfaces to be coated to remove all loose dirt, and spent abrasive leaving a dust free, sound concrete substrate.

   a. Surface cleanliness of prepared concrete substrates shall be inspected after cleaning, preparation, and/or drying, but prior to application of any coating materials. If concrete surfaces are repaired, they shall be reinspected for surface cleanliness prior to application of the coating system.

   b. If prepared surfaces become contaminated after first cleaning, they shall be cleaned again at the CONTRACTOR’s expense prior to applying the coating.

F. Masonry Surfaces:

1. Prepare masonry surfaces in general accordance with concrete surface preparation requirements above, CSM requirements and supplemental requirements below:

   a. Prepare surfaces to remove all chalk, loose dirt, dried mortar splatter, dust, peeling or loose existing coatings, or otherwise deleterious substances to leave a clean, sound substrate.
b. Ensure surfaces are dry prior to coating application.
   1) If pressure washing or low pressure water blast cleaning is used for preparation, allow the masonry to dry for at least 5 days under dry weather conditions at an ambient average temperature of 70°F. 
   2) Coordinate with CSM and Quality Assurance Inspector to determine minimum drying time requirements based on project specific conditions.

G. Fiberglass Reinforced Plastic (FRP) Surfaces:
1. Prepare FRP surfaces in general accordance with CSM requirements supplemental requirements herein:
2. Pressure wash to remove dust, dirt, contaminants and other materials.
3. Prepare surfaces by sanding and/or sweep (brush) blasting to establish uniform surface roughness and to remove any gloss from the resin in the FRP.
4. Remove existing coatings as specified, that are delaminating and/or do not satisfy CSM requirements for bond strength, performance and/or other performance properties.
5. Pressure wash to remove all contaminants, debris, etc.
6. Vacuum clean to remove all loose dust, dirt, and other materials.
7. Solvent clean using clean white rags and allow solvent to completely evaporate prior to application of any coating materials.

H. Chlorinated Polyvinyl Chloride (CPVC) and Polyvinyl Chloride (PVC) Surfaces:
1. Prepare PVC and CVPV surfaces in general accordance with CSM requirements supplemental requirements herein:
2. Pressure wash to remove dust, dirt, contaminants and other materials.
3. Prepare surfaces by sanding and/or sweep (brush) blasting to establish uniform surface roughness.
4. Remove existing coatings that are delaminating and/or do not satisfy CSM requirements for bond strength, performance and/or other performance properties.
5. Pressure wash to remove all contaminants, debris, etc.
6. Vacuum clean to remove all loose dust, dirt, and other materials.
7. Solvent clean using clean white rags and allow solvent to completely evaporate prior to application of any coating materials.

I. Wood Surfaces
1. Prepare wood surfaces in general accordance with CSM requirements supplemental requirements herein:
2. Ensure surfaces are clean and dry prior to coating application.
3. Remove surface deposits, sap, protrusions, etc. by scraping or similar means.
4. Seal knots, pockets, openings, etc. with CSM approved filler material.
5. Sand rough spots with the grain. Begin with medium grit sandpaper and finish with fine grit sandpaper.
6. Remove all sanding dust, debris, contaminants and other deleterious materials.
7. Wipe surfaces clean with clean rags and CSM approved cleaners.

J. Asphalt and Concrete Pavement:
1. Prepare asphalt and concrete pavements for installation of liquid and/or preformed markings, striping, etc. in accordance with the CSM requirements and requirements herein.
2. Remove all loose materials, dirt, debris and contaminants with high-pressure water blasting or other suitable means.
3. Verify surfaces are free of oils and/or other detrimental contaminants that are not compatible with the selected coating systems. Adhere to manufacturer recommended cure times for new asphalt surfaces and/or sealers.

3.6 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrates per CSM’s written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D4258.
For cementitious waterproofing systems, refer to CSM’s specific instructions for crack, joint and similar treatments. Unless otherwise specified by CSM, the following joint and crack treatment methods shall apply (at a minimum):

1. **Static Cracks**
   a. Fill hairline cracks according to manufacturer’s written instructions prior to coating application.
   b. Open cracks up to 1/4- to 3/8-inch wide and 1/4-inch deep:
      1) Clean cracks and surrounding area removing dust, dirt, and other impurities.
      2) Apply crack filler primer, as recommended by CSM, with a brush to obtain uniform coverage and spread approximately 2-inches on each side of cracks.
      3) Fill cracks with crack filler applied with a putty knife or trowel, and allow for shrinkage. If excessive shrinkage occurs, reapply crack filler.
   c. After filler material has cured, apply detail stripe of coating material extending 2-inches to each side of crack, including reinforcing mesh/tape as recommended by the CSM.

2. **Movement Joints and Cracks:**
   a. Coordinate with OWNER to determine crack nature (static or movement), as required.
   b. Detail coatings at moving joints in accordance with CSM’s written instructions.
      1) It is not permitted to bridge coatings with limited elongation and flexibility over moving joints.
   c. Apply joint materials acceptable to CSM. Refer to Section 07900 for concrete joint material specifications and requirements.

3. Notify OWNER if cracks larger than 3/8-inch are located.

B. Allow sealants and/or fillers to cure before proceeding with coating installation.

C. Do not commence coating system installation until CSM, OWNER and/or Quality Assurance Inspector approve the substrate and related conditions as suitable for receiving the coating system.

### 3.7 APPLICATION

**A. General:**
1. Prepare and apply materials according to CSM’s written instructions, at recommended rates and coverage’s.

**B. Workmanship:**
1. Coated surfaces shall be free from runs, drips, ridges, waves, laps, and brush marks. Coats shall be applied so as to produce an even film of uniform thickness completely coating corners and crevices. Coating work shall be performed in accordance with the requirements of SSPC Paint Application Specification No. 1.
   a. Cementitious coating systems shall also be free of cracking, honeycombing and abnormalities. CONTRACTOR shall be responsible to repair and/or replace all locations exhibiting detrimental conditions and/or conditions that are not consistent with the intended material finish at their expense as specified in CSM’s written data sheets.
2. Honor all joints and active movement locations including control joints, expansion joints, material interfaces, etc. Adhere to CSM’s requirements for proper preparation, treatment and/or application over these areas.
3. Equipment shall be designed for application of the materials specified.
4. Each coat of a coating system shall be applied evenly and sharply cut to line. Care shall be exercised to avoid overspraying or splattering coatings on surfaces not to be coated.
5. Application Method: Coating applications method can be conventional or airless spray, brush or roller, or trowel based on the permitted coating system application methods, conditions and related considerations.
6. Allow each coat to cure sufficiently, according to CSM’s printed instructions, prior to recoating.
7. Vary color for each successive coat for all coating systems, unless not viable and/or otherwise approved by OWNER.
8. Perform stripe painting on all edges, angles, weld seams, flanges, nuts, bolts, prior to application of the primer and other coats to ensure proper film build of the coating systems.
9. Cut in edges clean and sharp in accordance with CSM recommendations where work joins other materials or colors.

C. Atmospheric and Substrate Conditions: Apply coating when existing and forecast weather conditions permit coating to be installed according to CSM’s written instructions and the following requirements:
1. Surfaces to receive coatings shall be dry excluding cementitious coatings that specifically require saturated conditions. Do not proceed with coating operations until substrates are ready to receive coatings and have been verified by the OWNER and/or Quality Assurance Inspector.
   a. Test prepared surfaces for moisture and other conditions as recommended by CSM.
   b. Test for excess moisture in concrete substrates using the Plastic Sheet Test in accordance with ASTM D4263.
   c. Verify that ambient air and substrate surface temperatures, relative humidity, and dew point are within ranges recommended by CSM prior to and during coating operations.
      1) Measure and record ambient air and substrate temperature at the beginning and end of each shift and once every two hours of each shift using a thermometer.
      2) Measure and record relative humidity at the beginning and end of each shift and every two hours of each shift using a sling psychrometer in accordance with ASTM E337.
2. Coatings shall not be applied over any substrates during rainy, misty weather, or on surfaces upon which there is frost or moisture condensation and when surface temperature is within 10°, or CSM’s specified degree, of dew point, unless otherwise permitted by CSM and OWNER.
   a. Atmospheric conditions shall be measured in areas pertinent to coating installation.
   b. During damp weather and/or damp work environments, when the temperature of the surface to be coated is within 10°F of the dew point, heating or forced dehumidification equipment may be used to maintain a minimum temperature of 40°F and 10°F above the dew point for the surfaces to be coated, the coated surface, and the atmosphere in contact with the surface.
      1) Maintain conditions for a period of at least 8 hours or as recommended by the CSM.
      2) CONTRACTOR is responsible to provide dehumidification equipment, fans, and/or heaters inside enclosed and partially enclosed areas where conditions causing condensation are severe to maintain the required atmospheric and surface temperature requirements for proper coating application and cure.
3. Verify application restrictions and constraints for coatings applied over concrete surfaces with rising temperatures or in direct sunlight.
   a. Common coating deficiencies observed in these conditions include bubbling, pinhole formations and blistering.
   b. Coordinate preventative measures with OWNER, such as schedule adjustment, as required.
   c. Repair deficiencies as recommended by the CSM and OWNER at no additional cost to OWNER.
4. Do not apply coatings over substrates and surfaces outside of the CSM’s recommended minimum and maximum substrate temperatures for application during any point of time during application.
5. Spray painting shall not be permitted when wind velocities at Work location are greater than 20 MPH.
6. Work accomplished under unfavorable substrate and/or weather conditions will be considered unacceptable and complete re-cleaning and recoating of these areas will be required at the CONTRACTOR’s expense.
D. Mixing:
   1. Mix standard coating materials in strict accordance with CSM instructions with specified mixers and tools to achieve uniform, smooth consistency. Do not thin or dilute unless permitted by CSM; use recommended thinners within recommended limits.
      a. Stir as required during application.
      b. If surface film forms, do not stir film into material. Remove film and strain coating material before using.
      c. Dispose of mixed materials that have exceeded the CSM’s recommended pot-life.
      d. Maintain containers used for mixing and applying coating in clean condition, free of foreign materials and residue.
   2. Mix cementitious coating systems in strict accordance with CSM instructions. Strictly adhere to recommended mixing equipment, mixing durations, atmospheric and other requirements. Consider material volumes required for efficient/continuous application based on the size, configuration and/or restrictions associated with the Work and CSM’s requirements.

E. Coating Film Thickness, Continuity and Quality:
   1. Coating system thickness is the total thickness of all materials to be applied as part of the system including the primer, stripe, intermediate and finish coats.
      a. Verify DFT for each coat over concrete surfaces once for every 100 square feet of surface area using a Positector 6000 DFT Gauge, or equivalent.
      b. Verify DFT for each coat over non-ferrous surfaces once for every 50 square feet of surface area using a Positector 200 DFT Gauge, or equivalent.
      c. Verify DFT for each coat over metallic surfaces once for every 50 square feet of surface area in accordance with SSPC-PA-2 using magnetic gages for ferrous metal.
      d. Following quality control inspections, OWNER and/or Quality Assurance Inspector shall verify thickness of each coat.
   2. The surface area covered per gallon of coating for various types of surfaces shall not exceed those recommended by the CSM.

F. Application:
   1. Apply coating by roller, spray, brush and/or trowel as recommended by the CSM. Use applicator and technique best suited for the substrate, coating material and conditions.
      a. Apply materials as soon as practicable after completion of surface preparation or recommended curing of previous material application as recommended by CSM to satisfy recoat windows.
      b. Do not exceed recommended pot life of material.
      c. Apply stripe coats by brush application only, unless otherwise permitted by CSM and Quality Assurance Inspector.
         1) Stripe coat all edges, corners, crevices, welds, nuts, bolts, irregular surfaces, etc. to ensure minimum dry film thickness is achieved in accordance with SSPC-PA Guide 11. Stripe coat shall not be spray applied.
         2) Stripe coat shall extend 1-inch (minimum) from each edge of surfaces to be stripe coated.
      d. Do not coat over conditions detrimental to formation of durable coating film, such as dirt, rust, scale, grease, or moist or scuffed surfaces.
      e. Apply primer and/or finish coats in one, or two coats, to provide specified thickness or recommended CSM thickness, whichever is greater. Do not apply subsequent coats until previous coat has fully cured and/or as recommended by CSM. Select application method to avoid excessive coating thickness.
         1) If undercoats or other conditions show through final coat, apply additional coats until coating film is of uniform finish, color, and appearance, if approved by CSM and OWNER.
         2) Ensure that edges, corners, and crevices receive minimum dry film thickness.
3) **Brush Application:** Work material into surface in even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw lines at edges and color breaks.

4) **Roller Application:** Keep cover wet; do not dry roll. Apply material in sections. Lay on required amount of material, working material into grooves and rough areas. Then level material, working it into surface.

5) **Spray Application:** Use spray application only when permitted by CSM’s written instructions and authorities having jurisdiction. Apply material to provide equivalent hiding of brush-applied coat. Do not double back, building up film thickness of two coats in one application.

6) All dry spray shall be removed, by sanding if necessary. In areas of deficient primer thickness, the area shall be thoroughly cleaned with power washing equipment, as necessary to remove all dirt; the area shall then be wire brushed, vacuumed and recoated.

7) **Cure cementitious materials as recommended by CSM and/or as required to mitigate drying shrinkage cracking and/or other deficiencies.**
   - Do no patch, repair, overlay, disturb and/or otherwise alter finish coats of cementitious materials prior to review by the Quality Assurance Inspector.

8) **All areas coated with impure, unsatisfactory or unauthorized coating material, or coated in an unworkmanlike or objectionable manner, shall be thoroughly cleaned and recoated or otherwise corrected as directed by CSM, OWNER and/or Quality Assurance Inspector.**

   **f. Special Conditions:**
   1) **Asphalt and Concrete Pavement Markings and Striping:**
      - Install markings, striping and/or other pavement coating systems in accordance with CSM requirements and requirements herein.
      - Ensure substrates and surfaces are dry, clean and free of loose materials, debris, contaminants, etc. prior to application unless otherwise permitted by CSM.
      - Apply within CSM’s specified ambient and/or substrate surface temperature ranges for coating system to be applied.
      - Pre-heat and/or pre-treat substrate surfaces in accordance with CSM’s specifications and requirements.
      - Utilize stencils, string lines, pins, shapes and/or other appropriate layout and measuring tools, methods and techniques to ensure markings, lines, striping and/or other shapes are installed to the appropriate line and position.
      - Utilize manufacturer recommended equipment and application techniques for the selected coating system and/or materials to be applied.

   2) **Non-Skid Surfaces:**
      - Aggregate may be incorporated into topcoat applications when a walking nonskid surface is preferred. Non-Skid tape may also be applied.

   3) **Use of Sealant:**
      - When intermittent welding is used to attach unistrut, angles, brackets, structural members, etc. in an outdoor location or corrosive environment, the crevices at the joint, if 3/16-inch or less, may be filled with a sealant compatible with the coating system prior to coating to effectively seal the concealed area from air and moisture penetration.

### 3.8 FINAL INSPECTION

A. Perform a final inspection to determine whether coating system Work meets the requirements of the Contract Documents. OWNER, OWNER’s designated representative and/or Quality Assurance Inspector will subsequently conduct a final inspection with the CONTRACTOR.

Any rework required shall be marked. Such areas shall be recleaned and repaired as specified herein or as recommended by the CSM and/or OWNER at no additional cost to OWNER.
### TABLE 1: QUALITY ASSURANCE TESTING

<table>
<thead>
<tr>
<th>TEST / INSPECTION</th>
<th>STANDARD / METHOD</th>
<th>SUBSTRATE</th>
<th>SCHEDULE</th>
<th>FREQUENCY</th>
<th>ACCEPTANCE CRITERIA</th>
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<tr>
<td>Substrate Adhesion</td>
<td>ASTM D7234</td>
<td>Concrete ; CMU</td>
<td>Prior to coating application</td>
<td>1 test / 100 SF</td>
<td>≥ 300 psi</td>
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<td>Ultrasonic Thickness</td>
<td>ASTM E213</td>
<td>Ferrous Metal</td>
<td>After surface preparation</td>
<td>As required</td>
<td>Varies</td>
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<td>Sharp Edges, Weld Platter, Slivers, etc.</td>
<td>Visual</td>
<td>Ferrous Metal</td>
<td>Prior to coating application</td>
<td>All</td>
<td>All defects shall be addressed</td>
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<td>pH</td>
<td>pH Indicating Paper or Equal</td>
<td>Concrete ; CMU</td>
<td>After surface preparation; Prior to coating application</td>
<td>5 tests / 1000 SF</td>
<td>9.0 – 12.0</td>
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<td>pH</td>
<td>pH Indicating Paper or Equal</td>
<td>Ferrous Metal</td>
<td>After surface preparation; Prior to coating application</td>
<td>5 tests / 1000 SF</td>
<td>6.0 – 9.0</td>
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<td>Soluble Salt / Conductivity</td>
<td>SSPC Guide 15</td>
<td>Ferrous Metal (Immersion &amp; Intermittent Immersion)</td>
<td>After Surface Preparation; Prior to Coating Application</td>
<td>5 test / 1000 SF (or) 3 tests / element (Whichever is greater)</td>
<td>30 μS/cm</td>
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<td>Soluble Salt / Conductivity</td>
<td>SSPC Guide 15</td>
<td>Ferrous Metal (Atmospheric)</td>
<td>After Surface Preparation; Prior to Coating Application</td>
<td>5 test / 1000 SF (or) 3 tests / element (Whichever is greater)</td>
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<td>CHLOR*TEST™</td>
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<td>CHLOR*TEST™</td>
<td>All (Atmospheric)</td>
<td>After Surface Preparation; Prior to Coating Application</td>
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<td>SSPC-VIS1 ; ISO 8502-3</td>
<td>Steel</td>
<td>Prior to coating application</td>
<td>All</td>
<td>No Defects</td>
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<td>Visual</td>
<td>Ductile Iron ; Cast Iron</td>
<td>Prior to coating application</td>
<td>All</td>
<td>No Defects</td>
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<td>Surface Cleanliness</td>
<td>Visual</td>
<td>Concrete ; CMU ; All Other</td>
<td>Prior to coating application</td>
<td>All</td>
<td>No Defects</td>
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<td>Surface Profile</td>
<td>ASTM D4417 ; SSPC SP Guidelines</td>
<td>Ferrous Metal</td>
<td>Prior to coating application</td>
<td>1 test / 25 SF</td>
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<td>Surface Profile</td>
<td>ICRI 03732 - CSP Chips</td>
<td>Concrete ; CMU</td>
<td>Prior to coating application</td>
<td>1 test / 50 SF</td>
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<td>Moisture (Plastic Sheet)</td>
<td>ASTM D4263</td>
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<td>ASTM D4414</td>
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<td>All</td>
<td>1 test / 50 SF</td>
<td>Per CSM and/or Project Requirements</td>
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<td>ASTM D7091 ; SSPC-PA-2</td>
<td>Ferrous and Non-Ferrous Metal</td>
<td>After each coat applied; After final coat</td>
<td>1 test / 50 SF</td>
<td>Per CSM and/or Project Requirements</td>
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<td>ASTM D6132</td>
<td>Concrete ; CMU ; Wood ; Plastic ; FRP ; Etc.</td>
<td>After each coat applied; After final coat</td>
<td>1 test / 100 SF (concrete) ; 1 test / 50 SF (other)</td>
<td>Per CSM and/or Project Requirements</td>
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<td>Concrete</td>
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<td>3 test / element (or) 1 test / 500 SF (Whichever is greater)</td>
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TABLE 2: COLOR SHADE CODE

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**TABLE 3: EQUIPMENT AND PIPING COLOR IDENTIFICATION CODE**

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<tr>
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<td>Brown</td>
<td>CFS</td>
<td></td>
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<tr>
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<td>CCK</td>
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<tr>
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<td>CCT</td>
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<tr>
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<td></td>
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<tr>
<td>Water Reclamation</td>
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<td>RWM</td>
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<td>Unit Process Color</td>
<td>(Unit Process Name)/SAMP</td>
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CHECKLIST 1: CONCRETE COATING

<table>
<thead>
<tr>
<th>Date</th>
<th>Initials</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>____</td>
<td>_____</td>
<td>1. Required submittals have been provided to OWNER for review and have been accepted.</td>
</tr>
<tr>
<td>____</td>
<td>_____</td>
<td>2. Existing conditions, surfaces and related items relevant to work tasks have been examined and accepted. Deficiencies, obstructions, abnormalities and/or constraints have been communicated to OWNER and appropriately resolved.</td>
</tr>
<tr>
<td>____</td>
<td>_____</td>
<td>3. CSM has reviewed substrates, environmental and operating conditions. CSM has verified selected coating system is suitable for application.</td>
</tr>
<tr>
<td>____</td>
<td>_____</td>
<td>4. OWNER property including, but not limited to, equipment, components, structures, etc. have been adequately protected.</td>
</tr>
<tr>
<td>____</td>
<td>_____</td>
<td>5. Required mockups have been applied, reviewed, and approved by Quality Assurance Inspector.</td>
</tr>
<tr>
<td>____</td>
<td>_____</td>
<td>6. Newly placed concrete and/or cementitious surfaces have been cured a minimum of 28 days unless specified otherwise permitted by CSM. Validation of suitable substrate conditions have been tested per appropriate industry standards, recognized by the CSM and documentation has been provided to OWNER for review.</td>
</tr>
<tr>
<td>____</td>
<td>_____</td>
<td>7. Quality Assurance Inspector has conducted requisite number of substrate adhesion tests. Adhesion satisfies requirements as specified in the Contract Documents.</td>
</tr>
<tr>
<td>____</td>
<td>_____</td>
<td>8. Quality Assurance Inspector has verified concrete surface preparation meets ICRI CSP and CSM requirements as specified in the Contract Documents.</td>
</tr>
<tr>
<td>____</td>
<td>_____</td>
<td>9. Quality Assurance Inspector has conducted requisite number of soluble salt/conductivity and chloride testing. Testing satisfies requirements as specified in the Contract Documents.</td>
</tr>
<tr>
<td>____</td>
<td>_____</td>
<td>10. Quality Assurance Inspector has verified pH satisfies requirements as specified in the Contract Documents.</td>
</tr>
<tr>
<td>____</td>
<td>_____</td>
<td>11. Quality Assurance Inspector has verified degree of surface cleanliness satisfies requirements as specified in the Contract Documents.</td>
</tr>
<tr>
<td>____</td>
<td>_____</td>
<td>12. Static cracks have been prepared, treated, routed, and filled as specified in the Contract Documents and per the CSM’s requirements.</td>
</tr>
<tr>
<td>____</td>
<td>_____</td>
<td>13. Moving cracks have been identified and an RFI has been submitted to OWNER for review and recommendations as required.</td>
</tr>
<tr>
<td>____</td>
<td>_____</td>
<td>14. Control joints, expansion joints, movement joints/cracks and related items have been prepared and appropriate joint filler(s) have been installed as specified in the Contract Documents and CSM Requirements.</td>
</tr>
</tbody>
</table>
15. Bug holes and surface imperfections have been filled with the appropriate surfacer, crack filler and/or other material and cove joints have been installed as specified in the Contract Documents and per the CSM’s requirements.

16. Additional pre-coating tasks have been performed.

17. Substrates are visibly dry and passed manufacturer recommended moisture test, with no visible condensation (unless specifically permitted by CSM).

18. **Final substrate conditions and preparations have been reviewed by the CSM and/or Quality Assurance Inspector.**

19. Batch information, shelf life, storage conditions and related items for materials to be applied have been reviewed by the Quality Assurance Inspector.

20. Ambient and surface temperature, relative humidity, weather conditions, substrate and materials are within specified limits. Conditions related to wind have been reviewed to prevent overspray damage to nearby equipment, vehicles, etc.

21. Mixing and application equipment and tools have been tested and verified to be in good working order.

22. Mix and prepare coating materials according to CSM’s written instructions.

23. Quality Assurance Inspector has verified surfacer, primer, base or finish coat application.

24. **Quality Assurance Inspector has performed requisite number of wet film, adhesion and/or dry film thickness (DFT) tests. Coating has been reapplied to test locations and touch-up repairs are complete.**

25. Surfacer, primer or base coat has been prepared per Contract Documents and CSM Requirements and ready to receive primer, base, intermediate or finish coat within specified recoat period.

26. **Batch information, shelf life, storage conditions and related items for materials to be applied have been reviewed by Quality Assurance Inspector.**

27. Quality Assurance Inspector has verified surface preparation and degree of cleanliness.

28. Ambient and surface temperature, relative humidity, weather conditions, substrate and materials are within specified limits. Conditions related to wind have been reviewed to prevent overspray damage to nearby equipment, vehicles, etc.

29. Mixing and application equipment and tools have been tested and verified to be in good working order.

30. Primer, base, intermediate and/or finish coat is mixed and applied per Contract Documents and CSM Requirements.

31. **Quality Assurance Inspector has performed requisite number of wet film, adhesion and/or dry film thickness (DFT) tests. Coating has been reapplied to test locations and touch-up repairs are complete.**

32. Quality Assurance Inspector has performed holiday testing.

33. Coated surfaces have been installed per Contract Documents and CSM requirements and accepted by Quality Assurance Inspector.

34. Refer to steps 25 through 31 for subsequent applications.
CHECKLIST 2: FERROUS METAL COATING

<table>
<thead>
<tr>
<th>Date</th>
<th>Initials</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1. Required submittals have been provided to OWNER for review and have been accepted.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Existing conditions, surfaces and related items relevant to work tasks have been examined and accepted. Deficiencies, obstructions, abnormalities and/or constraints have been communicated to OWNER and appropriately resolved.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. CSM has reviewed substrates, environmental and operating conditions. CSM has verified selected coating system is suitable for application.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. OWNER property including, but not limited to, equipment, components, structures, etc. have been adequately protected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Required mockups have been applied, reviewed, and approved by Quality Assurance Inspector.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Quality Assurance Inspector has performed ultrasonic thickness (UT) testing (as required).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Required steel repairs have been performed and prepared for coating (as required). Repairs have been verified by Quality Assurance Inspector.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. Quality Assurance Inspector has conducted requisite number of soluble salt/conductivity and chloride testing. Testing satisfies requirements as specified in the Contract Documents.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9. Quality Assurance Inspector has verified pH satisfies requirements as specified in the Contract Documents.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10. Quality Assurance Inspector has verified surface preparation meets SSPC and CSM requirements as specified in the Contract Documents.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11. Quality Assurance Inspector has verified degree of surface cleanliness meets SSPC and CSM requirements as specified in the Contract Documents.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12. Joints, bridges and transition requiring sealant or other work has been addressed (as required).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13. Additional pre-coating tasks have been performed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14. Substrates are visibly dry and free of laitance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15. Final substrate conditions and preparations have been reviewed and approved by the CSM and/or Quality Assurance Inspector.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16. Batch information, shelf life, storage conditions and related items for materials to be applied have been reviewed by Quality Assurance Inspector.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17. Ambient and surface temperature, relative humidity, weather conditions, substrate and materials are within specified limits. Conditions related to wind have been reviewed to prevent overspray damage to nearby equipment, vehicles, etc.</td>
</tr>
</tbody>
</table>
18. Mix and prepare coating materials according to CSM’s written instructions.

19. Quality Assurance Inspector has verified primer, stripe, base or finish coat application.

20. Quality Assurance Inspector has performed requisite number of wet film, adhesion and/or dry film thickness (DFT) tests. Coating has been reapplied to test locations and touch-up repairs are complete.

21. Primer, base or intermediate coat has been prepared per Contract Documents and CSM Requirements and ready to receive stripe, base, intermediate or finish coat within specified recoat period.

22. Batch information, shelf life, storage conditions and related items for materials to be applied have been reviewed by Quality Assurance Inspector.

23. Quality Assurance Inspector has verified surface preparation and degree of cleanliness.

24. Ambient and surface temperature, relative humidity, weather conditions, substrate and materials are within specified limits. Conditions related to wind have been reviewed to prevent overspray damage to nearby equipment, vehicles, etc.

25. Stripe, base, intermediate and/or finish coat is mixed and applied per Contract Documents and CSM Requirements.

26. Quality Assurance Inspector has performed requisite number of wet film, adhesion and/or dry film thickness (DFT) tests. Coating has been reapplied to test locations and touch-up repairs are complete.

27. Quality Assurance Inspector has performed holiday testing.

28. Coated surfaces have been installed per Contract Documents and CSM requirements and accepted by Quality Assurance Inspector.

29. Refer to steps 21 through 26 for subsequent applications.

END OF SECTION
SECTION 13110

CATHODIC PROTECTION SPECIFICATION

PART 1. GENERAL

1.1 SUMMARY

A. The work included under this section includes providing all labor, materials, equipment, tools, and incidentals required for the installation of a complete corrosion control system.

B. The Contractor shall be responsible for the procurement, installation, testing, and commissioning of the corrosion control system as specified in this section.

C. The corrosion control system shall consist of the following major components:

1. Basic Corrosion Monitoring System:

   The Contractor shall install and test a system for the monitoring of corrosion potential on the installed pipeline. Provision of the basic corrosion monitoring system will be considered a part of the bid package, and will be included in the Contractor’s unit price for pipe material and installation.

2. Galvanic Anode Cathodic Protection System:

   The Contractor shall procure and install a galvanic anode cathodic protection system according to these specifications, plans, and details. The installation of the galvanic anode system will be considered a part of the bid package, and will be included in the Contractor’s unit price for pipe material and installation.

D. Reference Standards

   The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):


   f. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field

   g. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens


5. US Department of Transportation (DOT) H-20, Load Rating Designations


1.2 SUBMITTALS

A. Action Submittals

1. Manufacturer’s data, including catalog information, material specification, and other information for products to be used.

2. Layout of the basic corrosion monitoring system shall be included with pipeline shop drawings or lay schedule.

3. Corrosion specialist qualifications. The Contractor shall submit the credentials of the proposed cathodic protection or corrosion specialist as part of the shop drawing review process.

B. Informational Submittals

1. Compliance Statement: provide compliance statement that galvanic anode composition meets chemical requirements specified herein.

2. Field test reports to be completed and submitted to Owner with 14 calendar days of testing.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: provide anodes and reference electrodes packaged in a plastic or heavy paper bag of sufficient thickness to protect backfill, and cloth bag during normal shipping and handling.

B. Store prepackaged anodes off the ground to keep them dry. Protect against weather, condensation, and mechanical damage. Immediately remove wet or mechanically damaged prepackaged anodes from site. Handle anodes with care to prevent loss of backfill material. Do not lift or hold anodes by lead wire.

1.4 DEFINITIONS

A. Ferrous Metal Pipe: pipe made of steel or iron, and pipe containing steel or iron as a principle structural material.

B. Lead, Lead Wires, Joint Bonds, Cable: insulated copper conductor; the same as wire.

C. NACE: NACE International

D. CPS: Cathodic Protection or Corrosion Specialist
E. CP: Cathodic Protection

F. AWG: American Wire Gauge, standardized wire gauge system

G. ANSI: American National Standards Institute

H. HMWPE: High Molecular Weight Polyethylene, type of wire insulation.

I. THWN: Thermoplastic Heat and Water-resistant Nylon-coated, type of wire insulation.

J. RHH-RWH: Rubber insulation and heat resistant, type of wire insulation.

PART 2. PRODUCTS

2.1 BASIC CORROSION MONITORING SYSTEM

A. Wires

1. Conform to applicable requirements of NEMA WC 70.

2. Joint Bond:

   a. General:
      
      1) Stranded copper wire with 600-volt HMWPE insulation. Supply joint bonds complete with formed copper sleeve on each end of wire.

   b. DIP:
      
      1) Wire size for bonding joints shall be as follows:

      a) Main Size  
      b) Larger than 36 inches  
      c) 16 inches to 36 inches  
      d) 12 inches to small

      2) Steel Pipe:

      1) Push-On, Mechanical, or Flanged Joints:

      a) 18-inches long  

      2) Flexible Coupling Joints:

      a) 24-inches long

3. Anode Header Cable: single-conductor, #8 AWG stranded copper wire with 600-volt HMWPE insulation.
4. Insulation Colors:
   a. Galvanic Anodes: red
   b. Pipeline Test Wires: black (new pipeline) and white (existing pipeline)
   c. Reference Electrodes: blue
   d. Insulated Joints: as shown

B. Cathodic Protection Test Station

1. Flush Mounted:
   a. All test stations shall be flush mounted type unless otherwise shown on project drawings. The test box shall pass US DOT H-20 roadway load test.

2. Raised Test Station:
   a. When test station is out of the road, use a green riser protected by bollards. Cathodic protection monitoring stations shall be a non-metallic post-type station mounted on a non-metallic conduit post, Cott Big Fink® or equal, 5 terminals and 3 terminals.

   b. The test station shall be constructed as follows:
      1) Terminal Board: Polycarbonate Lexan plastic.
      2) Terminal Posts: Nickel-plated marine brass (5 terminal)
      3) Conduit Post: Green, 3-inch diameter UV stabilized polyethylene.

3. Test Station Wires:
   a. Stranded conductor, #10 AWG stranded copper with 600-volt rated THWN insulation. Wires shall be color coded per Section 2.01 A.4.b. of this document.

C. Buried Reference Electrodes

Prepackaged Copper-Copper Sulfate Reference Electrodes:

1. Material: permanent type, copper-copper sulfate reference electrode suitable for direct burial with a minimum design life of 30 years. Electrode shall be prepackaged in a cloth bag containing a low resistivity backfill.

2. Wire: #14 AWG stranded copper wire with blue, 600-volt HMWPE or RHH-RWH insulation. Wire shall be attached to electrode and insulated with manufacturer’s standard connection. Connection shall be stronger than the wire. No splicing of the reference electrode lead wire shall be permitted under any circumstances.

3. Acceptable Manufacturers:
   a. Borin Manufacturing; model SRE-007-CUY.
   b. Electrochemical Devices, Inc.; model UL50-CUG-CW.
   c. GMC Electrical, Inc.; model CU-1-UGPC.
D. Thermite Weld Materials

1. General:
   a. Thermite wire sleeves, welders, and weld cartridges according to manufacturer’s recommendations for each wire size, pipe or fitting size, and material.
   b. Welding materials and equipment shall be the product of a single manufacturer. Interchanging materials of different manufacturers will not be acceptable.

2. Molds: graphite. Ceramic “One-Shot” molds are not acceptable.

3. Cartridges:
   a. General:
      1) Maximum cartridge size as recommended by manufacturer
   b. DIP:
      1) Cast-iron thermite-weld cartridges for cast and ductile iron pipe and fittings.
   c. Steel Pipe:
      1) Carbon steel thermite weld cartridges for steel pipe and fittings.

4. Welding Materials Manufacturers:
   a. Erico Products Inc. (Cadweld), Cleveland, OH.
   b. Continental Industries, Inc. (Thermo-Weld), Tulsa, OK.

5. Thermite Weld Caps:
   a. Prefabricated weld cap with coating and suitable primer.
   b. Handy Cap II with Royston Primer 747, as manufactured by Royston Laboratories, Inc.
   c. Equivalent approved by HRSD.

E. AC Ground Mat

1. Zinc ribbon anodes shall be 1/2-inch x 9/16-inch in accordance with the specific project requirements.

2. The anode shall be continuously extruded over a steel wire core of 0.13-inch centrally located in the zinc alloy.

3. The zinc alloy shall meet the requirements of ASTM B418, Type II.

F. Ancillary Materials

1. Compression Connectors:
a. For in-line, tap, and multi splice compression connectors furnish “C” taps made of conductive wrought copper, sized to fit wires being spliced.

b. Manufacturer and Product: Burndy; type YC, or equivalent.

2. Ring Terminal Wire Connectors: one-piece, tin-plated crimp-on lug connector as manufactured by Burndy Co., Thomas and Betts, or equivalent.

3. Splicing Tape: linerless rubber high-voltage splicing tape suitable for moist and wet environments; Scotch 23 rubber splicing tape and Scotch 33+ super vinyl electrical tape, as manufactured by 3M Products, or equivalent.

4. Electrical Coating Compound: the electrical coating compound shall be a brush applied material formulated for sealing vinyl tape. The electrical coating compound shall be Scotchkote Electrical Coating as manufactured by the 3M Company, or equal.

5. Shunts: 0.01-ohm shunt. Test station shunts shall be constructed to fit the terminal posts for the specified test station. The resistance shall be 0.1-ohm with a current capacity of 2-amperes. The shunt shall be as manufactured by Cott Manufacturing Company Model “Yellow” or equivalent.

6. Earth Fill: native soil free of roots and other organic matter, ashes, cinders, trash, debris, and rocks conforming to the project specification for final backfill.

G. Concrete


2. Mixing: in a clean metal container, mix entire package of dry materials by hand or machine. Following manufacturer’s instructions, add clean water in sufficient quantity to produce a slump of 2 to 3 inches.

H. Insulating Joints

1. Flange Insulating Kits:

   a. General:

      1) Provide standard flange diameter bolt hole sizes.

      2) Gaskets: full-face type E, G-10 retainer with a quad ring elastomeric sealing element. Sealing element shall be retained in a groove within retainer portion of gasket.

      3) Insulating Sleeves: full-length fiberglass reinforced epoxy (NEMA G-10 grade).

      4) Insulating Washers: fiberglass reinforced epoxy (NEMA G-10 grade).

      5) Steel Washers: plated, hot-rolled steel, 1/8-inch thick.

         a) Provide 2 washers per bolt for flange diameters equal to or less than 36-inch diameter.

         b) Provide 4 washers per bolt for flange diameters larger than 36-inch diameter.
6) Manufacturers:
   a) Pipeline Seal and Insulator, Inc. (PSI), Houston, TX.
   b) Advance Products and Systems, Lafayette, LA.
   c) Equivalent approved by HRSD.

b. DIP:
   1) Fasteners: in accordance with AWWA C110, for ductile iron pipe. Minimum bolt length shall be the sum of the mating flange maximum thicknesses, sealing gasket, insulating and steel washer thickness, and depth of the nut plus 1/8-inch minimum before torqueing. Since insulating sleeves may not fit over unthreaded portions of fasteners, bolts shall be cut thread full body or threaded rod as required to meet the inside diameter dimensions of the insulating sleeves specified herein.

c. Steel Pipe:
   1) Fasteners: in accordance with AWWA C-208-Dimensions for Fabricated Steel Water Pipe Fittings. Minimum bolt length shall be the sum of the mating flange maximum thicknesses, sealing gasket, insulating and steel washer thickness, and depth of the nut plus 1/8-inch minimum before torqueing. Since insulating sleeves may not fit over unthreaded portions of fasteners, bolts shall be cut thread full body or threaded rod as required to meet the inside diameter dimensions of the insulating sleeves specified herein.

2. The insulating corporation valves (stops) shall consist of a brass fitting with a nylon insulator. The insulated corporation ball valve shall be manufactured by Ford Meter Box Company. The corporation valve shall be model FB600 and the insulator adaptor shall be as follows:
   a. 3/4-inch service: SI-C04-33-AWT
   b. 1-inch service: SI-C04-44-AWT
   c. 1-1/2-inch service: SI-C04-66-AWT
   d. 2-inch service: SI-C04-77-AWT

3. Insulating Unions: o-ring sealed with molded and bonded insulating bushing to union body. Unions shall be manufactured by Central Plastics Co., Shawnee, OK, or equivalent.

2.2 GALVANIC ANODE CATHODIC PROTECTION SYSTEM

A. Galvanic Anodes

1. Magnesium Anodes:
   a. Composition: high potential magnesium, ASTM B843. The composition of the high potential anode shall be as follows:
      1) Aluminum 0.010% Maximum
      2) Manganese 0.50 to 1.30%
### Copper
0.02% Maximum

### Nickel
0.001% Maximum

### Zinc
0.05% Maximum Iron 0.03% Maximum

### Silicon
0.05% Maximum

### Other
0.05% each

### Magnesium
Remainder

#### b. Open circuit potential and electrochemical capacity:

1) **Open Circuit Potential:** negative 1.70-volts or more negative to a copper-copper sulfate reference electrode.

2) **Electrochemical Capacity:** 490-ampere-hours per pound at 50% efficiency, minimum.

3) As determined by laboratory testing using ASTM G97.

#### c. Dimensions: Ingot dimensions shall be 5.5-inch x 19.875-inch, type 32D5. Final dimensions of the backfill and anode shall be 8-inch x 28-inch.

#### d. Weight: bare ingot weight shall be 17-pounds. Final weight of the anode and backfill shall be 45-pounds.

### B. Backfill

1. **Composition:**

   a. Ground Hydrated Gypsum 75%
   
   b. Powdered Wyoming Bentonite 20%
   
   c. Anhydrous Sodium Sulfate 5%

2. **Grain Size:** 100% passing through a 20-mesh screen and 50% retained by a 100-mesh screen.

3. **Mixture:** thoroughly mixed and firmly packaged around galvanic anode within cloth bag by means of adequate vibration.

4. **Quantity of backfill shall be sufficient to cover surfaces of anode to a depth of 1-inch.**
PART 3. EXECUTION

3.1 GENERAL

A. Construct pipe bonding system, test stations, electrical isolation and galvanic anode cathodic protection system on buried steel, ductile iron and cast iron, and appurtenances.

B. Conform to NFPA 70.

C. CPS shall observe installation of, or inspect following installation, all equipment required by this section. CPS to provide written certification of successful installation.

3.2 BASIC CORROSION MONITORING SYSTEM

A. Pipe Joint Bonding:

1. General:
   a. Electrically bond all pipe joints, including vault and manhole piping and fittings, and including restrained joints, except joints specified to be threaded, welded, or insulated.
   b. Number of Bonds per Joint:
      1) Install 2 joint bond wire assemblies at each joint that requires bonding, as shown on project details.
   c. Use thermite weld process for electrical connection of wires to pipe and fittings.
      1) When the weld has cooled, remove the weld slag and test the weldment for strength by striking a sharp blow with a 2-pound hammer while pulling firmly on the wire. Re-weld unsound welds and retest weldments. Thoroughly clean mold and mold covers after completion of each weld to assure that no slag will penetrate the next weld.
   d. After soundness of the weld has been verified, thoroughly clean with a stiff wire brush and coat.
      1) Thermite welds to ductile iron and steel pipe and fittings, steel bonding plates on ductile iron and steel pipe, and steel casings shall be coated with a plastic cap filled with elastomeric material. The elastomeric cap shall extend on all 4 sides beyond the cleaned area. Apply primer over the entire weld area and over the entire area where the elastomeric cap will be placed. Push the dome of the prefabricated cap containing elastomeric material firmly into weld area. Lift the wire away from the pipe and apply the elastomeric material completely around and underneath the wire. Push the wire back down on the pipe. Follow all manufacturers’ instructions for installing prefabricated caps. For coated pipe and fittings, repair any and all external coatings that are removed or damaged during the thermite welding.
   e. Test each bonded joint for continuity.
   f. Bronze wedges are not an acceptable method of achieving electrical continuity.
2. **DIP:**
   
   a. Thermite welds to ductile pipe shall be coated with a minimum of 10-mils of a brush-applied mastic. The mastic shall cover the entire area of the weld and the steel bonding plate. The mastic shall be allowed to completely dry before fully embedding within concrete mortar at the pipe joint. Follow all manufacturers’ instructions for applying mastic coating.

3. **Steel Pipes:**
   
   a. All the bonding cables should be installed at bonding plate on the pipeline.

B. **Wire Insulation Repair**

   a. Repair splices or damage to wire insulation by spirally wrapping (50% overlay, minimum) with 2 coats of splicing tape and 2 layers of vinyl electrical tape. Make wire splices with suitable sized compression connectors or mechanically secure and solder with rosin cored 50/50 solder. Splices shall be approved by Engineer.

C. **Test Station Installation**

   1. CPS to determine location of test stations based on actual site conditions and as shown on project plans.

   2. Attach test wires to pipe via thermite weld connections. Cover with coating material as specified.

   3. Test wires connected to foreign-owned pipelines shall be approved in writing by the operator of the pipeline. Wires to foreign-owned pipelines will be attached by pipeline owner. Coordinate this work with owner of foreign pipeline before pipe is excavated.

   4. Locate flush mounted test stations to side of street, behind curb.

   5. Install all flush mounted test stations in a 12-inch x 12-inch x 3-inch deep reinforced concrete pad in unpaved areas.

   6. Locate post mounted test stations as dictated by field conditions and as approved by the Engineer.

   7. **Reference Electrode Installation:**

      a. Place reference electrode within pipeline trench excavation 6-inches from centerline of pipe in a vertical or horizontal position. Install reference electrode within 12-inches of foreign pipelines or as directed by Engineer, between foreign and owner’s pipeline.

      b. Backfill reference electrodes with native trench material. Terminate wires in test stations.

      c. Bury test and reference electrode wires a minimum of 36-inches below finished grade.

      d. Make wire connections to test station terminals with crimp-on spade lug terminals, except where solid wire is specified or terminal strips with tubular clamps are used.

   8. **Wire Labels:**

      a. Install on conductors in boxes.

      b. Materials shall be suitable for permanent identification.
c. Plastic, paper, or cloth markers will not be permitted.

d. Position markers in boxes so they do not interfere with operation and maintenance.

e. Each pipe test wire shall include pipe diameter and pipe type, reference electrode, casing, or galvanic anode, as applicable.

D. Concrete

1. Concrete shall be Class B as specified.

2. Reinforcing shall be as specified.

E. Insulated Joints

1. Install insulated joints to electrically isolated pipeline from other structures. Locate insulated joints at connections to existing metallic pipe, where cathodically protected pipe connects to pipe not intended to have cathodic protection, and where shown. Install a 4 wire test station at each buried insulated joint as shown on the project drawings.

2. Align and install insulating joints according to manufacturer’s recommendations to avoid damaging insulating materials. Torque all flange isolation kits to the manufacturer recommended torque ratings, careful not to over torque the bolts.

3. Before backfilling, the Contractor shall test each insulator for electrical insulation. If the insulator is not properly isolated, the Contractor shall, at his expense, repair or replace all defective components. The Contractor shall test the repaired insulator. This process will continue until the insulator is tested to be properly isolated. Insulation that passes for effective isolation during the pre-backfill test, but does not render positive isolation results during the acceptance testing must be repaired by the Contractor at no additional cost to the Owner. The Contractor shall provide the Engineer a minimum notice of 5 business days prior to the conducting the testing of the isolation.

F. Insulated Joint Testing:

1. Test each insulation joint after assembly CPS shall monitor the tests. Contractor shall replace damaged or defective insulation parts at no cost to the Owner.

2. Correct defects identified during testing.

3. Provide Engineer with 5 business days’ notice before beginning tests.

Acceptance criteria are as follows:

a. High Frequency Isolation Tester: "Acceptable", "Satisfactory" or other similar direct meter reading, and

b. Electrical Potential: static potential difference across insulator of no less than 0.1 volt, and

c. Electrical Potential/Applied Current: a positive potential shift on the side of the insulator where current is applied, and a negative potential shift on the side of the insulator opposite of where current is applied.
3.3 GALVANIC ANODE CATHODIC PROTECTION SYSTEM

Galvanic Anode Installation:

A. Install galvanic anodes at locations as shown on the project drawings.

B. Alternate anode placement on opposite sides of pipe.

C. Provide minimum anode spacing of 2-feet from other unprotected pipelines.

D. Thoroughly compact earth-fill around each anode to a point 1-foot above anode. Stop backfill below grade to allow for placing of topsoil, when required.

E. Bury anode wires a minimum of 24-inches below finish grade.

3.4 FIELD TESTING

A. General:

1. Provide CPS to visit site throughout installation of the basic corrosion monitoring system including, pipe joint bonds, insulating flanges and couplings, test stations, reference electrodes, and other system components. CPS shall be responsible for certifying compliance with these specifications, and for observation and testing services. Certification shall be submitted to the Engineer and Owner for the project record.

2. The CPS shall visit the site during the installation of the galvanic anode system and shall be responsible for certifying compliance with these specifications and the design provided. Certification shall be submitted to the Owner and Engineer as part of the project record.

3. Energizing and Testing: provide Engineer with 5 working-day notices before beginning tests. After installation of the cathodic protection system is complete, the CPS shall connect anodes to pipe in test stations, where applicable, and make sufficient tests to ensure proper installation of cathodic protection system. Upon completion of such tests, the CPS who conducted the tests shall tabulate and report the data recorded. In addition to the field data tabulations. CPS shall include in his report recommendations for system maintenance and monitoring.

4. Electrical Continuity Tests

a. Provide necessary equipment and materials and make electrical connections to pipe as required to test continuity of bonded joints.

b. Conduct continuity test on buried joints that are required to be bonded. Test electrical continuity of joint bonds after bonds are installed but before backfilling of pipe.

c. Have CPS monitor tests of bonded joints.

d. Test electrical continuity of completed joint bonds using a digital low resistance ohmmeter.

e. Digital Low Resistance Ohmmeter Method:

   1) Provide the following equipment and materials:

   a) Digital low resistance ohmmeter.
b) 1 set of duplex helical current and potential hand spikes, cable length as required

c) 1 calibration shunt rated at 0.001-ohms, 100-amperes.

5. Test Procedure: measure resistance of joint bonds with low resistance ohmmeter in accordance with manufacturer’s written instructions. Use helical hand spikes to contact pipe on each side of joint, without touching thermite weld or bond. Clean contact area to bright metal by filing or grinding and without surface rusting or oxidation. Record measured joint bond resistance on test form described herein. Repair damaged pipe coating.

B. Joint Bond Acceptance:

1. DIP:
   a. Joint Bond Resistance: the maximum acceptable span resistance shall be 115% or less of the summation of the following:
      
      1) Number of pipe joints multiplied by the theoretical resistance of a joint bond.
      2) Number of pipe segments multiplied by the resistance per pipe segment. Replace joint bonds that exceed the allowable resistance. Retest replacement joint bonds for compliance with bond resistance.
   b. Repair any defective joint bonds discovered during energizing and testing. All repairs for defective joint bonds shall be completed at no cost to the Owner.
      
      1) Record Tests of Each Bonded Pipeline.
      2) Description and location of pipeline tested.
      3) Starting location and direction of test.
      4) Date of test.
      5) Joint type.
      6) Measured joint bond resistance (digital low resistance ohmmeter method only).

C. Insulated Joint Testing:

1. DIP:
   a. Test each insulation joint after assembly. CPS shall monitor the tests. Contractor shall replace damaged or defective insulation parts at no cost to the Owner.
   b. Correct defects identified during testing.
   c. Provide Engineer with 5 business days advance notice before beginning tests.
   d. Acceptance criteria are as follows:
      
      1) High frequency isolation tester: "Acceptable", "Satisfactory" or other similar direct meter reading, and
2) Electrical potential: Static potential difference across insulator of no less than 0.1 volt, and

3) Electrical potential/applied current: A positive potential shift on the side of the insulator where current is applied, and a negative potential shift on the side of the insulator opposite of where current is applied.

D. Test station wiring acceptance criteria shall be as follows:

1. Test wires attached to ductile iron and steel piping and/or portable copper/copper sulfate reference electrode. Adjacent test wires on piping shall also have identical potential values.

2. Test wires attached to concrete piping shall have potentials between -0.20 and -0.50 volts to a portable copper/copper sulfate reference electrode. Adjacent test wires on piping shall also have identical potential values.

3. Magnesium anode header cables shall have a potential between -1.55 and -1.65 volts to a portable copper/copper sulfate reference electrode. Both ends of the magnesium anode header cable shall also have identical potential values.

4. Permanent copper/copper sulfate reference electrodes shall have a potential between -0.05 and +0.05 volts to a portable copper/copper sulfate reference electrode.

3.5 AS-BUILT DATA

A. Documentation of the location, class, type, and all additional pertinent asset data shall be integrated into project as-built records submitted to Owner.

3.6 CLEAN-UP

A. The Contractor shall be responsible for clean-up and removal of all debris, extra material, and equipment utilized for installation of the corrosion control/corrosion monitoring system.

END OF SECTION
Section 41 – VDEQ Virginia Clean Water Revolving Loan Fund (VCWRLF)

A. Introduction – HRSD has previously and will continue to apply for Virginia Clean Water Revolving Loan Funds (VCWRLF) for qualifying Capital Improvement Projects (CIP). The VCWRLF is a self perpetuating loan fund which provides a low interest financing option to Virginia cities, towns and wastewater authorities for the upgrade, expansion, extension, replacement, repair, rehabilitation, and/or additions to public wastewater collection and treatment facilities. VCWRLF projects must adhere to specific requirements that HRSD, the FIRMs, and the Contractors are collectively responsible for generating and providing documentation to be in full compliance with VDEQ.

B. Attachments – the following referenced guidance documents are attached to this section of the standards.

1. Initial Meeting Review of VCWRLF Program Requirements & Procedures
2. Map to Loan Closing and Closeout Wastewater Projects

C. Additional Resources – the following hyperlink is to VDEQ webpage where additional information related to the VCWRLF is posted.

https://www.deq.virginia.gov/Programs/Water/CleanWaterFinancingAssistance/Wastewater.aspx

End of Section
Initial Meeting Review of
VCWRLF Program Requirements & Procedures

**General Procedures:** The letter you received from DEQ Clean Water Financing and Assistance Program Manager is the Loan Authorization from the agency provided so that you may proceed with your project(s) with the certainty of a funding commitment. DEQ staff will work with you to complete the program requirements so that you may advertise for construction bids. Upon the receipt of construction bid(s) and the development and approval of a final loan budget based on as-bid construction and contractual engineering costs, the loan will be closed and you may begin requesting monthly reimbursements for 100% of the eligible costs incurred.

There are a number of requirements which are applicable to projects funded through the Virginia Clean Water Revolving Loan Fund (VCWRLF) Program. It is the intent of the Department of Environmental Quality (DEQ) to ensure compliance with all of these requirements by our loan recipients through the most expeditious, streamlined, and least burdensome method. However, in order for this goal to be achieved, it is important that loan recipients be fully cognizant of these requirements and that they follow through in meeting these requirements in a thorough and timely manner.

The purpose of this overview is to provide a very brief summary of the program requirements as they relate to our loan recipients so that they are fully aware of them and can act accordingly. This initial meeting is not intended to explain all of the details of meeting these requirements, as that information is provided in the **Procedural Guidelines** on our website. It is imperative that the loan recipient read and become familiar with those Guidelines.

**Professional Services Procurement:** All goods and services for which the loan recipient will be requesting reimbursement must be procured in accordance with the procedures outlined in the Virginia Public Procurement Act, regardless of population size.

Documentation must be submitted to DEQ as either:

a) A letter stating that the Virginia Public Procurement Act was followed in the procurement or 

b) Documentation of Evidence of RFP or RFQ advertisement, Evaluation criteria used, Ranking of respondents, Statement detailing final selection, Copy of executed contract.

**Preliminary Engineering Report (PER):** For wastewater projects, the PER in addition to the evaluation of alternatives shall include both an environmental assessment and a cost effective analysis. This will need to be submitted to DEQ for approval.

**Categorical Exclusion or Environmental Assessment:** For wastewater projects, an environmental review must be conducted as part of the Preliminary Engineering Report. There are three types of environmental reviews: Categorical Exclusion (CE), Environmental Assessment (EA) and Environmental Impact Statement (EIS). These are based on the potential for significant environmental impacts and will be discussed during the initial meeting. The result of the environmental review will need to be submitted to DEQ for approval.
Plan and Specifications: Final plans and bid ready specifications must be submitted to DEQ for review and approval. The appropriate set of contract inserts must be included in the specifications verbatim. The Bid Advertisement must discuss and highlight the requirements of VCWRLF. A completed plan and specifications checklist, certificate to construct (for wastewater projects), and a cost estimate must be provided with this submittal.

Environmental Permits: All required environmental permits must be in place prior to the initiation of construction. As permits are obtained, please submit copies to DEQ.

Construction Contract Procurement: All goods and services for which the loan recipient will be requesting reimbursement must be procured in accordance with the procedures outlined in the Virginia Public Procurement Act, regardless of population size. Once the loan recipient has completed the bidding process and selected the contractor for the project, they must submit a bid package to DEQ for review. The bid package must contain the following:

a) evidence of bid advertisement
b) the bid tabulation, bid form, and bid bond
c) documentation regarding contractor selection
d) documentation verifying solicitation of MBE/WBE firms and the result
e) signed American Iron and Steel Certification Statement (for wastewater projects)
f) Confirmation of correct Wage Determination (for wastewater projects)

Loan Closing: Once all bid documentation, signed task orders, payment bond and performance bond documentation have been received, a date with VRA will be scheduled to close the loan. An initial disbursement request will be needed to close the loan.

Disbursements: Once the loan has closed, requests for disbursements may be submitted. It is recommended that disbursements requests be submitted at least quarterly, however monthly requests are highly encouraged. With each request for disbursement, please submit any change orders that have been executed, along with a discussion for the eligible items/costs for CWFAP staff review.

Project Schedule: A project schedule is also included in the loan agreement. From the time of the initial meeting through loan close out, a Quarterly Project Status (QPS) Report form should be filled out and emailed to the Project Manager within 15 days of the end of each quarter documenting any schedule changes and providing a project update. This form will be provided. Minutes from regularly scheduled progress meetings may be submitted to the Project Manager in lieu of the QPS reports. The Project Manager should be kept updated on any schedule or cost changes throughout the project.

Site Visits: To gauge progress and compliance with approved plans and specifications, site visits will take place at various times throughout the project construction. The DEQ Project Manager will coordinate these visits with the loan recipient. In addition, the DEQ Project Manager should be invited to the pre-bid meeting, pre-construction meeting, and any routine progress meetings. A copy of the Notice to Proceed should be provided to the DEQ Project Manager.
**Women and Minority Business Enterprises (WBE/MBE):** The loan recipient must evaluate the low bidder's good faith efforts regarding MBE/WBE solicitation prior to contract award. All MBE/WBE solicitation and recruitment documentation must be submitted to CWFAP along with the bid package. The contract should not be awarded until CWFAP has approved the bid package. The loan recipient shall also obtain copies of the VCWRLF MBE/WBE utilization reporting form identifying the selection of minority and female-owned businesses to be utilized during construction of the facility. The contractor and all subcontractors will report their utilization of MBE/WBE firms to the loan recipient on a quarterly basis during the construction period. The loan recipient must compile these MBE/WBE utilization reports and submit on a quarterly basis to CWFAP.

**Davis Bacon (DB) (for wastewater projects only):** The contractor and its subcontractors shall comply with provisions of the Davis-Bacon Act and Related Acts. All laborers and mechanics employed by the contractor or subcontractors shall be paid wages at rates not less than those in the applicable wage determination for this construction trade and geographic area are required as part of this contract. The wage determination(s) must be posted at the site of the work in a prominent and accessible place. The contractor will also post the Department of Labor poster “Employee Rights under the Davis-Bacon Act” (www.wagehours.dol.gov). The contractor or subcontractor shall insert in any subcontract the applicable wage rates, and a clause requiring the subcontractor include these clauses in any lower tier subcontract. Any class of laborers or mechanics employed under the contract, which is not listed in the wage determination, shall be classified in conformance with the wage decision if possible. Additional classifications shall be requested from the Department of Labor. Upon issuance of an additional classification, the new wage rate including fringe benefits where appropriate shall be paid to all workers performing the work in that classification.

The loan recipient or agent shall:

a) Verify that contractors and subcontractors include covered employees in fringe benefit plans as provided for in the Department of Labor wage determinations
b) Review contractors and subcontractors use of apprentices and trainees programs
c) Ensure all EEO, OSHA, Wage Determination and Additional Classifications, Davis Bacon, and any other required postings are displayed on each work site
d) Certify compliance with Davis Bacon requirements as part of each reimbursement request.
e) Maintain their records of payrolls, payroll reviews, on-site subcontractors, and compliance actions for at least three years after completion of the work

**American Iron and Steel (AIS) (for wastewater projects only):** The loan recipient must document that all iron and steel products which are retained as part of their “project” are American Iron and Steel. Production in the US of the iron or steel products requires that all manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives. It is the responsibility of the loan recipient to obtain and keep on file all required AIS certifications. The contractor must submit to the loan recipient an initial certification and a final certification. The prime contractor must certify that all iron and steel products which are retained as part of the project satisfy AIS requirements except those “waivered” by EPA, or those included as “De Minimis” products including those supplied or installed by their subcontractors.
**Project Inspections:** During construction, the loan recipient must provide for project inspection. Inspections may be carried out by staff of the consulting engineering firm, third party inspection firm, or by qualified internal staff. These inspections will gauge construction progress, quality, and conformance with plans and specifications. Inspections are very valuable in claim resolution, change order negotiation, and ensuring that payments are made for work in place. Inspections should be documented with construction progress reports that can be reviewed by DEQ CWFAP staff during site visits.

**Fiscal Sustainability Plan:** Provisions for repair, replacement, or capacity expansion of existing wastewater treatment and collection facilities must develop a Fiscal Sustainability Plan (FSP) (Loans for new facilities or upgrades not involving repair, replacement, or capacity expansion are not required to develop an FSP).

Impacted loan recipients must develop and implement an FSP that addresses:

- a) an inventory of critical assets that are a part of the treatment works;
- b) an evaluation of the condition and performance of inventoried assets or asset groupings;
- c) a certification that the recipient has evaluated and will be implementing water and energy conservation efforts as part of the plan; and
- d) a plan for maintaining, repairing, and, as necessary, replacing the treatment works including a funding strategy.

The FSP must include all assets (equipment and/or operational components) associated with the loan. After the new FSP is developed or the existing FSP is modified, the loan recipient must submit an FSP Certification to the Project Manager.

**Loan Close Out:** Reimbursements will be held at 95% of the total loan amount to ensure satisfactory completion of the eligible project. A final site visit will be performed once the Certificate of Substantial Completion is received. At this time, the loan recipient must submit a copy of the final change orders/adjustments (if applicable), final AIS certification, final WBE/MBE quarterly report, and FSP to the Project Manager.
Map to Loan Closing and Closeout

Wastewater Projects

In order to receive a VCWRLF Loan, there are several submittal packages that must be reviewed and approved by DEQ CWFAP staff. These documents allow DEQ to review the project’s design, specifications, and develop a final loan budget based on as-bid engineering and construction contractual costs. Upon receipt of all required documents, the loan will be closed and you may begin requesting monthly reimbursements for all \textit{eligible} costs incurred.

\textbf{Required Submittals}

\textbf{Professional Services Procurement:} All professional services that you will be requesting reimbursement for must be procured in accordance with the Virginia Public Procurement Act, regardless of population size. \textbf{Please provide the following to the Project Officer:}

\begin{itemize}
  \item A letter stating that the Virginia Public Procurement Act was followed in the procurement of engineering professional services for the Virginia Clean Water Revolving Loan Fund project. One of the following individuals must sign the letter: Chief Executive (City or Town Manager or County Administrator) or City, County, or Town Attorney. A template will be provided on the DEQ website.
  \item OR
  \begin{itemize}
    \item Evidence of RFP/RFQ advertisement
    \item Evaluation criteria used
    \item Ranking of respondents
    \item Statement detailing final selection
    \item Copy of executed contract/agreement
  \end{itemize}
\end{itemize}

\textbf{Preliminary Engineering Report (PER):}

The PER for your project must be reviewed and approved by DEQ. The PER must address the requirements for the Preliminary Engineering Proposal (PEP) described in the Sewage Collections and Treatment (SCAT) regulations. The PER must identify and select the most cost-effective solution for the project. All alternatives should include an evaluation of water and energy savings, and the use of green technology. \textbf{Please provide the following to the Project Manager:}

\begin{itemize}
  \item Copy of the final PER (one hard copy and one electronic copy)
\end{itemize}
Categorical Exclusion (CE) or Environmental Assessment (EA):

The CE or EA for your project must be reviewed and approved by DEQ. Detailed information for these requirements may be found in Section 7 of the Procedural Guidelines. Please provide the following to the Project Manager:

☐ A letter requesting a Categorical Exclusion based on a qualifying justification. The exclusion request must include a description of the project, a discussion of how the project meets one or more of the exclusion conditions and support documentation.

OR

☐ An Environmental Assessment that must address and consider both the direct and indirect environmental impacts of the selected alternative. Accordingly, both adverse and beneficial impacts need to be identified and considered. Direct impacts are caused by the construction of the treatment works, and indirect impacts are caused by the development made possible by the project. The assessment must also evaluate and discuss the impacts that would result without the project (a take-no-action alternative). The Environmental Assessment, including a project description and site location map, must also be forwarded to all review agencies for review and comment.

Plans and Specifications:

The design and contract documents for your project must be reviewed and approved by DEQ in order for the construction costs to be eligible. It is strongly suggested that this package is submitted and approved by CWFAP staff prior to putting the project out for bid. Please provide the following to the Project Manager:

☐ Copy of the final design plans (one hard copy and one electronic copy)
☐ Specifications to include Loan Contract Inserts and latest Wage Determination
☐ Completed DEQ Plans and Specifications checklist
☐ Proposed Project Bid Advertisement
☐ Cost Estimate
☐ All Required Environmental Permits
☐ Approved Certificate to Construct

Land Acquisition:

If the loan will include funding for the purchase of land, the price paid for the land must be substantiated. Please provide one of the following to the Project Officer:

☐ Basic Administrative Report(s)
☐ Appraisal(s)
**Construction Contract Procurement:**

All goods and services for which you will be requesting reimbursement must be procured in accordance with the Virginia Public Procurement Act, regardless of population size. **Please provide the following to the Project Officer:**

- Evidence of Advertisement
- Bid Form(s) or Bid Proposal(s) from low bidder
- Bid Tabulation(s)
- Bid Bond
- WBE/MBE Solicitation documentation
- Initial American Iron and Steel Certification
- Correct Wage Determination: ten days prior to opening bids, the loan recipient must check the DOL website to ensure their wage determination has not been amended. If it has been amended, the recipient must issue a specification addendum to include the latest wage determination in the specifications.

**Loan Closing:**

Prior to Loan closing, **please provide the following to the Project Officer:**

- Signed Professional Services Task Order(s)
- Awarded/Executed Construction Contract, including payment and performance bonds

**Reimbursements:**

The VCWRLF program is a reimbursement-based program. Once the loan has been closed, you may begin requesting reimbursements based on invoices that have been received. We recommend that reimbursement requests be submitted at least quarterly; however monthly requests are highly encouraged. **For each request for payment, please provide the following to both the Project Officer and Project Manager:**

- Requisition for Reimbursement Letter on locality’s letterhead
- Certificate of the Project Engineer
- Up-to-date Schedule 1
- Invoices to substantiate requested payments
- Change Order(s), including discussion of eligible items/costs (if any have been executed)
Project/Loan Close Out:

Reimbursements will be held at ninety-five percent (95%) of the total Loan amount to ensure satisfactory completion of the eligible project. In addition to submittal of the following documents, a final site inspection will be performed by CWFAP staff. **Please provide the following to the Project Manager:**

- Fiscal Sustainability Plan (FSP). If the cost for work on the FSP is funded by the loan, a copy of the completed FSP document must be submitted to the Project Manager with the certification statement and a completed FSP Checklist. If the cost for work on the FSP is not funded by the loan, only the certification statement should be submitted.
- Certificate of Substantial Completion
- Final change order for quantity adjustments, if applicable
- Final American Iron and Steel Certification
- Final Quarterly WBE/MBE report