Rehabilitation Action Plan

Prepared for Hampton Roads Sanitation District
February 2013
Updated November 2014

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AC	Asbestos Cement
ALD	Acoustic Leak Detection
ARV	Air Release Valve or AV
BEM	Broadband Electromagnetic
BO	Blow Off Valve
BP	Bypass Valve
CA	Condition Assessment
CAP	Condition Assessment Program
CCTV	Closed Circuit Television
CMMS	Computerized Maintenance Management System
CI	Cast Iron
CIP	Capital Improvement Program
CP	Cathodic Protection
CPTS	Cathodic Protection Test Station
DEQ	(Virginia) Department of Environmental Quality
DI	Ductile Iron
EC	Emergency Pump Connection or EPC
EPA	(United States) Environmental Protection Agency
ESVC	Extra Strength Vitrified Clay
FCAR	Final Condition Assessment Report
FM	Force Main
FPR	Flow, Pressure, Rainfall
FSL	Free Swimming Leak Detection
GV	Gate Valve
HDPE	High Density Polyethylene
HRPDC	Hampton Roads Planning District Commission
HRSD	Hampton Roads Sanitation District
I/I	Infiltration/Inflow
ICCP	Impressed Current Cathodic Protection
IFM	Interceptor Force Main
LD	Leak Detector
LF	Linear Feet
MACP	Manhole Assessment and Certification Program
MCC	Motor Control Center
MH	Manhole
ML	Mainline Valve
MOM	Management, Operations and Maintenance
N/A	Not applicable
NACE	National Association of Corrosion Engineers
NASSCO	National Association of Sewer Service Companies
NOAA	National Oceanic & Atmospheric Administration
PACP	Pipeline Assessment and Certification Program
PCAR	Preliminary Condition Assessment Report
PCCP	Prestressed Concrete Cylinder Pipe
PCV	Pressure Control Valve
PE	Polyethylene
PER	Preliminary Engineering Report
PFTs	Peak Flow Thresholds

PLC	Programmable Logic Controller
PM	Preventive Maintenance
PR	Prompt Repair
PRS	Pressure Reducing Station
PS	Pumping Station
PVC	Polyvinyl Chloride
RCP	Reinforced Concrete Pipe
RCCP	Reinforced Concrete Cylinder Pipe
RTS	Regional Technical Standards
RWWMP	Regional Wet Weather Management Plan
SCADA	Supervisory Control and Data Acquisition
SCAT	Sewage Collection and Treatment
SMH	Sewer Manhole
SOC	Special Order by Consent
SP	Steel Pipe
SSES	Sanitary Sewer Evaluation and Survey
SSO	Sanitary Sewer Overflow
SSORS	Sanitary Sewer Overflow Reporting System
STP	Sewage Treatment Plant
TBD	To Be Determined
TDH	Total Dynamic Head
TP	Treatment Plant
TS	CP Test Station or CPTS
UST	Ultrasonic Testing
WO	Work Order
VC	Vitrified Clay
VFD	Variable Frequency Drive

Executive Summary

The Hampton Roads Sanitation District (HRSD) is in the process of satisfying the requirements of a Consent Decree with the United States Environmental Protection Agency (EPA) and a Special Order by Consent (SOC) signed with the Virginia Department of Environmental Quality (DEQ). As part of the Consent Decree and SOC, HRSD submitted a Condition Assessment Plan (CAP) to locate conditions in its collection system which present a "material risk of failure." The approved CAP states that HRSD will submit a Final Condition Assessment Report (FCAR) with an Action Plan by February 12, 2013 and an Action Plan Update by February 12, 2014.

The FCAR reviews the scope of work performed, references the field procedures used and presents the condition assessment results. The output of the FCAR is used to generate the Rehabilitation Action (Rehab) Plan which proposes actions to those assets in the system that present a material risk of failure. Table 1-1 lists major components of this report and where to find them.

This document contains both the FCAR and the Rehab Plan Update and is consistent with the requirements set forth in the CAP and the Sanitary Sewer Evaluation and Survey (SSES) Plan submitted to DEQ as part of the SOC. The Rehab Plan includes proposed improvements to address specific assets which were found to present a material risk of failure. The proposed improvements are grouped into 61 projects which include a scope of repairs, rehabilitation, improvements or replacement, as applicable. Capital cost estimates are also identified for each project.

HRSD expects to spend approximately $183,400,000 (2013 Dollars) over a 10-year period following EPA/DEQ approval of the Rehab Plan to address the specific physical condition defects identified in the HRSD sanitary sewer system during the Condition Assessment Program. This expenditure is in addition to the amount already spent to address condition issues during the Prompt Repair (PR) Program and Capital Improvement Program (CIP).

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Section 1
Introduction

The HRSD sanitary sewer system in southeast Virginia includes approximately 450 miles of pressure sewer mains (and associated valves and appurtenances), approximately 50 miles of gravity sewer mains (and associated manholes, siphons, and vaults), and 81 pumping facilities which include 66 wet well pumping stations and 15 pressure reducing stations (PRS). The HRSD sanitary sewer system receives pumped flow and gravity flow from surrounding communities and transports the wastewater to its thirteen sewage treatment plants (STPs), nine of which are part of the Consent Decree/SOC. Since 2005, HRSD has been working with 13 of the surrounding communities (Localities) in development of a Rehab Plan and, eventually, a Regional Wet Weather Management Program (RWWMP).

As part of the Consent Decree and SOC, HRSD submitted a Condition Assessment Plan (CAP) to locate conditions in its collection system which presented a "material risk of failure." The CAP is consistent with the SSES Plan submitted to DEQ under the SOC. The approved CAP states that HRSD will submit a Final Condition Assessment Report (FCAR) by February 12, 2013 and an update by February 12, 2014. The FCAR reviews the scope of work performed, references the field procedures used and presents the condition assessment results. The output of the FCAR is used to generate the Rehab Plan which proposes actions to address those assets in the system identified as needing rehabilitation or replacement.

1.1 Purpose of the Plan

The purpose of this report is to present a Rehab Plan that will meet the requirements established by the regional SOC and the Consent Decree. The Rehab Plan is written to address assets within the HRSD system that present a material risk of failure. Assets presenting a material risk of failure are listed in the FCAR which summarizes the results of the CAP. Rehabilitation will be considered the repair or replacement of existing sanitary sewer assets to restore or improve the performance of the HRSD sanitary sewer system.

This report contains both the FCAR and Rehab Plan and is consistent with the requirements set forth in the CAP and SSES Plan. Under the Consent Decree/SOC, HRSD is preparing a Regional Wet Weather Management Plan (RWMMP) which includes wet weather capacity-related improvements. There may be instances where an asset requires upgraded capacity, as determined by the RWWMP, and presents a material risk of failure, as determined by the FCAR. Those projects in the Rehab Plan that are also addressed in the RWWMP will be given priority in the RWWMP implementation schedule, which will be the controlling schedule. In the interim, other measures, as warranted, will be employed to address any material risk of failure presented by such projects. The RWWMP implementation schedule is dependent on the results of the HRSD Regionalization Study and subsequent acceptance and implementation.

The Rehab Plan includes proposed improvements to address specific assets which were found to present a material risk of failure. For the purposes of this document, "failure" means conditions resulting in a sanitary sewer overflow, pipe leakage, or interruption of service to HRSD's customers, due to a physical condition defect in the system. The proposed improvements are projects which include a scope of repairs, rehabilitation, improvements or replacement, as applicable. Planning Level capital cost estimates are identified for each project.

1.1.1 Special Order by Consent - Regional Technical Standards

The Special Order by Consent contains the Regional Technical Standards (RTS) which provide guidance and requirements related to analysis of existing data, collection of additional system data, preparation of rehab plans, correction of serious defects requiring prompt attention, development of a hydraulic model and the assessment of the hydraulic performance of the Regional Sanitary Sewer System. Section 7 is titled Rehabilitation Planning and contains factors to be considered in the development of the Rehabilitation Plan. These factors are listed below in italic font with how HRSD considered them during the development of the Rehab Plan.

- *Location, cause and frequency of SSOs*
  - HRSD is preparing the Regional Wet Weather Management Plan to address capacity related sanitary sewer overflows (SSOs).
- *Structural condition of assets*
  - HRSD considered this as one of the primary drivers in the identification of assets to be included in this Plan. A significant portion of the data from the Condition Assessment Program is directly related to structural condition.
- *Hydraulic capacity of existing assets versus capacity needs (level of service requirement)*
  - The hydraulic capacity of existing assets versus capacity needs is being considered during the development of the RWWMP. HRSD's assets comprise the interceptor system making the factors relating to the capacity requirements numerous and complex. The comprehensive nature of the RWWMP provides the appropriate context for resolution of these issues.
- *I/I reduction potential*
  - HRSD is addressing I/I issues in their gravity systems, where they are present. Significant I/I defects are addressed in this Plan.
- *Criticality of the pump station, sewer basin, or sewer*
  - HRSD considered criticality in the prioritization of Rehab Plan projects.
- *Technical feasibility of rehabilitation*
  - HRSD considered the technical feasibility of rehabilitation when developing planning costs for the Rehab Plan Projects. This involved looking at various factors including coordination with other infrastructure, bypassing, access, etc.
- *Durability and useful life of various remedies*
  - HRSD will consider specific rehabilitation remedies during the design of each project as noted in Section 3.7 Rehabilitation Alternatives Evaluation.
- *Economic feasibility of rehabilitation*
  - HRSD considered the economic feasibility of rehabilitation when developing planning costs for the Rehab Plan Projects. Cost estimates included provisions for specific replacement or rehabilitation issues depending on the project. This will also be considered when the actual method of rehabilitation or replacement is determined in the design process.
- *Affordability of the Rehabilitation Plan in relation to the implementation schedule*
  - HRSD will specifically consider affordability of the Rehabilitation Plan and the RWWMP in relation to the implementation schedule during the development of the RWWMP.

1.2 Plan Organization

The HRSD sanitary sewer system consists of five sanitary sewer asset types: pumping stations, pressure reducing stations, gravity systems, force mains, and Supervisory Control and Data Acquisition (SCADA)

systems. For reporting, the FCAR and Rehab Plan are organized by these asset types with pumping stations, pressure reducing stations and SCADA systems being reported together.

The main body of this report consists of the Rehab Plan which presents project scopes, costs and scheduling. The appendices to the Rehab Plan make up the Final Condition Assessment Report. Table 1-1 presents major areas of this document and how they are organized.

Table 1-1. Rehabilitation Action Plan Organization

Major Areas:	Addressing Section:
Rehabilitation Action Plan	Main Report Body
Organization and Summary of the FCAR	Appendix A
Pumping Facility FCAR	Appendix B
Gravity System FCAR	Appendix C
Force Main FCAR	Appendix D
Rehabilitation Performed during CAP	Appendix E

1.3 Rehab Project Identification

Each of the Rehab Plan projects has a project name and number. Rehab project numbers give information on the treatment plant tributary area and identify themselves as part of the Rehab Plan. For example, a Rehab Plan project numbered “AT-R1” is within the Atlantic Treatment Plant (TP) service area (“AT”), is a Rehab Project (“R”) and is numbered sequentially (“1”) according to when the project was developed with respect to the other Rehab Projects. The sequential number does not reflect the project priority or any other project characteristics. Rehab Plan project names give a description of the type of work to be done and an indication of the geographic area in which the work will be performed.

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Section 2

Final Condition Assessment Report Summary

The Final Condition Assessment Report (FCAR) is included as a series of appendices to the Rehab Plan. The FCAR summarizes the condition assessment activities and gives a rehabilitation recommendation for each asset. The rehabilitation recommendation is either "Rehabilitation Required" or "No Rehabilitation Required at this time." "Rehabilitation" in this context could mean a rehabilitation activity (such as cured-in-place pipe liner), replacement or a mixture of both. The specific technical approach to each project will be identified during the design process. Assets receiving a recommendation of "Rehabilitation Required" have an associated addressing activity. The addressing activity gives information on how the asset recommendation will be implemented. The addressing activity field is populated with one of the following four options:

- A Rehab Project Number, which is associated with a Rehab Project.
- "Interim System Improvements", which are the specific projects identified in the Consent Decree and are not part of the Rehab Plan.
- "Rehab during CAP" is assigned when an asset has already been addressed (or work is currently being performed) through the CIP or Prompt Repairs Program. These assets need some type of corrective action but rehabilitation / replacement is underway or has already been performed.
- "N/A" is assigned to assets which do not present material risk of failure and no action is required under the Rehab Plan.

There are assets with a recommendation of "No Rehabilitation Required at this time" but also have an associated Rehab Project Number. These assets did not meet the criteria for a "Rehabilitation Required" recommendation but were nearby or co-located with assets that did meet the criteria. Including these assets in certain Rehab Projects will result in contiguous improvements.

If the addressing activity is "Interim System Improvements", the asset is within the scope of an existing project within the Consent Decree Interim System Improvements. The Interim System Improvements are a separate commitment from the Rehab Plan and will continue to be constructed concurrently with the Rehab Plan.

2.1 Assets Requiring Rehabilitation

Assets requiring rehabilitation are listed within the appendix in various tables as described below.

- Table B-11 Pumping Facility Assets that Present a Material Risk of Failure
- Table C-4 through C-21 Gravity Pipeline Condition Assessment Summary by Treatment Plant Service Area and Manhole Condition Assessment Summary by Treatment Plant Service Area
- Table D-10 Force Mains that Present a Material Risk Of Failure and Table D-6 Force Main Appurtenances Condition Assessment Results

2.1.1 Findings and Conclusions

Summaries of the findings and conclusions for each asset type are presented in the following sections.

2.1.1.1 Pumping Facilities

HRSD developed 16 projects from the condition assessment data for pump stations that were referred for action. From the 16 projects, 13 pump stations will be replaced and 35 will receive specific rehabilitation actions which could include wet well rehabilitation, electrical improvements, reliability upgrades or flooding mitigation improvements.

2.1.1.2 Gravity Main Systems

HRSD identified approximately 70,000 linear feet (LF) of gravity pipe and approximately 300 manholes (MH) for rehabilitation or replacement. In addition to those gravity main assets presenting material risk of failure, HRSD identified contiguous assets comprising 35,000 LF of gravity pipe and 470 manholes to be included with the rehabilitation required assets. The additional gravity main assets are incorporated for reasons including, but not limited to, hydraulic continuity, constructability restrictions, relocation flexibility, etc. The additional manholes are incorporated so that pipeline rehabilitation or replacement includes adjacent manhole rehabilitation or replacement. Gravity pipelines presenting a material risk of failure, along with additional gravity pipelines to be included with the anticipated projects, consist of 105,000 LF which is approximately 40% of HRSD's total gravity pipeline.

2.1.1.3 Force Main Systems

From the CAP and existing information, HRSD identified approximately 63,000 LF of force main (FM) as presenting a material risk of failure for rehabilitation or replacement. HRSD also identified approximately 50 appurtenances and various cathodic protection and aerial crossing assets that will be addressed under the Rehab Plan.

Section 3

Rehabilitation Action Plan Implementation

3.1 Rehabilitation Action Plan

HRSD used condition assessment data to develop improvement projects for the HRSD sanitary sewer system. A total of 61 projects were developed with a total estimated cost of approximately $183,400,000 (2013 Dollars).

3.2 Project Overview

Rehab Projects were developed for each asset class with consideration to nearby HRSD infrastructure, geography, etc. In general, there is a primary asset class for each project. For example, a pump station project may also include the discharge force main or influent gravity main.

The 61 projects will be funded by the HRSD Capital Improvement Program (CIP) or Improvement budget. Table 3-1 presents a summary of the Rehab Plan projects by asset class with a summary and total planning level cost estimate.

Table 3-1. Project Summary

Asset Class	Number of Projects	Assets to be addressed	Estimated Cost*
Pumping Facilities	16	13 PS Replacements 35 PS Improvements	$ 46,000,000†
Gravity Main Systems	17	105,000 LF of pipe 770 manholes	$ 57,000,000†
Force Main Systems	18	63,000 LF of pipe	$ 67,400,000
Appurtenances, Cathodic Protection and Aerial Crossings	10	50+ valves Various cathodic protection and aerial crossing defects	$ 13,000,000
Total Projects	61	Total Cost	$183,400,000

**Planning Level Costs in 2013 Dollars*

†Includes cost for Project Elements identified in Table 3-10.

These costs are planning level estimates and actual completed costs will vary.

3.3 Project Development

In general, HRSD used a standard workflow across asset classes to develop the Rehab Projects. The standard workflow included a review of condition data from the CAP including, but not limited to, the data listed below:

- Pumping Station (PS)/Pressure Reducing Station (PRS) Facility Inspections
- Flooding Analysis

- History available through maintenance records and SSORS
- Gravity Pipeline Assessment and Certification Program (PACP) data
- Gravity Manhole Assessment and Certification Program (MACP) data
- Closed circuit television (CCTV) of gravity infrastructure
- Force Main wall thickness test results
- Pipe samples (coupons)
- Photographs and notes from field inspections
- Laboratory testing of pipe samples
- Structural analysis of various assets

The data were evaluated to determine if assets presented a material risk of failure according to criteria described in the FCAR. Assets presenting a material risk of failure were evaluated with upstream and downstream data (as available) and / or co-located assets to determine a cost effective project scope. Projects and assets were cross-referenced to the existing HRSD CIP to see if there was already a project to address the assets. For those Rehab Projects that may be fulfilled by the completion or partial completion of an existing CIP project, there is a reference to the CIP project number in the Rehab Project description. Assets being addressed by Interim System Improvements (a separate regulatory commitment) are excluded from the Rehab Plan.

The workflow is represented visually by Figure 3-1.

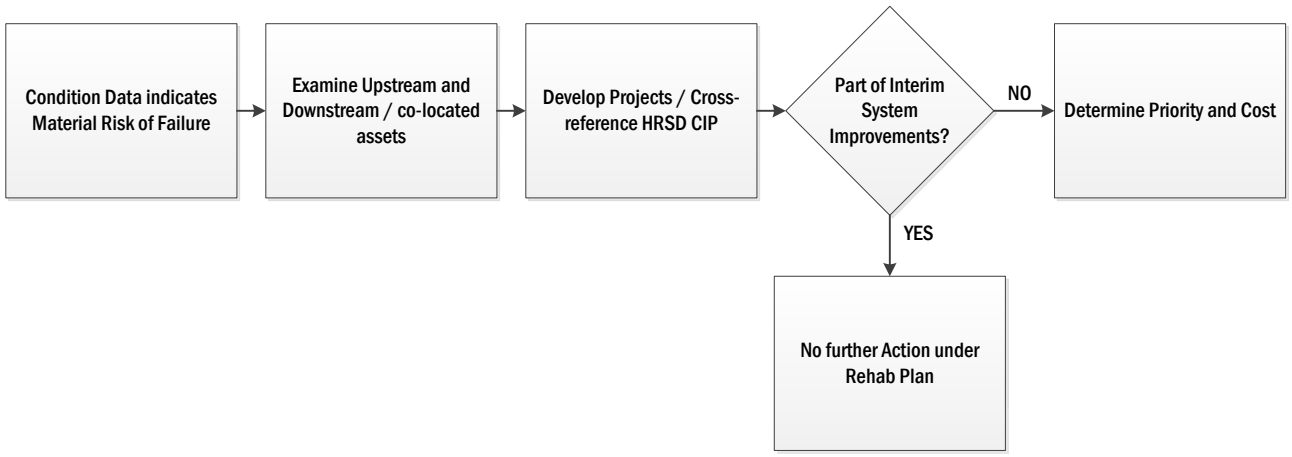

Figure 3.1 Rehab Project Development

3.4 Additional Rehab Projects

HRSD has developed Rehab Projects primarily from the findings of the CAP. Additionally, current CIP projects that address known condition issues, while not specifically investigated during the CAP, have also been included. Many of the condition assessment findings that require action are already scheduled to be addressed within the HRSD CIP. For those assets which require action and are already part of the CIP, HRSD has developed a scope within the Rehab Plan and referenced a CIP project that may fulfill the requirements of the Rehab Plan. Any future shift in scope of the CIP project will be cross-referenced to the required actions documented in the Rehab Plan to ensure that assets presenting a material risk of failure are addressed. In this way, HRSD has integrated the findings of the CAP with the existing CIP. For assets outside of the existing CIP, HRSD has developed new projects.

Consent Decree Modification No. 3 removed several projects from the Interim System Improvements. Five of these projects had broad scopes which had elements that were referred for action in the FCAR as well as elements not requiring action. The project elements requiring action are listed in Table 3-10 with the CIP project that HRSD will use to repair or replace the specific elements/assets. The Table 3-10 specific project elements will be addressed by the Phase 2 deadline.

3.5 Cost Estimation

HRSD developed planning level costs for each of the 61 projects in the Rehab Plan in 2013 dollars unless the project was underway during the time of submittal. Projects currently underway remain in 2012 dollars. For existing CIP projects with cost estimates, HRSD utilized the established cost. For projects without existing cost estimates, HRSD developed a cost model using construction unit prices. The cost model was adjusted for the Hampton Roads area through the use of bid tabs and the local cost index. The use of unit prices required assumptions on the means and methods to address various condition defects as well as asset physical characteristic data such as pipe size, length, depth, etc. Table 3-1 lists a summary of the cost estimates by asset type and Table 3-2 lists cost estimates for each project. These costs are planning level estimates and actual completed costs will vary.

3.6 Schedule

The Rehab Plan projects address specific condition defects within the HRSD sanitary sewer system. HRSD utilized a prioritization process with criteria from the Regional Technical Standards (RTS) Section 7.4 to provide an approximate prioritization. The prioritization was vetted against several criteria including operational knowledge and regional coordination with other infrastructure projects. Further details on prioritization can be found in Section 3.9 Prioritization.

HRSD will complete the Rehab Plan projects in a phased manner. There will be three phases numbered 0 through 2. Phase 0 includes those projects which are already in progress. Phase 1 contains the next highest priority projects and will be completed according to the schedule in Figure 3-2 below. Phase 2 includes projects that have lower priorities and will be completed accordingly. Phase completion dates coincide with the substantial completion of the last project completed within each phase. A schedule for the phases is shown below (Figure 3-2).

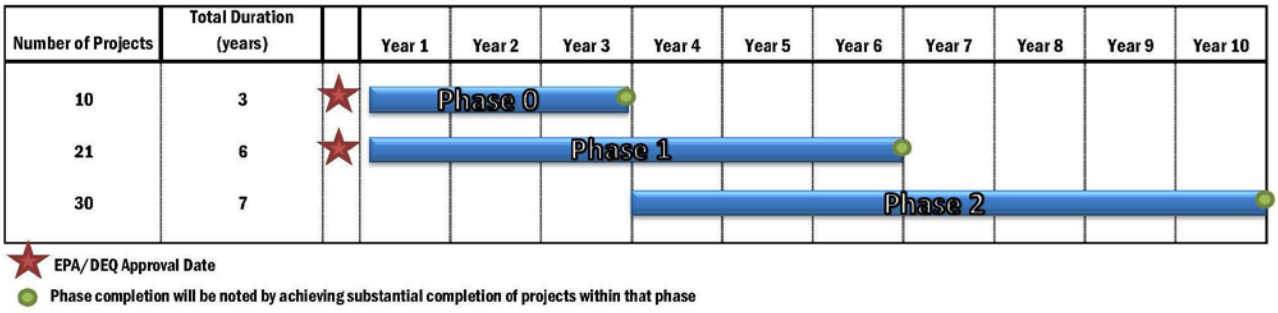

Figure 3-2. Rehabilitation Action Plan Program Schedule

The schedule published in Figure 3-2 will take effect upon EPA/DEQ approval of the Rehab Plan and is subject to change based on the findings of the Regional Wet Weather Management Plan (RWWMP). HRSD may have to adjust the sequence of project completion for reasons including, but not limited to, local coordination with other infrastructure projects, analysis of newly collected data or any capacity constraints identified in the RWWMP. HRSD will notify and seek approval from EPA and DEQ for changes in the Rehab Action Plan schedule resulting from the RWWMP.

3.6.1 Projects Affected by RWWMP

In order to get a preliminary understanding of how the RWWMP may affect the implementation of the Rehab Plan, HRSD cross-referenced Rehab Plan projects with capacity upgrades identified in the Comparative Analysis[1] solution sets. The projects which overlap or are related (such as a storage tank located near a PS for replacement or two pipelines sharing the same corridor) are listed below and may be addressed in the RWWMP as well as the Rehab Plan.

- AT-R1 Washington District Pump Station Area Sanitary Sewer Improvements
- AT-R2 South Norfolk Area Gravity Sewer Improvements
- AT-R3 Shipps Corner Pressure Reducing Station Replacement
- AT-R6 Doziers Corner Pump Station and Washington District Pump Station Flooding Mitigation Improvements
- BH-R3 Hampton Trunk Sewer Extension Division K Gravity Improvements
- BH-R8 Hampton Trunk Sewer Extension Division B – Claremont Force Main Replacement
- GN-R1 Manhole Rehabilitation / Replacement Phase I
- GN-R3 Pump Station Wet Well Rehabilitation Phase I
- GN-R4 North Shore Gravity Sewer Improvements Phase I
- GN-R5 South Shore Gravity Sewer Improvements Phase I
- GN-R12 North Shore Pump Station Wet Well Rehabilitation
- GN-R13 Pump Station Generators
- JR-R1 City Farm Interceptor Force Main Replacement
- NP-R2 Shingle Creek and Hickmans Branch Gravity Sewer Improvements
- NP-R4 Suffolk Interceptor Force Main Replacement
- VIP-R2 Norview Estabrook Division I 18-Inch Force Main Replacement Phase II (Norfolk Fairmont Park Phase IX)
- VIP-R8 Ingleside Road Pump Station Replacement
- VIP-R10 Larchmont Area Pump Station Replacements
- VIP-R11 Lafayette Norview-Estabrook Pump Station Replacements
- VIP-R14 Norview-Estabrook Division I 12-Inch Force Main Replacement
- VIP-R15 Norview-Estabrook Division I 18-Inch Force Main Replacement Phase III
- WB-R1 North Trunk Force Main Part B Replacement
- YR-R1 N. King St Gravity Replacement/Rehabilitation

It should be noted that the Comparative Analysis solution sets were not optimized and solutions in the RWWMP may be different. There are several factors that will change for the RWWMP such as system valve configuration.

If assets in any rehab project are identified for replacement in the RWWMP with greater capacity, HRSD will notify EPA and DEQ and may elect to forego the rehabilitation of those assets in favor of replacement in the RWWMP.

1- *Regionalization of the Hampton Roads sanitary sewer utilities was proposed as a potential cost saving measure for regional rate payers. The Consent Decree was modified to allow HRSD to study regionalization. As part of the Regionalization Study, HRSD performed a Comparative Analysis to assess the costs for a "regionalized" and a "non-regionalized" approach for rehabilitation and wet weather management programs. Assessing the costs of the two approaches required the development of preliminary wet weather solution sets.*

3.7 Rehabilitation Alternatives Evaluation

It is necessary to determine if those assets presenting a material risk of failure can be rehabilitated or if they will require replacement. In addition, the RWWMP may cause Rehab Projects to be removed if the asset needs to be resized to achieve the selected level of service in the RWWMP. HRSD has given consideration to potential rehabilitation and replacement methods and has developed a preliminary method for each project for the purposes of estimating capital costs. The actual method of rehabilitation and/or replacement will be determined at the time of the Preliminary Engineering Report (PER) or during the design phase for each project using the most recent data available.

3.8 Rehab Projects

The Rehab Projects are sorted by project number in Table 3-2 along with project scopes, preliminary cost estimates and Phase numbers. Vicinity maps showing the extents of each pipeline rehab project have been included in Section 4. Projects with spatial information not suitable for map display are included in Tables 3-3 through 3-9. HRSD reserves the right to reallocate project elements amongst projects.

3.9 Prioritization

HRSD maintains a robust Capital Improvement Program (CIP) to identify, prioritize, schedule and implement upgrades and expansions to the regional sanitary sewer system. In order to integrate the Rehab Plan into the CIP, HRSD developed a Rehab Plan project prioritization to sort projects into Phase 1 and 2. Projects that were already in progress were excluded from prioritization and assigned to Phase 0.

Nearly all of the Rehab Projects encompass dozens of assets. Thus, individual assets/defects were considered in relation to the system being addressed. It should be noted that any defects meeting the criteria for a Prompt Repair were referred to (and will continue to be referred to) the Prompt Repair Program. The defects being addressed by the Rehab Plan have not met the Prompt Repair Criteria; thus, they do not pose an *imminent* material risk of failure and are suitable for scheduled repairs.

The project prioritization used criteria identified in Section 7.4 of the RTS. Each project was considered individually for significant factors which would cause the project the have a higher priority. An explanation of how HRSD considered the RTS criteria is presented below. Text from the RTS is shown in italic font.

- *Number and severity of system defects*
  - Force mains - Multiple safety factors less than 2.0 or Lab tests indicate degraded material condition.
  - Gravity assets and pump stations - Specialty inspection indicates degraded material condition.
- *Number of sanitary sewer overflows (SSOs) that could be avoided if the system was rehabilitated* – Multiple condition related SSOs indicating a systematic failure.
- *Operation and maintenance history and costs* – Significant concerns of operational staff
  - Gravity Assets – Frequent cleaning or inspection required due to observed conditions.
  - Pump Stations – Operation and maintenance history shows patterns of issues and frequent occurrence.
- *Quantity of infiltration and inflow (I&I) entering the system and the potential for I&I reduction* – inflow sources are present.
- *Probability and consequence of failure of the sanitary sewer system* – HRSD used the guidelines in Figure 3-3 (at the end of Section 3) to assess probability (likelihood) and consequence of failure.

Projects with high risk scores of 8 or above were added to Phase 1 unless there are mitigation factors in place.

- *Available capacity* –Without an established level of service, HRSD cannot determine available capacity for system components. However, HRSD used the results of the pump station runtime analysis in the Preliminary Condition Assessment Report (PCAR) to determine if any stations had extended dry weather runtimes.

Table 3-9 presents the Rehab Projects in Phases 1 and 2 and details on any significant factors which elevated the project to Phase 1. Comments are also provided when necessary to explain mitigation or other important considerations. The table is sorted by phase.

After the above criteria provided the initial prioritization to the CIP process, HRSD added the Rehab Projects to the CIP. As part of the regular CIP process, HRSD evaluates several additional factors to determine specific project schedules. The additional factors apply the remaining two criteria from the RTS. Those two criteria are listed below:

- *Estimated cost of the proposed rehabilitation* – HRSD evaluates costs by modeling cash flow for the CIP cycle. This includes costs for every project in the CIP. Balancing cash flow can mean shifting project schedules and priorities.
- *Technical complexity of the rehabilitation activities and potential secondary impacts* – To model cash flow, HRSD must know the duration of a project. The duration is a function of several factors including project scope and complexity. Projects may also be front-end or back-end loaded. This adds a great deal of complexity to schedule determination. Secondary impacts are also considered as HRSD must coordinate improvements between the locality systems, interceptor system and the treatment plants so that improvements are made in logical steps

Table 3-2. Rehabilitation Action Plan Projects (Planning Level Estimates)

Project Number	Project Name	Asset Class	Project Description	Estimated Cost	Phase	Figure Reference
AB-R1	Taussig Boulevard Pump Station Instrumentation Improvements	Pump Station	This project is to replace the bubbler panel at Taussig Blvd pump station.	$31,000	2	4-1
AT-R1	Washington District Pump Station Area Sanitary Sewer Improvements	Gravity Main	This project is to rehabilitate and / or replace 4300 LF of gravity pipeline with associated manholes. Pipe diameter is 18 inches. Project extends from MH-SG-162-3950 to SS-PS-131-1. This project will include the permanent abandonment of the inactive Washington District outfall.	$1,299,000	2	4-2

Table 3-2. Rehabilitation Action Plan Projects (Planning Level Estimates)

Project Number	Project Name	Asset Class	Project Description	Estimated Cost	Phase	Figure Reference
AT-R2	South Norfolk Area Gravity Sewer Improvements	Gravity Main	This project is to rehabilitate and / or replace the following gravity sewer segments: - Park Ave Gravity Sewer (along Bainbridge Blvd) - 1500 LF of gravity pipeline with associated manholes is referred for action. Pipe diameters range from 18 to 24 inches. Project extents are from: • MH-SG-149-4897 to MH-SG-149-4932; • MH-SG-149-3764 to MH-SG-149-4057; • MH-SG-149-2846 to MH-SG-149-3567 Manholes MH-SG-153-0 and MH-SG-153-2142 are also included. - Quail Ave Gravity Sewer Influent - 2000 LF of gravity pipeline with associated manholes is referred for action. Pipe diameter is 18 inches. • Project extends from MH-SPS-148-623 to SS-PS-123-1 and from MH-SG-151-6392 to MH-SG-151-4425. • Manholes MH-SG-148-293, MH-SG-148-1000 and MH-SG-148-4035 are also included - State Street Gravity Sewer (Berkeley Trunk Sewer/Pearl Street to State Street) - 2000 LF of gravity pipeline with associated manholes is referred for action. Pipe diameters range from 12 to 30 inches. • Project extends from MH-SG-202-922 to MH-SG-202-0 and from MH-SG-096-486 to SS-PS-127-1. • Point repairs are needed between MH-SG-098-6624 and MH-SG-098-6409 as well as between MH-SG-098-5523 and MH-SG-098-5190. • Additional manholes are referred for action within the scope of this project. See Table 3-3. - Bainbridge Blvd PS Gravity Sewer - 1300 LF of gravity pipeline and 7 manholes are referred for action. Pipe diameter is 12 inches. Project extends are MH-SG-145-0 to MH-SG-145-445 and from MH-SG-145-760 to MH-SG-145-1294. - Steamboat Creek Gravity Sewer - 4300 LF of gravity pipeline and 20 manholes are referred for action. Pipe diameters range from 8 to 10 inches. Project extends from MH-SG-105-2271 to SS-PS-128-1 and from MH-SG-102-1950 to SS-PS-128-1.	$5,096,000	2	4-3- 4-6 Table 3-3

Table 3-2. Rehabilitation Action Plan Projects (Planning Level Estimates)

Project Number	Project Name	Asset Class	Project Description	Estimated Cost	Phase	Figure Reference
AT-R3	Shipps Corner Pressure Reducing Station Replacement	Pump Station	This project is to design and construct the Shipp's Corner Pressure Reducing Station (PRS) replacement in the City of Virginia Beach once the Regional Wet Weather Management Plan is complete. This project includes a new building, pumping station, and emergency generator. The requirements of this project may be fulfilled through existing CIP AT-115-1.	$1,951,000	2	4-7
AT-R4	Great Bridge Interceptor Extension 16-Inch Replacement	Force Main	This project is to replace 5,700 LF of the 16-inch Great Bridge Interceptor Extension force main along Battlefield Blvd in Chesapeake (SF-184). The replacement portion is from the connection to line SF-183 near Mt. Pleasant Rd to the connection at SF-259 near Edna St. Mainline valve AT-1161-2 will be replaced. The requirements of this project may be fulfilled through existing CIP AT-119.	$4,718,000	2	4-8
AT-R5	Battlefield Boulevard/Johnstown Road Valve Replacement	Appurtenance	This project is to rehabilitate and / or replace the 14-inch branch valve (AT1162-1) connecting the City of Chesapeake's 14-inch force main along Johnstown Road. The requirements of this project may be fulfilled through existing CIP AT-127.	$106,000*	0	No figure available.
AT-R6	Doziers Corner Pump Station and Washington District Pump Station Flooding Mitigation Improvements	Pump Station	The project is to install dry pit submersible pumps and raise or otherwise protect electrical equipment at Doziers Corner and Washington District Pump Stations. In addition, all electrical assets such as electrical control panels, generator, disconnects, etc. shall be evaluated for flood protection and corrected as necessary.	$277,000	2	4-9 - 4-10
BH-R1	Boat Harbor Outlet Sewer Improvements	Gravity Main	This project is to rehabilitate and / or replace 4300 LF of gravity pipeline with associated manholes. Pipe diameters range from 48 to 54-inches. Project extends from MH-NG-169-852 to MH-NG-124-5328. Rehabilitation work includes the 25th and 26th street siphons and the associated chambers.	$4,361,000	1	4-11
BH-R2	Jefferson Ave Extension Gravity Improvements	Gravity Main	This project is to rehabilitate and / or replace 4800 LF of gravity pipeline with associated manholes. Pipe diameters range from 27 to 36-inches. Project extends from MH-NG-103-2020 to MH-NG-106-8070 and from MH-NG-108-2800 to MH-NG-108-2340. Manholes MH-NG-108-719 and MH-NG-112-12636 are also included.	$1,992,000	1	4-12
BH-R3	Hampton Trunk Sewer Extension Division K Gravity Improvements	Gravity Main	This project is to rehabilitate and / or replace 3700 LF of gravity pipeline with associated manholes. Pipe diameter is 30-inches. Project extends from MH-NG-160-25773 to NS-PS-225-1. There is also a point repair required between MH-NG-160-26350 and MH-NG-160-26040.	$3,484,000	2	4-13

Table 3-2. Rehabilitation Action Plan Projects (Planning Level Estimates)

Project Number	Project Name	Asset Class	Project Description	Estimated Cost	Phase	Figure Reference
BH-R4	Orcutt Ave and Mercury Blvd Gravity Sewer Improvements	Gravity Main	This project is to rehabilitate and / or replace the following gravity sewer segments: - Orcutt Ave Section A Gravity Sewer - 7200 LF of gravity pipeline with associated manholes is referred for action. Pipe diameters range from 15 to 18-inches. Project extends from MH-NG-051-6116 to MH-NG-127-3791; - Orcutt Ave Section B Gravity Sewer - 3800 LF of gravity pipeline with associated manholes is referred for action. Pipe diameter is 24-inches. Project extends from MH-NG-127-3791 to NS-PS-219. - Mercury Blvd Gravity Sewer - 9400 LF of gravity pipeline with associated manholes is referred for action. Pipe diameters range from 15 to 18-inches. Project extends from MH-NG-057-6293 to MH-NG-127-3791.	$5,740,000	1	4-14
BH-R5	Bloxoms Corner Force Main Replacement	Force Main	This project is to rehabilitate and / or replace NF-090 Bloxoms Corner Force Main. Project extents include 6,100 LF of 8-inch pipe from Bloxoms Corner Pump Station to the gravity discharge at MH-NG-094-1264.	$2,645,000	2	4-15
BH-R6	Hampton Trunk Sewer Extension Division M Replacement	Force Main	This project involves the rehabilitation and / or replacement of the piping and associated pipe fittings within the Washington Street Pump Station and the replacement of line NF-132 from Washington St Pump Station to the connection at NF-170. The NF-132 replacement section is approximately 1,100 LF of 14-inch cast iron pipe. Also included is a portion of line NF-170 from the new NF-132 connection point to the gravity discharge at Eaton St and East Queen St (approximately 220 LF of 27-inch force main).The requirements of this project may be fulfilled through existing CIP BH-121.	$1,746,000*	0	4-16
BH-R7	Bayshore, Copeland Park, and Newmarket Pump Station Electrical Equipment Improvements	Pump Station	This project involves the rehabilitation and / or replacement of the motor control cabinets (MCCs), variable frequency drives (VFDs), and generators at Bayshore, Copeland Park, and Newmarket Pump Stations. The requirements of this project may be fulfilled through existing CIP BH-125.	$1,151,000*	0	4-17 - 4-19
BH-R8	Hampton Trunk Sewer Extension Division B - Claremont Force Main Replacement	Force Main	This project involves the rehabilitation and / or replacement of a portion of line NF-153 which includes approximately 2,900 LF of 34-inch pipe and 930 LF of additional pipe. The extents are from just west of Buxton Avenue to Claremont Avenue Pump Station. This project will also include the rehabilitation of an existing manhole MH-NG-152-13410 and a City of Hampton manhole located approximately 90 feet southwest. The requirements of this project may be fulfilled through existing CIP BH-127.	$4,659,000	1	4-20

Table 3-2. Rehabilitation Action Plan Projects (Planning Level Estimates)

Project Number	Project Name	Asset Class	Project Description	Estimated Cost	Phase	Figure Reference
BH-R9	Ferguson Park Interceptor Force Main-Bridge Span Relocation	Force Main	This project involves the rehabilitation and / or replacement of a portion of line NF-105 which includes approximately 1,300 LF of 10-inch force main from just west of the CSX railroad to the discharge manhole (MH-NG-103-940). This project will also include the rehabilitation and/or replacement of the discharge manhole. The requirements of this project may be fulfilled through existing CIP BH-137.	$1,097,000	1	4-21
BH-R10	Jefferson Avenue Emergency Gravity Repairs	Gravity Main	This project will rehabilitate and / or replace approximately 2,400 LF of 42-inch gravity sewer pipe along Jefferson Avenue from 42nd Street to 33rd Street. The requirements of this project may be fulfilled through existing CIP BH-139.	$2,557,000*	0	4-22
BH-R11	West Avenue and 35th Street Interceptor Force Main Replacement	Force Main	This project will rehabilitate and / or replace approximately 3,800 LF of force main, primarily along West Avenue and 35th Street in the City of Newport News (NF-119, NF-121, and NF-122). Approximately 1,000 feet of the force main is 20-inch, 250 feet is 18-inch, and 2,500 feet is 12-inch pipe. The requirements of this project may be fulfilled through existing CIP BH-140.	$3,481,000	2	4-23
BH-R12	46th Street Diversion Sewer Rehabilitation/ Replacement	Gravity Main	This project will involve the rehabilitation and / or replacement of the following infrastructure based on the 46th Street Diversion Sewer Condition Assessment Report (June 2011). - MH 24 to 33rd St. PS – installation of approx. 1,900 LF of new replacement gravity sewer and 12 MHs - SMH 83 to SMH 24 – rehabilitation of approx. 1,400 LF of ex. gravity, rehabilitation of approx. 9 MHs, and installation of approx. 230 LF of new gravity sewer and 2 MHs - SMH 99 to SMH 83 – rehabilitation of approx. 1,000 LF of ex. gravity, rehabilitation of approx. 7 MHs, and installation of approx. 1,300 LF of new gravity sewer and 5 MHs - 46th St. Connection – one (1) point repair on the ex. 42-inch gravity pipe - 38th St. Connection – rehabilitation of approx. 300 LF of ex. gravity sewer, and installation of approx. 400 LF of new gravity sewer and 3 MHs - 31st St. Connection – installation of approx. 300 LF of new gravity sewer and 1 MH and the rehabilitation of 1 MH - Abandonment of ex. gravity sewer and MHs to be replaced. The requirements of this project may be fulfilled through existing CIP BH-146.	$10,158,000	2	4-24

Table 3-2. Rehabilitation Action Plan Projects (Planning Level Estimates)

Project Number	Project Name	Asset Class	Project Description	Estimated Cost	Phase	Figure Reference
CE-R1	Poplar Hall Davis Corner Trunk 24-Inch Gravity Sewer Improvements	Gravity Main	This project is to rehabilitate and / or replace 1900 LF of gravity pipeline with associated manholes. Pipe diameter is 24-inches. Project extents are from: • MH-SG-113-1543 to SS-PS-115-1; • MH-SG-113-2583 to MH-SG-113-2297; • MH-SG-113-4219 to MH-SG-113-3961	$637,000	2	4-25
CE-R2	Western Trunk Force Main Replacement	Force Main	This project will replace a portion of SF-015, SF-109, and SF-110 Western Trunk Force Main. The project extents will be determined during the design process as additional condition assessment is necessary. The contiguous asbestos cement pipe consists of 4100 LF of 16-inch force main and 8500 LF of 18-inch force main.	$8,134,000	1	4-26
CE-R3	Lynnhaven and Western Trunk FM Chlorine Injection Vault Demolitions	Appurtenance	This project is to remove the obsolete force main access vaults and remove or repair pipe appurtenances as determined during the project. The access vaults are located on SF-017 Lynnhaven Trunk Force Main and SF-014 Western Trunk Force Main. The requirements of this project may be fulfilled through existing CIP CE-100.	$236,000	1	No figure available.
CE-R4	Independence Boulevard Pressure Reducing Station Modifications	Pump Station	This project is to rehabilitate and / or replace the Variable Frequency Drives (VFDs) and all associated equipment, including pumps, generator, motors, valves (internal and external) and yard piping to ensure reliability of Independence Blvd PRS. The requirements of this project may be fulfilled through existing CIP CE-104.	$1,975,000	1	4-27
CE-R5	Central Trunk Interceptor Force Main A & B Main Line Valves	Appurtenance	This project is to add three (3) main line valves to the Central Trunk Interceptor Force Main A & B, SF-119. The requirements of this project may be fulfilled through existing CIP CE-112.	$1,632,000	1	No figure available.
CE-R6	Birchwood Trunk 24”/30” Force Main at Independence Boulevard Replacement Phase II	Force Main	This project will rehabilitate and / or replace approximately 350 LF of 24-inch force main crossing Independence Boulevard just south of Cleveland Street in the City of Virginia Beach. The requirements of this project may be fulfilled through existing CIP CE-113. In the event that Independence Blvd PRS is relocated in Rehab Project number CE-R4, this project may not be necessary.	$914,000	2	4-28

Table 3-2. Rehabilitation Action Plan Projects (Planning Level Estimates)

Project Number	Project Name	Asset Class	Project Description	Estimated Cost	Phase	Figure Reference
GN-R1	Manhole Rehabilitation/ Replacement Phase I	Gravity Main	This project is to rehabilitate and / or replace manholes and siphon chambers (not already included in other Interceptor projects) identified as presenting material risk of failure or significant I/I during condition assessment activities. Manholes have isolated issues with respect to the surrounding system. See Table 3-4 for list of manholes to be addressed. Included siphon chambers are: FLWCTRL-NG-129-4484, FLWCTRL-NG-137-1672, FLWCTRL-NG-137-1673, FLWCTRL-NG-149-980.	$2,458,000	1	Table 3-4
GN-R2	PROJECT FORMERLY IDENTIFED AS GN-R2 – North Shore Siphon Chamber Rehabilitation Phase I was combined into GN-R1 above.					
GN-R3	Pump Station Wet Well Rehabilitation Phase I	Pump Station	This project is to rehabilitate wet wells at Bloxoms Corner PS, Ferebee Ave PS, North Shore Rd PS, Norview Ave PS, Newtown Rd PS, Virginia Beach Blvd PS, Willoughby Ave PS, Fords Colony PS, Washington District PS, Dovercourt Rd PS, and Bainbridge Blvd PS. The requirements of this project may be fulfilled through existing CIP GN-117.	$1,512,000	1	4-29 - 4-38
GN-R4	North Shore Gravity Sewer Improvements Phase I	Gravity Main	This project is to rehabilitate and / or replace the following gravity sewer segments: - Washington Street Area Gravity Sewer - 2000 LF of gravity pipeline with associated manholes is referred for action. Pipe diameters range from 16 to 18 inches. Project extents are from: • MH-NG-082-1868 to MH-NG-082-1110 • MH-NG-078-5500 to MH-NG-082-3034 • MH-NG-078-5500 to MH-NG-082-3034 is included for point repairs due to defects at lateral connections; - Copeland Park Gravity Sewer - 1700 LF of gravity pipeline with associated manholes is referred for action. Pipe diameter is 24-inches. Project extends from MH-NG-109-6314 to MH-NG-109-4656 and from MH-NG-109-121 to NS-PS-209;	$3,512,000	2	4-39 - 4-46

Table 3-2. Rehabilitation Action Plan Projects (Planning Level Estimates)

Project Number	Project Name	Asset Class	Project Description	Estimated Cost	Phase	Figure Reference
GN-R4	North Shore Gravity Sewer Improvements Phase I	Gravity Main	- Seaboard Ln / Bayshore Ln Gravity System - 4000 LF of gravity pipeline with associated manholes is referred for action. Pipe diameter is 15 to 18-inches. Project extends from MH-NG-094-1264 to NS-PS-203. - Williamsburg Pump Station Influent Lines - 60 LF of gravity pipeline with associated manholes is referred for action. Pipe diameter is 24-inches. Project extends from MH-NPS-226-66 to SS-PS-226; - Normandy Lane Pump Station Influent Line - 23 LF of gravity pipeline and one manhole are referred for action. Pipe diameter is 24-inches. Project extends from MH-NG-034-3560 to NS-PS-220; - Hampton Institute Pump Station Influent Line - 60 LF of gravity pipeline and one manhole are referred for action. Pipe diameter is 18-inches. Project extends from Hampton VA Hospital MH to NS-PS-211; - Ferguson Park Pump Station Influent Line - 30 LF of gravity pipeline and one manhole are referred for action. Pipe diameter is 10-inches. Project extends from MH-NPS-210-275 to NS-PS-210; - Morrison Pump Station Influent Line - 11 LF of gravity pipeline and one manhole are referred for action. Pipe diameter is 18-inches. Project extends from MH-NPS-218-770 to NS-PS-218;			

Table 3-2. Rehabilitation Action Plan Projects (Planning Level Estimates)

Project Number	Project Name	Asset Class	Project Description	Estimated Cost	Phase	Figure Reference
GN-R5	South Shore Gravity Sewer Improvements Phase I	Gravity Main	This project is to rehabilitate and / or replace the following gravity sewer segments: - Dovercourt Road Pump Station Gravity Influent Line - 30 LF of gravity pipeline and one manhole are referred for action. Pipe diameter is 24-inches. Project extends from MH-SPS-108-1445 to SS-PS-108-1; - Doziers Corner Influent Line - 10 LF of gravity pipeline with associated manholes is referred for action. Pipe diameter is 16-inches. Project extends from MH-SPS-109-1446 to SS-PS-109-1; - Arctic Ave Pump Station Influent Lines - 90 LF of gravity pipeline with associated manholes is referred for action. Pipe diameters range from 24 to 30-inches. Project extends from MH-PS101-1411 to SS-PS-101-1; - Seay Ave Pump Station Gravity Influent - 80 LF of gravity pipeline with associated manholes is referred for action. Pipe diameter is 12-inches. Project extends from MH-SP-125-1000 to SS-PS-125-1; - Powhatan Ave Area Gravity Sewer - 360 LF of gravity pipeline with associated manholes is referred for action. Pipe diameter is 10-inches. Project extends from MH-SG-044-0 to MH-SG-044-363; - Elmhurst Lane Influent Line - 20 LF of gravity pipeline and one manhole is referred for action. Pipe diameter is 24-inches. Project extends from MH-SPS-144-30 to SS-PS-144-1	$650,000	2	4-47 - 4-52
GN-R6	Arctic Avenue Pump Station and Newtown Road Pump Station Electrical Improvements	Pump Station	This project is to replace the pump controls at Arctic Avenue and Newtown Road pump stations. In order to ensure motor/drive compatibility, replacement of liquid rheostat "Flomatcher" systems with Variable Frequency Drives will require compatible Inverter Duty type motors. The Inverter duty motors shall match speed range and torque characteristics required by the associated driven equipment. Introduction of VFDs require a means of control such as a PLC and possible new instrumentation depending on the desired method of control. System programming to achieve desired control methodology will be required.	$589,000	1	4-53 - 4-54

Table 3-2. Rehabilitation Action Plan Projects (Planning Level Estimates)

Project Number	Project Name	Asset Class	Project Description	Estimated Cost	Phase	Figure Reference
GN-R7	North Shore Operations Unvented High Spot Correction	Appurtenance	This project will involve field verification of unvented high spots using condition assessment techniques. The project will also include air vent installations (number dependent on condition assessment results) The action taken at each unvented high spot will depend on actual field conditions. The requirements of this project may be fulfilled through existing CIP GN-143.	$2,056,000*	0	Figure not available.
GN-R8	Interceptor System Valve Improvements Phase I	Appurtenance	This project is to address 26 valves, 26 ARVs and 1 Leak Detector assessed to be at material risk of failure during the Condition Assessment Program. See Table 3-5.	$3,009,000	2	Table 3-5
GN-R9	South Shore Aerial Crossing Improvements	Force Main / Appurtenance	This project is to repair and / or rehabilitate HRSD's aerial / exposed crossings. See attached project list for details. HRSD may adjust the scope of this project if other projects outside of the Rehabilitation Action Plan address the condition issues. See Table 3-6.	$287,000	2	Table 3-6
GN-R10	Cathodic Protection Systems Improvement Phase I	Cathodic Protection	This project is to repair Force Main Cathodic Protection systems. Included cathodic protection systems require rehabilitation to address specific defects as identified in the Force Main Final Condition Assessment Report. See Table 3-7 for assets to be addressed.	$73,000	2	Table 3-7
GN-R11	Horizontal Valve Replacement Phase III	Appurtenance	This project is to replace known unreliable main line isolation valves within the interceptor system. Valves to be addressed: AT 1182 #2,4,6; AT 1189 #2; AT 1195 #1; AT 1218 #1; AT 8101 #1; AT 8109 #1; AT 8117 #1; AT 8125 #3 NA 5018 #1; NA 5059 #2; NA 5063 #1,2,3; NA 7000 #1; NA 7001 # 1,2,3; NA 7008 #1; NA 7014 #1; NA 7020 #1; NA7024 #3 The requirements of this project may be fulfilled through existing CIP GN-107-3.	$3,327,000	2	No figure available.
GN-R12	North Shore Pump Station Wet Well Rehabilitation	Pump Station	This project involves the rehabilitation of existing wet well influent channels at Ft. Eustis, Greensprings and Lodge Road Pump Stations. The requirements of this project may be fulfilled through existing CIP GN-136.	$2,110,000	1	4-55 - 4-57
GN-R13	Pump Station Generators	Pump Station	This project will install generators or permanent emergency pumps at various interceptor system pump stations. The following stations are included in this project: Bloxom's Corner, Hampton University, Langley Circle, Cedar Lane, Dovercourt Road, Norview Ave, Plume St, Taussig Blvd, Virginia Beach Blvd, Washington District, Willoughby Ave	$5,820,000	1	Figure not available.
JR-R1	City Farm Interceptor Force Main Replacement	Force Main	This project will provide for the rehabilitation and / or replacement of approximately 3,000 LF of 36-inch force main from valve JR1003-2 to main line valve JR1001-3 along line NF-029. The requirements of this project may be fulfilled through existing CIP JR-111.	$2,937,000	1	4-58

Table 3-2. Rehabilitation Action Plan Projects (Planning Level Estimates)

Project Number	Project Name	Asset Class	Project Description	Estimated Cost	Phase	Figure Reference
JR-R2	Huxley to Middle Ground Force Main Extension	Force Main	This project will involve the installation of approx. 2,300 LF of new 36-inch force main from the intersection of Alpine Street and Huxley Place to the proposed Middle Ground-City Center Interconnect force main west of the CSX railroad tracks. This extension will allow for abandonment of the 36-inch pipe from the intersection of Maxwell Lane and Route 60 to the intersection of Huxley Place and Carnegie Drive (approx. 5,500 LF of NF-037 and NF-033 abandoned). The requirements of this project may be fulfilled through existing CIP JR-121.	$2,245,000	1	4-59
NP-R1	Western Branch Sewer System Gravity Improvements	Gravity Main	This project is to rehabilitate and / or replace 5600 LF of gravity pipeline with associated manholes. Pipe diameters range from 15 to 30-inches. Project extends from MH-SG-035-18453 to MH-SG-034-14607 and from MH-SG-033-1782 to MH-SG-035-16720.	$1,792,000	2	4-60
NP-R2	Shingle Creek and Hickmans Branch Gravity Sewer Improvements	Gravity Main	This project is to rehabilitate and / or replace the following gravity sewer segments: - Shingle Creek Gravity Sewer - 7200 LF of gravity pipeline with associated manholes is referred for action. Pipe diameters range from 18 to 24-inches. Project extends from MH-SG-193-14688 to SS-PS-135 (two siphon barrels and the associated chamber are included). - Hickmans Branch Gravity Sewer - 2100 LF of gravity pipeline with associated manholes is referred for action. Pipe diameter is 18-inches. Project extents are from: • MH-SG-193-2640 to MH-SG-193-3285; • MH-SG-193-1629 to MH-SG-193-1919; • MH-SG-193-4361 to MH-SG-193-5550 - Additional manholes are referred for action within the scope of this project due to flooding potential and other defects. See Table 3-8.	$6,890,000	2	4-61 Table 3-8
NP-R3	Deep Creek Interceptor Force Main Replacement	Force Main	This project is to rehabilitate and / or replace a portion of SF-142 Deep Creek Interceptor Force Main. The project extents include 3600 LF of 24-inch pipe along Canal Drive from Deep Creek PRS to Military Hwy.	$2,528,000	1	4-62
NP-R4	Suffolk Interceptor Force Main Section I Main Line Valving Replacement	Appurtenance	This project is to rehabilitate and / or replace the main line valving on the 48-inch Suffolk Interceptor Force Main Section I, line number SF-023. Replacement of two 42 inch main line valves NA1011-3, NA1011-5, remove the check valve, and removal of the four 24-inch branch valves, NA1011-7, NA1011-9, NA1011-11, NA1011-13 and corresponding pipelines is included. The requirements of this project may be fulfilled through existing CIP NP-113.	$1,013,000	1	4-63

Table 3-2. Rehabilitation Action Plan Projects (Planning Level Estimates)

Project Number	Project Name	Asset Class	Project Description	Estimated Cost	Phase	Figure Reference
VIP-R1	Central Norfolk Area Gravity Sewer Improvements	Gravity Main	This project is to rehabilitate and / or replace the following gravity sewer segments: - Fox Hall/ Norcova Dr / E. Princess Ave Interceptor Gravity Sewer - 4100 LF of gravity pipeline with associated manholes is referred for action. Pipe diameters range from 8 to 12-inches. Project extends from MH-SG-079-3701 to MH-SG-108-85 and from MH-SG-107-390 to MH-SG-078-748; - Luxembourg Ave Gravity Sewer - 2900 LF of gravity pipeline with associated manholes is referred for action. Pipe diameters range from 8 to 27-inches. Project extents are from: • MH-SG-068-2540 to SS-PS-113-1; • MH-SG-068X-230 to MH-SG-068-2045; • MH-SG-067-8 to MH-SG-067-25 - Norview-Estabrook / Chesapeake Blvd Gravity Sewer - 2900 LF of gravity pipeline with associated manholes is referred for action. Pipe diameters range from 12 to 24-inches. Project extents are from: • MH-SG-075-1800 to MH-SG-074-250; • MH-SG-077-2796 to MH-SG-074-2634; • MH-SG-071-768 to MH-SG-073-795; • MH-SG-073-0 to SS-PS-105-1 -Manholes to be included with this project are MH-SG-077-2796, MH-SG-074-2634, MH-SG-074-2385, MH-SG-074-945, and MH-SG-072-336.	$2,496,000	2	4-64
VIP-R2	Norview Estabrook Division I 18-Inch Force Main Replacement Phase II (Norfolk Fairmont Park Phase IX)	Force Main	This project is to rehabilitate and / or replace a portion of SF-066 Norview-Estabrook Division I 18-inch Force Main. The project extents are approximately 2,700 LF of 18-inch force main along Pershing Avenue between Brest Avenue and Chesapeake Boulevard and continuing along Chesapeake Blvd to Robin Hood Road. The requirements of this project may be fulfilled through existing CIP VIP-109.	$2,521,000	2	4-65
VIP-R3	Park Avenue Pump Station Replacement	Pump Station	This project is to design and construct a replacement pump station for the existing Park Avenue Pump Station. This project is to include installation of an emergency generator/ pump and address the replacement/rehabilitation of 50 linear feet of the 24-inch gravity influent line. The requirements of this project may be fulfilled through existing CIP VIP-110-2.	$4,256,000	2	4-66

Table 3-2. Rehabilitation Action Plan Projects (Planning Level Estimates)

Project Number	Project Name	Asset Class	Project Description	Estimated Cost	Phase	Figure Reference
VIP-R4	State Street Pump Station Electrical Modifications	Pump Station	This project will provide new pump station switchgear, a new emergency generator or alternate powered reserve pumps, VFDs, pumps and motors. The new generator will require new floor space isolated from the station controls. The requirements of this project may be fulfilled through existing CIP VIP-121.	$1,700,000*	0	4-67
VIP-R5	South Trunk Sewer Section C 24-Inch Force Main Replacement	Force Main	This project rehabilitates and / or replaces SF-60 which consists of 1,800 ft. of 24-inch pipe that serves as the discharge line for HRSD PS 107 (Colley Ave.) The requirements of this project may be fulfilled through existing CIP VIP-138.	$2,592,000*	0	4-68
VIP-R6	Ferebee Avenue Pump Station Replacement/Rehabilitation	Pump Station	This project is to study, design, and construct a replacement pump station for the Ferebee Pump Station and replace/rehabilitate the cast iron discharge force main SF-155 Sanitary Sewer Project 1950 12-inch Force Main. The requirements of this project may be fulfilled through existing CIP VIP-140.	$2,877,000	1	4-69
VIP-R7	South Trunk Sewers Section B and C 48-Inch Force Main Replacement	Force Main	This project will rehabilitate and / or replace lines SF-58 and SF-57, which consist of approximately 5,300 feet of 48-inch pipe. The requirements of this project may be fulfilled through existing CIP VIP-146.	$14,014,000*	0	4-70
VIP-R8	Ingleside Road Pump Station Replacement	Pump Station	This project is to rehabilitate and / or replace Ingleside Road Pump Station. This project also includes the design and installation of a new emergency generator/pump. The requirements of this project may be fulfilled through existing CIP VIP-147.	$1,665,000	2	4-71
VIP-R9	Lee Avenue/Wesley Street Horizontal Valve Replacement	Appurtenance	This project will rehabilitate and / or replace a 36-inch mainline valve (VIP2004-2) and install a new 48-inch valve at the intersection of Lee Avenue and Wesley Street in the City of Portsmouth on SF-221. The requirements of this project may be fulfilled through existing CIP VIP-148.	$1,299,000	2	No figure available.

Table 3-2. Rehabilitation Action Plan Projects (Planning Level Estimates)

Project Number	Project Name	Asset Class	Project Description	Estimated Cost	Phase	Figure Reference
VIP-R10	Larchmont Area Pump Station Replacements	Pump Station	This project is to relocate, rehabilitate, and / or replace five pump stations in the Larchmont area of the City of Norfolk (Monroe Place Pump Station # 114, Hanover Ave. Pump Station #141, Jamestown Crescent Pump Station #142, Richmond Crescent Pump Station # 124, and Powhatan Ave Pump Station #122). Additionally, the following gravity sewer work will be done if pump station site remains: - Richmond Crescent Gravity Lines (N Trunk Sewer Section A) - 800 linear feet of 8-inch gravity pipeline and 7 manholes will be rehabilitated / replaced. Project extends from MH-SG-205-100 to SS-PS-124-1. In addition, 50 linear feet of the Pump Station parallel influent line and the upstream MH SG-205-901 will be rehabilitated / replaced. - Jamestown Crescent Influent Line - 5 linear feet of 10-inch gravity pipeline and one manhole will be rehabilitated / replaced. Project extends from MH-SPS-142-1457 to SS-PS-142-1. The requirements of this project may be fulfilled through existing VIP-153.	$9,975,000	2	4-72 - 4-76
VIP-R11	Lafayette Norview-Estabrook Pump Station Replacements	Pump Station	This project is to rehabilitate and / or replace four pump stations in the Lafayette-Norview-Estabrook areas of the City of Norfolk (City Park Pump Station # 106, Chesapeake Boulevard Pump Station #105, Luxembourg Avenue Pump Station #113, and Ashland Circle Pump Station # 102). The requirements of this project may be fulfilled through existing VIP-154.	$9,286,000	2	4-77 - 4-80
VIP-R12	Granby Street Pump Station Improvements	Pump Station	This project will upgrade the pumps, controls, electrical service and piping in the HRSD Granby Street Pump Station located in the City of Norfolk. The requirements of this project may be fulfilled through existing CIP VIP-161.	$552,000*	0	4-81
VIP-R13	South Trunk Section G 30 and 24-Inch Force Main Replacement	Force Main	This project will rehabilitate and / or replace force main SF-084 which consists of approximately 1,700 LF of 30-inch pipe and SF-083 which consists of approximately 800 LF of 24-inch pipe. The requirements of this project may be fulfilled through existing CIP VIP-162.	$5,580,000	1	4-82
VIP-R14	Norview-Estabrook Division I 12-Inch Force Main Replacement	Force Main	This project is to rehabilitate and / or replace the SF-069 Norview-Estabrook Division I 12-inch Force Main consisting of approximately 2,800 LF of 12-inch pipe along Robin Hood Road. The requirements of this project may be fulfilled through existing CIP VIP-165.	$2,745,000	2	4-83
VIP-R15	Norview-Estabrook Division I 18-Inch Force Main Replacement Phase III	Force Main	This project is to rehabilitate and / or replace a portion of the SF-066 Norview-Estabrook Division I 18-inch Force Main for approximately 3,000 LF of 18-inch cast iron pipe starting at the existing force main near the Luxembourg Pump Station extending east to the valve on Pershing Ave. The requirements of this project may be fulfilled through existing CIP VIP-167.	$4,117,000	2	4-84

Table 3-2. Rehabilitation Action Plan Projects (Planning Level Estimates)

Project Number	Project Name	Asset Class	Project Description	Estimated Cost	Phase	Figure Reference
WB-R1	North Trunk Force Main Part B Replacement	Force Main	This project is to rehabilitate and / or replace 1,200 feet of 24-inch pipe along NF-001. The pipe to be addressed is located in between existing line stops which are near branch valve W5016-2 and air vent W5018-2.	$714,000	1	4-85
YR-R1	N. King St Gravity Replacement/Rehabilitation	Gravity Main	This project is to rehabilitate and / or replace the following gravity sewer segments: -1800 LF of gravity pipeline with associated manholes is referred for action. Pipe diameters range from 15 to 21-inches. Project extends from MH-NG-062-8225 to MH-NG-062-8105 and from MH-NG-063-6225 to NS-PS-217-1. The project also includes manholes MH-NG-063-6845, MH-NG-063-6694, and MH-NG-063-6377. The requirements of this project may be fulfilled through existing CIP YR-123.	$854,000*	0	4-86
YR-R2	Foxridge San Sewer Sections 1, 4 & 5 Gravity and Woodland Road Fox Hill Road Gravity Sewer Rehabilitation	Gravity Main	This project involves the rehabilitation and /or replacement of (length dimensions approximate): - NG-086 – 3,000 LF of 15-inch and 410 linear feet of 14-inch pipe, from the terminus manhole at the intersection of Little Back River and Harris Creek to the intersection of Ft. Worth Street and Waco Court. - NG-087 - 1,500 LF of 18-inch pipe - NG-092 - 500 LF of 21-inch and 228 linear feet of 24-inch pipe Line rehabilitation / replacement will also include the rehabilitation and/or replacement of at least 41 manholes. Approximately 1900 LF of existing 10-inch pipe was already replaced along Beach Road with new 10-inch pipe as part of the Prompt Repair program. The requirements of this project may be fulfilled through existing CIP YR-103.	$2,603,000	2	4-87

** Costs for projects that were underway at time of submittal were not updated to reflect 2013 dollars.*

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Table 3-3. AT-R2 State Street Manholes To Be Addressed		
Facility ID	Line Number	TP
FLWCTRL-SG-096-3202	SG-098	AT
MH-SG-096-1099	SG-096	AT
MH-SG-096-1505	SG-096	AT
MH-SG-096-1796	SG-096	AT
MH-SG-096-2124	SG-096	AT
MH-SG-096-2505	SG-096	AT
MH-SG-096-2561	SG-096	AT
MH-SG-096-2721	SG-096	AT
MH-SG-096-2938	SG-096	AT
MH-SG-096-3445	SG-096	AT
MH-SG-096-3848	SG-096	AT
MH-SG-096-4257	SG-096	AT
MH-SG-096-515	SG-096	AT
MH-SG-096-725	SG-096	AT
MH-SG-096-759	SG-096	AT
MH-SG-098-4932	SG-098	AT
MH-SG-098-5190	SG-098	AT
MH-SG-098-5523	SG-098	AT
MH-SG-098-5684	SG-098	AT
MH-SG-098-5790	SG-098	AT
MH-SG-098-5845	SG-098	AT
MH-SG-098-5976	SG-098	AT
MH-SG-098-6081	SG-098	AT
MH-SG-098-6409	SG-098	AT
MH-SG-098-6624	SG-098	AT
MH-SG-098-6814	SG-098	AT
MH-SG-098-7145	SG-098	AT
MH-SG-098-7487	SG-098	AT

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Table 3-4. GN-R1 Manholes To Be Addressed		
Facility ID	Line Number	TP
FLWCTRL-SG-003-1633	SG-003	AB
MH-SG-001-1000	SG-001	AB
MH-SG-001-1500	SG-001	AB
MH-SG-001-1820	SG-001	AB
MH-SG-001-2000	SG-001	AB
MH-SG-001-2270	SG-001	AB
MH-SG-001-2595	SG-001	AB
MH-SG-001-2750	SG-001	AB
MH-SG-001-3351	SG-001	AB
MH-SG-001-42	SG-001	AB
MH-SG-001-500	SG-001	AB
MH-SG-003-1207	SG-003	AB
MH-SG-003-1791	SG-003	AB
MH-SG-003-2230	SG-003	AB
MH-SG-003-2658	SG-003	AB
MH-SG-003-3050	SG-003	AB
MH-SG-003-3258	SG-003	AB
MH-SG-003-3565	SG-003	AB
MH-SG-003-3604	SG-003	AB
MH-SG-003-3735	SG-003	AB
MH-SG-003-3747	SG-003	AB
MH-SG-003-3889	SG-003	AB
MH-SG-196-5000	SG-196	AB
MH-SG-196-5360	SG-196	AB
MH-SG-196-5825	SG-196	AB
MH-SG-196-6420	SG-196	AB
MH-SG-196-7000	SG-196	AB
MH-SG-196-7478	SG-196	AB
MH-SG-196-7718	SG-196	AB
MH-SPS-129-1501	SPS-129	AB
MH-SPS-129-3073	SPS-129	AB
MH-NG-067-7504	NG-067	BH
MH-NG-083-499	NG-083	BH
MH-NG-083-690	NG-083	BH
MH-NG-083-929	NG-083	BH
MH-NG-084-575	NG-084	BH
MH-NG-109-135	NG-109	BH
MH-NG-109-185	NG-109	BH
MH-NG-109-242	NG-109	BH
MH-NG-116-1576	NG-116	BH
MH-NG-117-1954	NG-117	BH
MH-NG-123-50	NG-123	BH
MH-NG-124-1307	NG-124	BH
MH-NG-124-1522	NG-124	BH

Table 3-4. GN-R1 Manholes To Be Addressed		
Facility ID	Line Number	TP
MH-NG-124-3798	NG-124	BH
MH-NG-124-4418	NG-124	BH
MH-NG-138-11292	NG-138	BH
MH-NG-143-242	NG-143	BH
MH-NG-143-4290	NG-143	BH
MH-NG-143-4620	NG-143	BH
MH-NG-143-4950	NG-143	BH
MH-NG-147-1601	NG-147	BH
MH-NG-147-1860	NG-147	BH
MH-NG-150-15214	NG-150	BH
MH-NG-150-15600	NG-150	BH
MH-NG-150-15909	NG-150	BH
MH-NG-150-16263	NG-150	BH
MH-NG-034-2698	NG-034	JR
MH-NG-034-3001	NG-034	JR
MH-NG-034-3506	NG-034	JR
MH-NG-035-750	NG-035	JR
MH-NPS-212-266	NPS-212	JR
MH-NPS-212-7025	NPS-212	JR
MH-NPS-212-7035	NPS-212	JR
MH-NPS-221-6705	NPS-221	JR
MH-SG-041-0	SG-041	VIP
MH-SG-047-1025	SG-047	VIP
MH-SG-047-1130	SG-047	VIP
MH-SG-047-17	SG-047	VIP
MH-SG-047-1728	SG-047	VIP
MH-SG-047-1754	SG-047	VIP
MH-SG-047-2306	SG-047	VIP
MH-SG-047-2463	SG-047	VIP
MH-SG-047-2754	SG-047	VIP
MH-SG-047-3123	SG-047	VIP
MH-SG-047-3156	SG-047	VIP
MH-SG-047-3414	SG-047	VIP
MH-SG-048-263	SG-048	VIP
MH-SG-050-2078	SG-050	VIP
MH-SG-050-3129	SG-047	VIP
MH-SG-050-4500	SG-050	VIP
MH-SG-053-3779	SG-053	VIP
MH-SG-053-4189	SG-053	VIP
MH-SG-053-4525	SG-053	VIP
MH-SG-055-4804	SG-055	VIP
MH-SG-055-4920	SG-055	VIP
MH-SG-055-5109	SG-055	VIP
MH-SG-056-5366	SG-056	VIP
MH-SG-089-3538	SG-089	VIP

Table 3-4. GN-R1 Manholes To Be Addressed		
Facility ID	Line Number	TP
MH-SG-089-3843	SG-089	VIP
MH-SG-089-4160	SG-089	VIP
MH-SG-089-4168	SG-089	VIP
MH-SG-089-4518	SG-089	VIP
MH-SG-089-5053	SG-089	VIP
MH-SG-089-5551	SG-089	VIP
MH-SG-089-5690	SG-089	VIP
MH-SG-089-5863	SG-089	VIP
MH-SG-089-6219	SG-089	VIP
MH-SG-089-6287	SG-089	VIP
MH-SG-089-6434	SG-089	VIP
MH-SG-089-6692	SG-089	VIP
MH-SG-089-6971	SG-089	VIP
MH-SG-089-7021	SG-089	VIP
MH-SPS-130-1498	SPS-130	VIP
MH-NPS-230-737	NPS-230	WB

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Table 3-5. GN-R8 Force Main Appurtenances To Be Addressed			
Line No.	Description	Valve Guide No.	Valve No.
NF-001	2" AV	W5019A	1
NF-003	24" ML	W4005A	2
NF-005	12" BRANCH	W2016	3
NF-007	12" BRANCH	W1004	1
NF-007	24" ML	W1004	2
NF-011	36" ML	YR1017B	1
NF-015	6" BRANCH	JR6014	1
NF-017	12" BRANCH	JR4012	1
NF-047	12" BRANCH	YR2037	1
NF-060	LD	YR4002	3
NF-077	10" ML	BH2002	3
NF-105	10" ML	BH6013	1
NF-162	12" BRANCH	BH1008A	1
NF-163	18" BRANCH	W3003	4
NF-172	12" BRANCH	W1004	9
NF-172	20" Branch	W1004J	10
NF-172	24" ML	W1004	4
NF-172	8" BRANCH	W1004	10
NF-179	12" BRANCH	JR5033	3
NF-183	4" BRANCH	YR6603A	1
NF-192	36" ML	W1004	6
SF-002	2" AV	AB1003	3
SF-002	20" VALVE	AB1006	9
SF-014	24” VALVE	CE3005	2
SF-023	2" AV	NA1006	1
SF-024	2" AV	NA1017	1
SF-024	2" AV	NA1018	1
SF-028	2" AV	NA1040	1
SF-060	20" VALVE	LP1009A	1
SF-101	10" VALVE	AT6042	6
SF-117	24” VALVE	CE2042	2
SF-129	24” VALVE	AT3048	14
SF-136	2" AV	NA3047E	1
SF-136	2" AV	NA3047H	3
SF-137	2" AV	NA3059	1
SF-137	2" AV	NA3059A	2
SF-137	2" AV	NA3049	2

Table 3-5. GN-R8 Force Main Appurtenances To Be Addressed			
Line No.	Description	Valve Guide No.	Valve No.
SF-146	2" AV	AT6031A	1
SF-170	2" AV	AT1019A	1
SF-188	2" AV	NA1138A	1
SF-208	2" AV	NA3002	1
SF-208	2" AV	NA3003	1
SF-208	2" AV	NA3006	1
SF-209	2" AV	AT1159Q	1
SF-218	2" AV	VIP6004	1
SF-219	2" AV	VIP7005	1
SF-219	2" AV	VIP7011	1
SF-219	2" AV	VIP7012	1
SF-220	2" AV	VIP7002	1
SF-224	36" VALVE	VIP4003	6
SF-230	2" AV	NA3110	6
SF-232	2" AV	AT1224	1
SF-267	2" AV	NA7021	2

Table 3-6. GN-R9 Aerial Crossings To Be Addressed		
Shore	Location Identifier	Condition Assessment Findings
North	NF-158	Joint diapers cracking and spalling and support system has potential evidence of deterioration. Repair joint diapers and repair and/or remove and replace support system as required. Crossing is scheduled to be addressed in CIP.
South	CE-2043	One pipe support is damaged; minimal surface corrosion.
South	AB-2010 & AB-2011	Portions of concrete pipe cracking at joints and repairs. Repair cracks and spalling concrete as required.
South	NA; SG-191 MH#15	Pipe supports and piles have potential evidence of deterioration. Further evaluate pipe supports and piles.
South	NA-1103	Joint diapers showing some signs of deterioration; minimal corrosion. Address joint diaper.
South	NA-3105	One cross member support is in poor condition and will be addressed. Inspect and evaluate rest of support system. Repair and/or remove and replace support system as required.
South	VIP-1102	Pipe supports, coating and hardware showing signs of weathering. Repair or replace support system as required and properly coat or otherwise protect pipe for exposed service.
South	CE-5033 CE-5034 CE-5035	Pipe supports showing signs of deterioration. Repair or replace support system as required. Minimal corrosion.
South	CE-1049 & CE-1050	Pipe supports showing signs of weathering. Minimal corrosion. Further evaluation of pipe supports required. Repair or replace support system as necessary.
South	NA; SG -191 MH#24	Pipe supports and piles showing signs of weathering. Further evaluation of pipe supports and piles is required. Repair or replace support system as necessary.

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Table 3-7. GN-R10 Cathodic Protection Assets To Be Addressed			
Valve Guide Number	HRSD Line Number	Line Name / Location	Asset Description
AT2045-1, AT2046-1, AT2047-1, AT2048-1, AT2049-1, AT2050-5	SF-262	Lake Ridge Section E, 42-inch DIP Year 2002	Anodes
AT7036	SF-273	Gum Swamp Crossing (ICCP System)	Negative cable
VIP1107, VIP1108	SF-228	Elizabeth River Crossing (VIP)	Rectifier
W1004A-1,2,3; W1004E-5,6,7,8; W1004I-3	NF-172, NF-173, NF-174	Kingsmill IFM INT FM	Anodes
W5037-2	NF-178	North Trunk INT	Anodes
W6008A-1	NF-205	Lackey IFM – Sect. A	Anodes
W7012F-2	NF-204	Powhatan Creek FM	Anodes

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Table 3-8. NP-R2 Manholes To Be Addressed		
Facility ID	Line Number	TP
MH-SG-193-10087	SG-193	NP
MH-SG-193-10265	SG-193	NP
MH-SG-193-10352	SG-193	NP
MH-SG-193-10526	SG-193	NP
MH-SG-193-10730	SG-193	NP
MH-SG-193-10859	SG-193	NP
MH-SG-193-11143	SG-193	NP
MH-SG-193-11343	SG-193	NP
MH-SG-193-11386	SG-193	NP
MH-SG-193-11442	SG-193	NP
MH-SG-193-11740	SG-193	NP
MH-SG-193-12004	SG-193	NP
MH-SG-193-12264	SG-193	NP
MH-SG-193-12380	SG-193	NP
MH-SG-193-12566	SG-193	NP
MH-SG-193-12637	SG-193	NP
MH-SG-193-12687	SG-193	NP
MH-SG-193-12701	SG-193	NP
MH-SG-193-12982	SG-193	NP
MH-SG-193-13277	SG-193	NP
MH-SG-193-13372	SG-193	NP
MH-SG-193-13672	SG-193	NP
MH-SG-193-13824	SG-193	NP
MH-SG-193-14209	SG-193	NP
MH-SG-193-14517	SG-193	NP
MH-SG-193-14629	SG-193	NP
MH-SG-193-5801	SG-193	NP
MH-SG-193-6046	SG-193	NP
MH-SG-193-6306	SG-193	NP
MH-SG-193-6605	SG-193	NP
MH-SG-193-6660	SG-193	NP
MH-SG-193-6907	SG-193	NP
MH-SG-193-7210	SG-193	NP
MH-SG-193-7469	SG-193	NP
MH-SG-193-7747	SG-193	NP
MH-SG-193-7930	SG-193	NP
MH-SG-193-7978	SG-193	NP
MH-SG-193-8670	SG-193	NP
MH-SG-193-8970	SG-193	NP
MH-SG-193-9069	SG-193	NP
MH-SG-193-9142	SG-193	NP
MH-SG-193-9288	SG-193	NP
MH-SG-193-9516	SG-193	NP
MH-SG-193-9753	SG-193	NP

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Table 3-9 Rehab Project Prioritization

Project Number	Project Name	Asset Class	Significant factors related to number and severity of system defects	Significant factors related to the number of SSOs that could be avoided if the system were rehabilitated	Significant factors related to operation and maintenance history and costs	Significant factors related to quantity of I&I entering the system and the potential for I&I reduction	Total score for probability and consequence of failure of the sanitary sewer system	Significant factors related to available capacity	Comments	Phase
BH-R1	Boat Harbor Outlet Sewer Improvements	Gravity Main	None	None	None	None	12	N/A	None	1
BH-R2	Jefferson Ave Extension Gravity Improvements	Gravity Main	None	None	None	None	12	N/A	None	1
BH-R4	Orcutt Ave and Mercury Blvd Gravity Sewer Improvements	Gravity Main	None	None	Frequent cleaning and inspection are required due to observed conditions	None	8	N/A	None	1
BH-R8	Hampton Trunk Sewer Extension Division B - Claremont Force Main Replacement	Force Main	None	None	None	N/A	8	N/A	None	1

Table 3-9 Rehab Project Prioritization

Project Number	Project Name	Asset Class	Significant factors related to number and severity of system defects	Significant factors related to the number of SSOs that could be avoided if the system were rehabilitated	Significant factors related to operation and maintenance history and costs	Significant factors related to quantity of I&I entering the system and the potential for I&I reduction	Total score for probability and consequence of failure of the sanitary sewer system	Significant factors related to available capacity	Comments	Phase
BH-R9	Ferguson Park Interceptor Force Main-Bridge Span Relocation	Force Main	None	Failures have been due to internal corrosion of unlined pipe. The subject pipe is a bridge crossing where air may collect.	None	N/A	2	N/A	None	1
CE-R2	Western Trunk Force Main Replacement	Force Main	Lab analysis reported microcracking	None	None	N/A	8	N/A	None	1
CE-R3	Lynnhaven and Western Trunk FM Chlorine Injection Vault Demolitions	Appurt enance	None	None	None	N/A	8	N/A	None	1

Table 3-9 Rehab Project Prioritization

Project Number	Project Name	Asset Class	Significant factors related to number and severity of system defects	Significant factors related to the number of SSOs that could be avoided if the system were rehabilitated	Significant factors related to operation and maintenance history and costs	Significant factors related to quantity of I&I entering the system and the potential for I&I reduction	Total score for probability and consequence of failure of the sanitary sewer system	Significant factors related to available capacity	Comments	Phase
CE-R4	Independence Boulevard Pressure Reducing Station Modifications	Pump Station	None	None	Liquid-rheostat controls have exhibited reliability concerns in the HRSD system.	N/A	6	None	None	1
CE-R5	Central Trunk Interceptor Force Main A & B Main Line Valves	Appurtenance	None	None	There are a significant number of connections between isolation valves that could not be isolated in the event of a failure.	N/A	1	N/A	None	1
GN-R12	North Shore Pump Station Wet Well Rehabilitation	Pump Station	None	None	Operations has experienced issues with air entrainment and has concerns about localized wet well corrosion	N/A	3	None	None	1
GN-R1	Manhole Replacement / Rehabilitation Phase I	Gravity Main	Specialty inspections showed poor material condition	None	None	None	9	N/A	Manhole (GN-R1) and Siphon Chamber (GN-R2) Projects were combined in Rehab Update.	1

Table 3-9 Rehab Project Prioritization

Project Number	Project Name	Asset Class	Significant factors related to number and severity of system defects	Significant factors related to the number of SSOs that could be avoided if the system were rehabilitated	Significant factors related to operation and maintenance history and costs	Significant factors related to quantity of I&I entering the system and the potential for I&I reduction	Total score for probability and consequence of failure of the sanitary sewer system	Significant factors related to available capacity	Comments	Phase
GN-R3	Pump Station Wet Well Rehabilitation Phase I	Pump Station	Specialty wetwell structural inspections showed poor material condition	None	None	N/A	9	None	None	1
GN-R6	Arctic Avenue Pump Station and Newtown Road Pump Station Electrical Improvements	Pump Station	None	None	Liquid-rheostat controls have exhibited reliability concerns in the HRSD system.	N/A	4	None	None	1
GN-R13	Pump Station Generators	Pump Station	None	None	None	N/A	4	N/A	This project is in Phase 1 because of continuous operability concerns.	1
JR-R1	City Farm Interceptor Force Main Replacement	Force Main	None	None	None	N/A	8	N/A	None	1

Table 3-9 Rehab Project Prioritization

Project Number	Project Name	Asset Class	Significant factors related to number and severity of system defects	Significant factors related to the number of SSOs that could be avoided if the system were rehabilitated	Significant factors related to operation and maintenance history and costs	Significant factors related to quantity of I&I entering the system and the potential for I&I reduction	Total score for probability and consequence of failure of the sanitary sewer system	Significant factors related to available capacity	Comments	Phase
JR-R2	Huxley to Middle Ground Force Main Extension	Force Main	None	None	Operations has identified several unvented high spots from existing records and has concerns about material condition of pipeline.	N/A	8	N/A	None	1
NP-R3	Deep Creek Interceptor Force Main Replacement	Force Main	None	None	None	N/A	8	N/A	None	1
NP-R4	Suffolk Interceptor Force Main Section I Main Line Valving Replacement	Appurtenance	None	None	Check valve may fail in closed position causing blockage in line	N/A	8	N/A	None	1
VIP-R6	Ferebee Avenue Pump Station Replacement/Rehabilitation	Pump Station	None	None	None	N/A	3	None	Project must be done ahead of Park Ave Pump Station Replacement	1

Table 3-9 Rehab Project Prioritization

Project Number	Project Name	Asset Class	Significant factors related to number and severity of system defects	Significant factors related to the number of SSOs that could be avoided if the system were rehabilitated	Significant factors related to operation and maintenance history and costs	Significant factors related to quantity of I&I entering the system and the potential for I&I reduction	Total score for probability and consequence of failure of the sanitary sewer system	Significant factors related to available capacity	Comments	Phase
VIP-R13	South Trunk Section G 30 and 24-Inch Force Main Replacement	Force Main	None	None	None	N/A	8	N/A	None	1
WB-R1	North Trunk Force Main Part B Replacement	Force Main	None	No	Operations noted visible crown corrosion in section of pipe outside of recent repair.	N/A	6	N/A	None	1
AB-R1	Taussig Boulevard Pump Station Instrumentation Improvements	Pump Station	None	None	None	N/A	4	None	None	2
AT-R1	Washington District Pump Station Area Sanitary Sewer Improvements	Gravity Main	None	None	None	None	6	N/A	None	2
AT-R2	South Norfolk Area Gravity Sewer Improvements	Gravity Main	None	None	None	None	6	N/A	None	2

Table 3-9 Rehab Project Prioritization

Project Number	Project Name	Asset Class	Significant factors related to number and severity of system defects	Significant factors related to the number of SSOs that could be avoided if the system were rehabilitated	Significant factors related to operation and maintenance history and costs	Significant factors related to quantity of I&I entering the system and the potential for I&I reduction	Total score for probability and consequence of failure of the sanitary sewer system	Significant factors related to available capacity	Comments	Phase
AT-R3	Shipps Corner Pressure Reducing Station Replacement	Pump Station	None	None	Liquid-rheostat controls have exhibited reliability concerns in the HRSD system.	N/A	8	None	This project is not in Phase 1 because there are currently diesel driven pumps onsite which provide pumping and are not controlled by the liquid-rheostat controls.	2
AT-R4	Great Bridge Interceptor Extension 16-Inch Replacement	Force Main	None	None	None	N/A	6	N/A	None	2
AT-R6	Doziers Corner Pump Station and Washington District Pump Station Flooding Mitigation Improvements	Pump Station	None	None	None	N/A	4	None	None	2
BH-R12	46th Street Diversion Sewer Rehabilitation/	Gravity Main	None	None	None	No	6	N/A	None	2

Table 3-9 Rehab Project Prioritization

Project Number	Project Name	Asset Class	Significant factors related to number and severity of system defects	Significant factors related to the number of SSOs that could be avoided if the system were rehabilitated	Significant factors related to operation and maintenance history and costs	Significant factors related to quantity of I&I entering the system and the potential for I&I reduction	Total score for probability and consequence of failure of the sanitary sewer system	Significant factors related to available capacity	Comments	Phase
BH-R3	Hampton Trunk Sewer Extension Division K Gravity Improvements	Gravity Main	None	None	None	None	4	N/A	None	2
BH-R5	Bloxoms Corner Force Main Replacement	Force Main	None	The force main has a history of condition related failures.	None	N/A	6	N/A	This project is not in Phase 1 because the failure history is primarily outside timeframe noted in the Condition Assessment Plan. Only one failure has been documented since 1999.	2
BH-R11	West Avenue and 35th Street Interceptor Force Main Replacement	Force Main	None	The pipe has failed in a similar mode three times.	None	N/A	6	N/A	This project is not in Phase 1 because the flow in the pipeline is controlled by two HRSD pump stations meaning mitigation of a failure can be done quickly.	2
CE-R1	Poplar Hall Davis Corner Trunk 24-Inch Gravity Sewer Improvements	Gravity Main	None	None	None	No	4	N/A	None	2

Table 3-9 Rehab Project Prioritization

Project Number	Project Name	Asset Class	Significant factors related to number and severity of system defects	Significant factors related to the number of SSOs that could be avoided if the system were rehabilitated	Significant factors related to operation and maintenance history and costs	Significant factors related to quantity of I&I entering the system and the potential for I&I reduction	Total score for probability and consequence of failure of the sanitary sewer system	Significant factors related to available capacity	Comments	Phase
CE-R6	Birchwood Trunk 24”/30” Force Main at Independence Boulevard Replacement Phase II	Force Main	None	None	Pipeline may be very difficult to repair.	N/A	8	N/A	This project is not in Phase 1 because HRSD has already prepared a design in the event of a failure as a mitigation measure. Additionally, the project must be coordinated with Independence Blvd PRS.	2
GN-R10	Cathodic Protection Systems Improvement Phase I	Cathodic Protection	None	None	None	N/A	4	N/A	None	2
GN-R11	Horizontal Valve Replacement Phase III	Appurtenance	None	None	None	N/A	4	N/A	None	2
GN-R4	North Shore Gravity Sewer Improvements Phase I	Gravity Main	None	None	None	None	3	N/A	None	2

Table 3-9 Rehab Project Prioritization

Project Number	Project Name	Asset Class	Significant factors related to number and severity of system defects	Significant factors related to the number of SSOs that could be avoided if the system were rehabilitated	Significant factors related to operation and maintenance history and costs	Significant factors related to quantity of I&I entering the system and the potential for I&I reduction	Total score for probability and consequence of failure of the sanitary sewer system	Significant factors related to available capacity	Comments	Phase
GN-R5	South Shore Gravity Sewer Improvements Phase I	Gravity Main	None	None	None	None	6	N/A	None	2
GN-R8	Interceptor System Valve Improvements Phase I	Force Main	None	None	None	N/A	4	N/A	None	2
GN-R9	South Shore Aerial Crossing Improvements	Force Main / Appurtenance	None	None	None	N/A	4	N/A	None	2
NP-R1	Western Branch Sewer System Gravity Improvements	Gravity Main	None	None	None	No	3	N/A	None	2
NP-R2	Shingle Creek and Hickmans Branch Gravity Sewer Improvements	Gravity Main	None	None	None	No	6	N/A	None	2

Table 3-9 Rehab Project Prioritization										
Project Number	Project Name	Asset Class	Significant factors related to number and severity of system defects	Significant factors related to the number of SSOs that could be avoided if the system were rehabilitated	Significant factors related to operation and maintenance history and costs	Significant factors related to quantity of I&I entering the system and the potential for I&I reduction	Total score for probability and consequence of failure of the sanitary sewer system	Significant factors related to available capacity	Comments	Phase
VIP-R1	Central Norfolk Area Gravity Sewer Improvements	Gravity Main	None	None	None	None	6	N/A	None	2
VIP-R10	Larchmont Area Pump Station Replacements	Pump Station	None	None	None	N/A	6	None	None	2
VIP-R11	Lafayette Norview-Estabrook Pump Station Replacements	Pump Station	None	None	None	N/A	4	None	None	2
VIP-R14	Norview-Estabrook Division I 12-Inch Force Main Replacement	Force Main	None	None	None	N/A	6	N/A	None	2
VIP-R15	Norview-Estabrook Division I 18-Inch Force Main Replacement Phase III	Force Main	None	None	None	N/A	6	N/A	None	2

Table 3-9 Rehab Project Prioritization

Project Number	Project Name	Asset Class	Significant factors related to number and severity of system defects	Significant factors related to the number of SSOs that could be avoided if the system were rehabilitated	Significant factors related to operation and maintenance history and costs	Significant factors related to quantity of I&I entering the system and the potential for I&I reduction	Total score for probability and consequence of failure of the sanitary sewer system	Significant factors related to available capacity	Comments	Phase
VIP-R2	Norview Estabrook Division I 18-Inch Force Main Replacement Phase II (Norfolk Fairmont Park Phase IX)	Force Main	None	None	None	N/A	6	N/A	None	2
VIP-R3	Park Avenue Pump Station Replacement	Pump Station	None	None	Station is aging causing operational difficulties.	N/A	4	None	Project must be done after Ferebee Ave Pump Station Rehabilitation/Replacement	2
VIP-R8	Ingleside Road Pump Station Replacement	Pump Station	None	None	None	N/A	3	None	None	2
VIP-R9	Lee Avenue/Wesley Street Horizontal Valve Replacement	Appurtenance	None	None	None	N/A	4	N/A	None	2

Table 3-9 Rehab Project Prioritization

Project Number	Project Name	Asset Class	Significant factors related to number and severity of system defects	Significant factors related to the number of SSOs that could be avoided if the system were rehabilitated	Significant factors related to operation and maintenance history and costs	Significant factors related to quantity of I&I entering the system and the potential for I&I reduction	Total score for probability and consequence of failure of the sanitary sewer system	Significant factors related to available capacity	Comments	Phase
YR-R2	Foxridge San Sewer Sections 1, 4 & 5 Gravity and Woodland Road Fox Hill Road Gravity Sewer Rehabilitation	Gravity Main	None	None	None	None	3	N/A	None	2

Table 3-10. Consent Decree Modification No.3 Project Elements

Project Elements	Asset Class	HRSD CIP Number*	Project Element Cost (Portion of CIP total)
Army Base Gravity Influent Line – 142 LF of gravity pipeline are referred for action. Pipe diameter is 24 inches. Project extends from MH-SG-003-3747 to MH-SG-003-3889.	Gravity Main	AB-100	$12,000
North Shore Rd Pump Station Gravity Influent Line - 13 LF of gravity pipeline and one manhole are referred for action. Pipe diameter is 12-inches. Project extends from MH-SPS-117-1476 to SS-PS-117-1;	Gravity Main	AB-105	$78,000
Manholes in the Ivy Home-Shell Road area are referred for action: MH-NG-141-4467; MH-NG-141-5073; MH-NG-142-1002; MH-NG-142-1390; MH-NG-142-1780; MH-NG-142-2183; MH-NG-142-2371; MH-NG-142-2610; MH-NG-142-2867; MH-NG-142-3125; MH-NG-142-3282; MH-NG-142-3628; MH-NG-142-3793; MH-NG-142-4110; MH-NG-142-470; MH-NG-142-750	Gravity Main	BH-145	$112,000
Lucas Creek Pump Station Influent Line – 132 LF of gravity pipeline; Pipe diameters include 30 and 36 inch. Project extents are from: NPS-216-69 to the upstream chamber ; NPS-216-69 to NPS-216-517); NPS-216-69 to NPS-PS-216	Gravity Main	JR-106	$166,000
The Suffolk Pump Station Flomatcher pump speed controllers are referred for action.	Pump Station	NP-106-2	$252,000

*The Rehab Plan commitment is only for the listed project elements not the entire CIP project.

Consequence Score	Force Main Guidelines	Gravity Main Guidelines	Pump Station Guidelines
4 Failure results in a discharge of untreated wastewater that has a significant impact on environmental and/or public health	**Sensitive Receptors:** Failure results in a discharge of untreated wastewater within 500 feet of drinking water surface reservoir.[1] **OR** **Diversion / Repair Difficulty:** High amount of time or effort to repair: - High level of effort to handle flow with no diversion available including multiple line stops, multiple pick-up points, or significant set up time[1] -Greater than 16 feet deep[1] -Interference with major roads and/or railroad crossings[1] **OR** **Pipe Diameter:** Greater than 24"[1]	**Sensitive Receptors:** Failure results in a discharge of untreated wastewater within 500 feet of drinking water surface reservoir.[1] **OR** **Repair Difficulty:** High amount of time or effort to repair because: -Greater than 16 feet depth (MH depth)[1] -Interference with major roads and/or railroad crossings[1] **OR** **Pipe Diameter:** Greater than 26"[1]	**Subject Equipment** failure may result in overflow **AND** (**Sensitive Receptors:** Failure results in a discharge of untreated wastewater within 500 feet of drinking water surface reservoir.[1] **OR** **Size:** Large to Very Large Capacity greater than 3.77 MGD for wet well stations / 18.0 MGD for PRS[3])
3 Failure results in a discharge of untreated wastewater that does not have a significant impact on environmental and/ or public health	**Diversion / Repair Difficulty:** Moderately high time or effort to repair: - Moderately high level of effort to handle flow with no diversion available including one line stop, multiple pick-up points, or significant set up time[1] - Between 10 to 16 feet depth or unknown depth1 - Project crosses major roads / interference with minor roads [1] **OR** **Pipe Diameter:** 14" to 24"[1]	**Repair Difficulty:** Moderately high time or effort to repair: -Between 8 or 10 feet depth (MH depth) or unknown depth[1] - Project crosses major roads / interference with minor roads[1] **OR** **Pipe Diameter:** 13" to 26"[1]	**Subject Equipment** failure may result in overflow **AND** **Size**: Small to Medium; Capacity equal to or less than 3.77 MGD for wet well stations / 18.0 MGD for PRS[3]
2 Failure will not cause a discharge of untreated wastewater, but prevention of the discharge requires a significant commitment of resources	**Diversion / Repair Difficulty:** Moderate time or effort to repair: - Moderate level of effort to handle flow. Diversion available or other flow handling methods able to be implemented efficiently[1] - Between 8 to 10 feet depth or unknown depth[1] - Interference with minor roads[1] **OR** **Pipe Diameter: 9**" to 13"[1]	**Repair Difficulty:** Moderate time or effort to repair: - Between 8 to 10 feet depth or unknown depth (MH depth) [1] - Interference with minor roads [1] **OR** **Pipe Diameter:** 10" to 13"[1]	**Subject Equipment** failure will not likely result in overflow **AND** **Size:** Large to Very Large Capacity greater than 3.77 MGD for wet well stations / 18.0 MGD for PRS[3]
1 Failure will not cause a discharge of untreated wastewater and does not impact ability to convey wastewater.	**Diversion / Repair Difficulty:** Short repair time - Requires a low level of effort to handle flow and repair[1] **OR** **Pipe Diameter:** Less than 9"[1]	**Repair Difficulty:** Short repair time - Requires a low level of effort to bypass and repair[1] **OR** **Pipe Diameter**: Less than 10"[1]	**Subject Equipment** failure will not likely result in overflow **AND** **Size:** Small to Medium; Capacity equal to or less than 3.77 MGD for wet well stations / 18.0 MGD for PRS[3]

Likelihood Score	Force Mains Guidelines	Gravity System Guidelines	Pump Stations Guidelines
3 Potential for failure; Majority of assets are rated as fair or poor	Multiple SSOs caused by a condition defect[4] Safety Factor less than 1.2 (if SF is the factor for inclusion into the rehab plan)[5] Known condition issues indicate potential for failure.	Average PACP asset rating per linear foot is greater than 0.9 (overall sum of asset PACP scores / total feet to be repaired)[6] Multiple SSOs caused by a condition defect[4]	More than one instance of documented equipment damage due to flooding[8] OR Condition data indicates failure very likely (For wet wells, need replaced in 2 years or Condition and Performance Region 4/5)[2] OR Multiple SSOs caused by a condition defect[4]
2 Potential for failure; Majority of assets are rated as fair	An SSO caused by a condition defect[4] Safety Factor less 1.2 to 2.0 (if SF is the factor for inclusion into the rehab plan)[5] Known condition issues indicate low potential for failure.	Average PACP asset rating per linear foot is greater than or equal to 0.08 and less than 0.9; (overall sum of asset PACP scores / total feet to be repaired)[6] An SSO caused by a condition defect[4]	One instance of documented damage due to flooding.[8] OR Condition data indicates potential failure (For wet wells, need replaced in 5 years or Condition and Performance Region 2/3)[2] OR An SSO caused by a condition defect[4]
1 Failure is not anticipated; Majority of assets are rated as good / fair	No SSOs caused by condition defects[4] Safety Factor greater than 2.0 (if SF is the factor for inclusion into the rehab plan)[5] Known condition issues do not indicate potential for failure.	Average PACP asset rating per linear foot is less than 0.08 (overall sum of asset PACP scores / total feet to be repaired)[6] No SSOs caused by condition defects[4]	No documentated damage due to flooding.[8] OR Condition data indicates failure unlikely (Condition and Performance Region 1/2)2[2] OR No SSOs caused by condition defects[4]

Likelihood \ Severity	4	3	2	1
3	12	9	6	3
2	8	6	4	2
1	4	3	2	1

Data Sources				
	1: GIS	3: PCAR Pump Station Sizes	5: FM Condition Database	7: RPM Tool; RPM log2 tab
	2: PS FCAR	4: Compiled SSOs list	6: GM CAR tables	8: Flooding study

Figure 3-3. Likelihood and Consequence of Failure Criteria

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Section 4

Rehabilitation Action Plan Maps

This section contains maps of each of the pipeline projects included in the Rehab Plan. The maps are sorted by project number and may include multiple pages.

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