May 2010

HAMPTON ROADS SANITATION DISTRICT

Preliminary Condition Assessment Report

PRELIMINARY CONDITION ASSESSMENT REPORT

Prepared for
Hampton Roads Sanitation District
September 2009
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LIST OF ACRONYMS

AC	Asbestos Cement
CA	Condition Assessment
CCTV	Closed Circuit Television
CIP	Cast Iron Pipe
DEQ	(Virginia) Department of Environmental Quality
DIP	Ductile Iron Pipe
EPA	(United States) Environmental Protection Agency
ESVC	Extra Strength Vitrified Clay
FM	Force Main
HDPE	High Density Polyethylene
MACP	Manhole Assessment and Certification Program
MOM	Management, Operations and Maintenance
PACP	Pipeline Assessment and Certification Program
PCCP	Prestressed Concrete Cylinder Pipe
PE	Polyethylene
PRS	Pressure Reducing Station
PS	Pumping Station
PVC	Polyvinyl Chloride
RCP	Reinforced Concrete Pipe
RCCP	Reinforced Concrete Cylinder Pipe
RTS	Regional Technical Standards
SCADA	Supervisory Control and Data Acquisition
SP	Steel Pipe
SSO	Sanitary Sewer Overflow
STP	Sewage Treatment Plant
TBD	To Be Determined
VC	Vitrified Clay

1. INTRODUCTION

The Hampton Roads Sanitation District (HRSD) sanitary sewer system in southeast Virginia includes approximately 430 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 65 wet well pumping stations and 16 pressure reducing stations. The HRSD sanitary sewer system takes pumped flow and gravity flow from surrounding communities and transports the flows to its thirteen sewage treatment plants (STPs), of which 9 are part of the Consent Decree. Since 2005, HRSD has been working with 13 of the surrounding communities (Localities) in development of a Regional Wet Weather Management Program, including Condition Assessment.

1.1 Purpose of the Preliminary Condition Assessment Report

In September 2009, the Hampton Roads Sanitation District (HRSD) completed a Condition Assessment Plan (CAP) that was submitted to the EPA and DEQ. The CAP described the Condition Assessment Program for the Hampton Roads Sanitation District (HRSD) required by the pending enforcement action by the Environmental Protection Agency (EPA). The CAP includes:

- Details on how previous condition assessment activities will be utilized;
- The approach for Condition Assessment screening and prioritization for HRSD's pumping facilities, gravity mains, and force mains; and
- Procedures for conducting the Condition Assessment Activities.

This document, Preliminary Condition Assessment Report (PCAR), serves as a companion document to the CAP and provides the results of the screening, prioritization, and scheduling for HRSD's sanitary sewer system assets. A significant amount of description of how the screening approach was developed is contained in the CAP with the results included in the PCAR.

HRSD will be conducting condition assessments of assets within its sanitary sewer system for the purpose of locating conditions that present a "material risk of failure". For the purposes of this document, "failure" means any condition 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 goal of the PCAR is to develop a detailed plan and schedule for inspecting, assessing, and prioritizing HRSD's sanitary sewer system assets. Specific assets are identified to evaluate their physical condition in order to determine those that present a "material risk of failure".

1.2 Condition Assessment Program Approach

The HRSD sanitary sewer system is comprised of five sanitary sewer asset types: force mains, pumping stations, pressure reducing stations, SCADA systems, and gravity systems. The Condition Assessment Plan includes condition assessment standards for each of the five sanitary sewer asset types. The approach for conducting the Condition Assessment Program is organized into three distinct parts that address the asset types as described below:

1. **Force Main Condition Assessment** - The force main condition assessment will be conducted in two phases. The first phase is the initial screening of HRSD force main assets, utilizing selected criteria, to identify segments that require further analysis, and possibly field inspection. Initial screening has been conducted using a desktop Criticality Model which assesses the likelihood and consequence of failure of each force main segment. This information along with previous failure history has been used to identify assets that will be considered to have the **potential** for "material risk of failure," and in the second phase, these assets will undergo further assessment if the assessment is cost effective relative to rehabilitation and/or replacement. If rehabilitation or replacement of a portion of the force main is deemed more cost effective then further condition assessment activities will be discontinued. If HRSD learns more about a particular asset class or attribute that may influence condition assessment priorities and schedule, HRSD will use this information to adjust the force main re-inspection frequencies appropriately.
2. **Pumping Facility Condition Assessment** - The pumping facility condition assessment will include assessment of wet well pumping station assets and pressure reducing station assets within the HRSD system. SCADA assets within the HRSD system will be assessed as part of the Pumping Facility Condition Assessment since these are predominantly located at the pumping facilities. Pumping facilities and critical components that have the **potential** for material risk of failure have been identified in a screening process for prioritization in the assessment schedule.
3. **Gravity System Condition Assessment** - The gravity system condition assessment will evaluate the gravity sewer system assets within the HRSD system, including gravity pipeline and manhole assets. Gravity sewer assets that are at material risk of failure have been identified in a screening process and prioritized in the assessment schedule.

Upon completion of field activities, the Final Condition Assessment Report will be developed that presents results along with Action Plans and schedules. The Action Plan will identify specific assets that will be rehabilitated or replaced in order to mitigate the actual material risk of failure and an associated schedule. This process is shown in Figure 1-1.

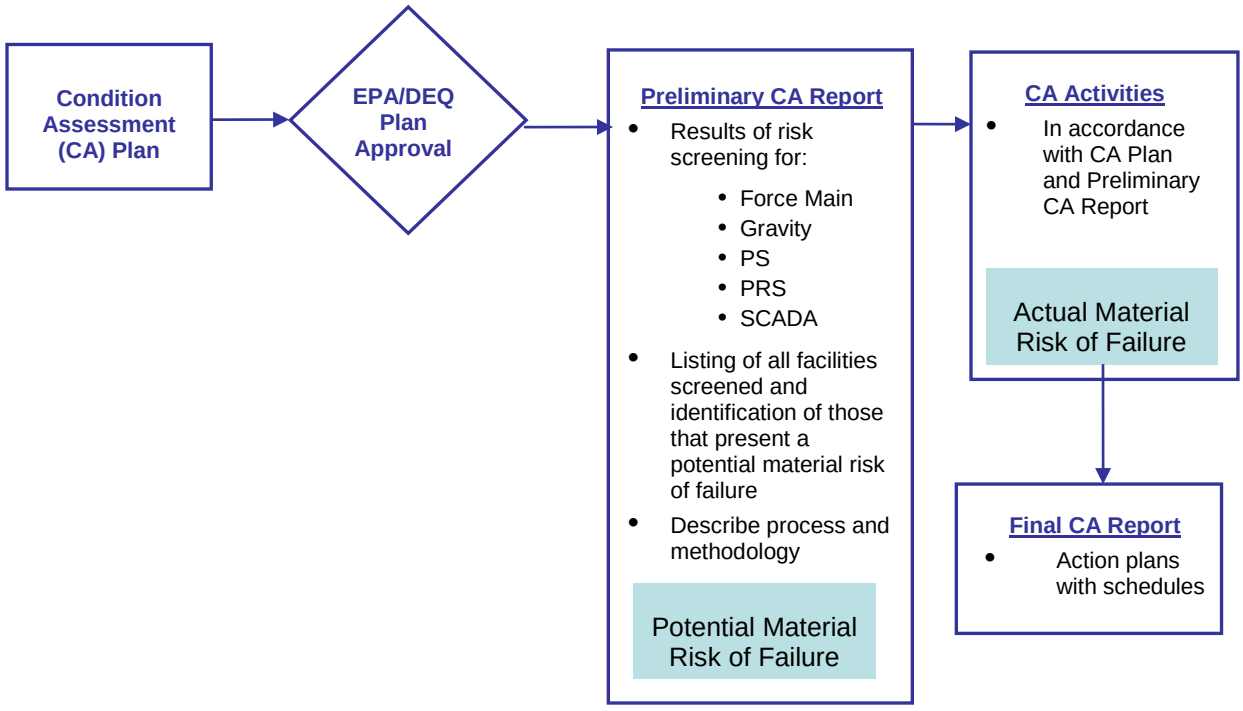

Figure 1-1. CAP Program Phasing

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2. SANITARY SEWER SYSTEM ANALYSIS

HRSD includes Condition Assessment as part of its normal operation and maintenance of the sanitary sewer system, and has done so since its formation. As part of this PCAR, HRSD has researched its recent records to obtain pertinent existing inspection reports related to condition assessment studies that may be useful in the development of the screening and prioritization of assets.

2.1 Review of Historical Records

Research of HRSD's records has been conducted to obtain pertinent existing inspection reports related to SSES and condition assessment studies that may be useful in the development of the Condition Assessment Plan. Inspections dating back to September 2005 have been researched to determine their compliance with industry standards and the CAP approach.

2.1.1 Force Main Inspections

HRSD routinely inspects exposed portions of its force main interceptor system as well as assets associated with the force mains within vaults or pits (i.e., in-line valves, pressure control valves, air release valves). Although a number of these inspections could be considered for exclusion from the Condition Assessment Activities, HRSD intends to complete a current inspection of the assets identified in this PCAR as documented in the CAP.

2.1.2 Pumping Facility Inspections

HRSD performs routine inspections and preventive maintenance of its pumping facilities; however, additional inspections will be performed at each pumping station and pressure reducing station as part of the field investigations for HRSD's pumping facilities. The HRSD SCADA system exists for the most part at HRSD pumping facility sites. These systems have been inspected routinely by HRSD staff including alarm testing and wiring assessments. Although particular aspects of HRSD's routine pumping facility inspections (e.g., wet well inspections, generator testing) could be considered for exclusion from the Condition Assessment Activities, HRSD intends to complete a current inspection of the assets identified in this PCAR as documented in the CAP. This inspection will include an analysis of historical flooding information to determine the potential for contribution of inflow to the sewer system at HRSD pumping stations.

2.1.3 Gravity Sewer Inspections

HRSD routinely performs internal inspection of gravity sewer within its system, including manhole inspections. Mainline inspection using CCTV has been completed using the NASSCO Pipeline Assessment and Certification Program (PACP) to provide standardization and consistency in the evaluation of sewer pipe condition. PACP trained and certified staff has been using PACP compliant software since September 2005. HRSD has also implemented a NASSCO Manhole Assessment and Certification Program (MACP); however, most existing manhole inspections were completed prior to MACP implementation and will not meet the requirements of the CAP. A table showing the gravity sewer inspections from October 2005 through 2009 is

included in Table C-1 of Appendix C. HRSD will complete a current inspection of its gravity sewer mains as part of the Condition Assessment Activities in this program.

2.2 Analysis of Sanitary Sewer System Data

HRSD collects various operations data from its collection system at numerous locations including flow measurements, pump station run time, pump station high level alarms, pipe failures, and sanitary sewer overflow data. This data is available upon request from the Localities, and data in this PCAR will be shared with the associated Localities. HRSD continues to expand its network of flow, pressure, and rainfall monitoring sites, and the Localities have been provided web access to HRSD's Telog server which houses the data. The following sections detail HRSD's analysis of data collected on these items.

In addition, a summary of the relationship between HRSD's wet well pump stations and Locality sewer basins is provided in Table B-5 of Appendix B. This is further demonstrated in the Figures A-1 through A-64 that depicts the collection areas for each HRSD wet well pumping station. This information is being provided to the Localities concurrently with the EPA and DEQ. No conclusions regarding pump station capacity may be drawn from this information. Pump station capacity will be analyzed as part of the Regional Wet Weather Management Plan (RWWMP).

2.2.1 Sanitary Sewer Overflow (SSO) Analysis

HRSD compiled a list of all recorded SSOs from October 2002 to December 2008 in a GIS geodatabase. Based on the data, there were slightly more than 250 recorded SSOs from HRSD's facilities since early October 2002. The database was sorted into three distinct infrastructure asset groups: force mains, pumping facilities, and gravity sewers. Table B-2 in Appendix B lists the SSOs that have appear to be associated with an HRSD pumping facility in this time period. Table B-3 narrows the list of SSO occurrences by eliminating those caused by operator error, third party action, or major storms. The nine dates associated with major storms, and also used for exclusion of Locality Overflow Point sites during the evaluation process, are:

- Tropical Storm (TS) Hanna 9/16/2002
- Isabel 9/18/2003
- TS Alex 8/2/2004
- TS Charley 8/14/2004
- Major Storm 10/08/2005
- Alberto 6/14/2006
- TS Ernesto 9/1/2006
- Major Storm 10/07/2006
- Major Storm 11/22/2006

This information on SSOs is used in the screening and prioritization of Section 3. Similarly, tables in Appendix C and D provide details on the SSOs related to HRSD's gravity sewer mains and force mains, respectively.

2.2.2 Pump Run Time Analysis

Excessive Pump Run Time is one criterion used for screening and prioritization of HRSD's pumping facility inspections. Section 4 of the CAP describes the process for determining Excessive Pump Run Time. The results were split into two categories: wet well pump stations containing constant speed pumps only, and wet well pump stations with VFDs or pumps with Flomatcher controls. The results for these two categories are depicted in Tables 2-1 and Table 2-2, respectively.

As a result of the way variable speed pumping stations operate, the threshold is not as clear as for the constant speed pumping stations. Limited data on pump RPM or pump controller output was available to conclusively determine the status of these VSD facilities; however, the run time data is provided in Table 2-2.

Table 2-1. Excessive Pump Run Time Analysis - Constant Speed Pumps

Pump Station No.	Pump Station Name	No. of Pumps	Excessive Pump Run Time Threshold (hrs)	Excessive Run Time Calculation (hrs)	Time Stamp of Peak Occurrence	Comments
NORTH SHORE						
219	Newmarket	3	48	53	4/21/2008 15:00	Peak occurrence is associated with wet weather event on 4/21/08
SOUTH SHORE						
102	Ashland Circle	2	24	28	8/10/2008 10:00	Also, long pump runs in early-July 2008
109	Dozier's Corner	2	24	41	12/11/2008 12:00	Peak occurrence is associated with wet weather event on 12/11/08
119	Park Avenue	2	24	25	12/11/2008 16:00	Peak occurrence is associated with wet weather event on 12/11/08
147	Chesterfield Blvd	2	24	32	12/11/2008 4:00	Peak occurrence is associated with wet weather event on 12/11/08

Table 2-2. Excessive Pump Run Time Analysis - VFD or Flomatcher Controls

Pump Station No.	Pump Station Name	No. of Pumps	Excessive Pump Run Time Threshold (hrs)	Excessive Run Time Calculation (hrs)	Time Stamp of Peak Occurrence	Comments
NORTH SHORE						
217	Langley Circle	3	48	60	4/22/2008 10:00	Peak occurrence is associated with wet weather event on 4/22/08
218	Morrison	2	24	32	12/11/2008 3:00	Peak occurrence is associated with wet weather event on 12/11/08
221	Patrick Henry	2	24	28	12/11/2008 8:00	Peak occurrence is associated with wet weather event on 12/11/08
225	Willard Ave	3	48	58	12/11/2008 14:00	Peak occurrence is associated with wet weather event on 12/11/08
231	Ford's Colony	2	24	35	12/11/2008 13:00	Peak occurrence is associated with wet weather event on 12/11/08
232	Greensprings	2	24	30	4/21/2008 13:00	Peak occurrence is associated with wet weather event on 4/22/08
SOUTH SHORE						
116	Norchester Street	2	24	34	9/24/2008 23:00	Peak occurrence is associated with wet weather event on 9/25/08
135	Suffolk	2	24	48	4/22/2008 9:00	Peak occurrence is associated with wet weather event on 4/22/08
145	Rodman Avenue	3	48	63	12/11/2008 12:00	Peak occurrence is associated with wet weather event on 12/11/08
146	Camden Avenue	3	48	69	12/11/2008 19:00	Peak occurrence is associated with wet weather event on 12/11/08

2.2.3 Pump Station Wet Well Levels

Data was analyzed for the 65 wet well pump stations within the HRSD sanitary sewer in order to determine which pump stations have a recorded history of high level alarms. The data set used for this analysis spanned over an 8-month period from 04/01/08 to 12/15/08 in hourly increments. It should be noted that there were data gaps in the SCADA database for the following dates: 7/1/08, 7/31/08 through 8/11/08, 9/30/08, and 12/31/08.

A pump station was labeled as having a recorded high level alarm for a specific calendar day if the pump station SCADA system recorded at least one high level alarm between midnight and the following midnight on that particular calendar day. Table B-4 in Appendix B lists the wet well pump stations which had recorded high level alarms that were not caused by operational procedures such as preventative maintenance execution and alarm testing false alarms. This table displays the number days that a legitimate high level alarm was recorded, as well as the date that the high level alarm occurred. An alarm was considered legitimate if it was not determined to be a test alarm, low level alarm, or caused by maintenance activities at the pumping station. This information is used in the screening and prioritization of Section 3.

2.2.4 Infiltration/Inflow Hydrographs

HRSD is a regional service provider that conveys wastewater flows from the Localities' systems with a relatively small amount of gravity sewer pipelines compared to its extensive force main network. As further described in this document, HRSD maintains an on-going program of gravity sewer inspection to identify defects in their limited gravity sewer system.

2.2.4.1 Flow Monitoring Program

HRSD installed temporary gravity sewer flow monitors in 2008 under the DEQ Special Order by Consent (SOC) to measure flows in its significant gravity sewer lines. In practice, HRSD intends to build the Regional Hydraulic Model based on the input flows from the Localities contributing flow in the system, and use the results of the gravity sewer flow monitoring to provide additional model calibration data. Only areas where HRSD owned a significant amount of gravity sewer upstream of its pumping station were considered for gravity flow monitoring.

Some modifications to the Flow Monitoring Plan submitted to the EPA in April 2009 (as Appendix E to the Flow, Pressure, and Rainfall Monitoring Plan) have been made as detailed below. Most locations have been changed in ID number only with one exception (Sites 22 and 23). In addition, data from several sites in the City of Norfolk (not a party to the Consent Order with the DEQ) are included in this document that were not originally included in the Flow Monitoring Plan. The following is a list of modifications from the figures in HRSD's Flow Monitoring Plan:

- Ferebee Ave PS 110 (Chesapeake) - Site 22 and 23 on Figure 5-14 were combined into Site 22B after finding field conditions requiring only one flow meter to capture the flow to the site instead of two.
- Park Ave PS 119 (Chesapeake) - Renamed Site 23 (previously Site 24 on Figure 5-14) after elimination of one of the Ferebee Ave meters.
- Quail Ave PS 123 (Norfolk) - Renamed Site 24 (previously Site 25 on Figure 5-14) after elimination of one of the Ferebee Ave meters.
- State St PS 127 (Norfolk) - Renamed Site 25 (previously Site 26 on Figure 5-15) after elimination of one of the Ferebee Ave meters.
- Steamboat Creek PS 128 (Norfolk) - Renamed Site 26 (previously Site 27 on Figure 5-16) after elimination of one of the Ferebee Ave meters.

- Portsmouth Blvd (Shingle Creek) (Suffolk) - Renamed Site 27 (previously Site 28 on Figure 5-17) after elimination of one of the Ferebee Ave meters.
- Addition of Sites 28 through 37 in Norfolk.

2.2.4.2 Hydrographs

Appendix C includes hydrographs from each of the gravity sewer flow monitors documenting the peak flow event for each site during the initial flow monitoring period and the date periods which vary per site. The location of the flow meters is shown on the Gravity Flow Monitor Location maps in Appendix A. The actual flow values for each site have been fitted to a simple hydrologic model to represent the average flow pattern and match the peak wet weather flow. This is shown as the light blue Total Flow line in the graphs. The modeled Base Flow (the brown line) includes Base Sewage Flow and Dry Weather Infiltration. The rainfall amounts are shown inverted on a secondary Y-axis for each graph. By subtracting the Total Flow (light blue) from the Base Flow (brown), the rainfall dependent infiltration/inflow value has been calculated as shown in the dark blue line.

Table C-4 in Appendix C lists each flow monitor location, the jurisdiction it is in, and the rain event associated with each I/I Hydrograph presented. To show the rainfall derived I/I at each site, the most significant peak flow was selected from the available data, and as such, not all hydrographs present the date period where the largest amount of rain fell probably due to antecedent moisture conditions. For example, Site 26 received a 1-year rain event on September 26, 2008; however, the December 11, 2008, hydrograph (less than a 1 year event) presented the highest peak flow from the available flow monitoring data. Events where the system was surcharged were also excluded from the data presented.

HRSD is building its Regional Hydraulic Model using inputs from the Localities' hydrologic models. Per the Consent Order, the Localities are required to develop model inputs to HRSD's model using hydrologic methods. As such, HRSD will not be building separate hydrologic models for the downstream collection point of these Locality inputs. The I/I Hydrographs discussed in this section have been developed based on raw flow monitoring data and will not be used to develop the Regional Hydraulic Model. No comparison has been made between the flow monitoring data collected and the Peak Flow Threshold, as this is the responsibility of the Localities.

2.2.5 Pump Station Summary Table

A Pump Station Summary Table has been developed to document the relationship between HRSD's facilities and the Locality facilities. This table is organized by HRSD Pump Station and includes information such as:

- Upstream HRSD gravity sewer segments, linear feet of gravity main, and number of HRSD manholes;
- Associated HRSD flow monitor if applicable;
- Occurrence of Unresolved SSOs (see tables in Appendices B and C) in the gravity system or at the pump station;
- Exceedence of the Pump Runtime Threshold;
- Firm design capacity of the pumping facility and pump type; and
- Data on upstream Locality sewer basins as documented in their SSES Plans to the DEQ, including their Peak Flow Threshold and SSES status

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3. SCREENING, PRIORITIZATION, AND SCHEDULE

As discussed in Section 1, the CAP and PCAR are structured to outline HRSD's Condition Assessment Program for force mains, pumping facilities, and gravity sewers. Condition Assessment Activities will be performed on HRSD's sanitary sewer assets to provide an appropriate level of system information to support sound rehabilitation and/or replacement decisions.

HRSD has used a screening process in two ways: to prioritize gravity sewer and pumping facility inspection, and to identify and prioritize force main segments for field investigation that have the **potential** for material risk of failure.

3.1 Force Main Screening

Based on the preliminary failure history review, HRSD has identified force main segments having the **potential** for material risk of failure using a set of criteria listed below:

- Group 1: Force main segments which have a recorded failure during the previous ten years (1999 though 2008). Twenty-nine segments have been identified in this category that present the potential risk for additional failures.
- Group 2: Of the segments that have had a failure in the previous records (from 1989 through 1998), this group includes those where the consequence of failure exceeds a score of 200. Twenty-three segments (including the three described in the following paragraph) have been identified for this group.

The process described in the CAP was used to identify all force main segments which have the **potential** for material risk of failure. Any of the identified force main segments that are already scheduled for repair, replacement or rehabilitation in HRSD's Capital Improvement Program (CIP) have been removed from the list; however three segments that are included in the CIP overlap with the list of segments with failures since 1989. Portions of these three segments have been added to Group 2. Inspection will not be needed on the reminder of those segments since they are already scheduled for improvement.

Table D-3 in Appendix D details the fifty-two (52) force main segments totaling approximately 143,000 feet to be included in the Condition Assessment Activities based on the criteria described above. Rather than identify a specific order in which the inspections will occur for every line segment, they have been divided into groups based on the Grouping detailed above and the consequence of failure scores. System shut-downs and diversions require the HRSD field and operations staff to have flexibility to efficiently complete the field activities. Milestones have been established in the schedule for each Group (See Section 3.4 for additional schedule details.) The results of the screening, prioritization, and scheduling of force main inspections are shown in Table D-3.

A second set of force mains have been identified to be included in the Condition Assessment Program if they are ferrous material pipes (cast iron or ductile iron) and within 3,000 feet downstream of an HRSD pumping station. An ultrasonic wall thickness test on the exterior of these pipes at an approximate spacing of every 500 feet will be performed. Specific locations will be selected to coincide with documented high spots and to

avoid traffic, surface features, and conflicting utilities. Table D-4 provides the details on the sixty-nine (69) segments totaling approximately 90,000 feet that fit this criteria.

A third set of force mains have been identified to be included in the Condition Assessment Program if they fall within 500 feet of a Hampton Roads drinking water surface reservoir. Only the portion of each segment that is within this buffer is proposed to be included in the program. Twenty (20) force main segments totaling approximately 22,000 feet have been identified that meet these criteria and they are detailed in Table D-5 in Appendix D.

Similar to Groups 1 and 2 above, the "ferrous" and "reservoir" sets of segments have been prioritized based on their individual consequence of failure score and partially grouped by location to minimize remobilization expenses. Each of these groups is shown visually on maps in Figures D-1 and D-2 in Appendix D.

Table 3-1. Summary of Force Main Inspection Program

Criteria	Subgrouping	Segments	Approximate Linear Feet
Segments with failures	Group 1: Failures from 1999 to 2008	29	80,000
	Group 2: Failures from 1989 to 1998 with high Consequence of Failure	23	63,000
Ferrous pipe within 3,000 feet downstream of HRSD pumping facility		69	90,000
Force mains within 500 feet of drinking water reservoir		20	22,000

Note: Total segment number and linear footage that will be assessed may vary from values in table due to previous rehabilitation and inclusion in planned renewal and replacement program.

3.2 Pump Station and Pressure Reducing Station Screening

3.2.1 Screening Approach

Although HRSD will perform condition assessment of each of its pumping facilities, a screening system was developed to prioritize the Condition Assessment Activities. Each pumping facility was prioritized based on several weighted criteria and relative criticality factors. The rankings were developed using a numerical scoring system. The approach consists of the following steps:

- Identification of the qualifying criteria.
- Assign a weighting factor (score) to each criterion. The weighting factor helps characterize the relative importance of each criterion.
- For each criterion, identify a range of parameters or measures and assign values covering the range of parameters.
- Calculate the criterion score for each pumping facility by multiplying the criterion ranking times the criterion weight.

The prioritization of the pumping facility is then based on the sum of the individual criteria weighting points, with the highest total points representing the pumping facilities with highest priority for further evaluation.

The screening process for HRSD pumping facilities was divided into two independent models: one for wet well pump stations and one for pressure reducing stations. The qualifying criteria for wet well pump stations and pressure reducing stations within the HRSD system were independently established due to the variation of infrastructure components between these two types of pumping systems. For example, the use of high level alarm activation is an applicable qualifying criterion for prioritization of wet well pump stations, but is

not an applicable qualifying criterion for pressure reducing stations due to their closed-system configurations. The qualifying criteria and prioritization methodology for Wet Well Pump Stations and Pressure Reducing Stations are presented respectively as follows:

Wet Well Pump Stations

The qualifying criteria to prioritize wet well pump stations for Condition Assessment Activities are listed in Table 3-2. The wet well pump station prioritization analysis did not include the Lodge Road Pump Station (PS-233), since it is a newly acquired pump station (acquired by HRSD in 2008) that has been previously identified by HRSD as requiring condition assessment activities and will be included in Group 3.

Table 3-2. Wet Well Pump Station Qualifying Criteria

Qualifying Criteria	Description	Weighting Factor
Pump Station Size Based on Capacity	Pump Station size based on flow data derived from pump draw down tests, with the assumption that the largest pump is out of service.	30
SSOs Not Related to Major Storm Events, Operator Error, or Third Party Actions	Pump Station-related SSOs which occurred between the dates of Oct. 2002 and Dec. 2008 and were not caused by Major Storm events as listed in the November 26, 2007 LOP letter (e.g., tropical storms), Operator Error (e.g., incorrect valve operation or bypass pump failure), Third Party Actions (e.g., infrastructure damage by Contractor), or uncontrolled events (e.g., lightning strike).	40
Excessive Pump Run Time	Pump Stations which exceeded the Excessive Pump Run Time threshold, as defined in the RTS, between the dates of April 2008 and Jan. 2009.	10
Number of Days with High Level Alarms	The number of days in which a Pump Station had at least one recorded high level alarm between the dates of April 2008 and Dec. 2008.	20
TOTAL AVAILABLE POINTS		100

The prioritization criteria were applied to each of the 65 wet well pump stations analyzed, using a consistent ranking methodology and based on the operational data reviewed in Section 2 of this Plan. The higher the overall score, the higher the assessment priority is.

1) Pump Station Size Based on Capacity **(WEIGHT 30)**

What is the *relative* size of the wet well pump station as compared to the total number of wet well pump stations in the HRSD system?

Value Range	Rank
Very Large (>7.56 MGD)	10
Large (3.77 – 7.56 MGD)	8
Medium (1.54 – 3.77 MGD)	3
Small (<1.54 MGD)	1

2) SSOs Not Related to Major Storm Events, Operator Error, Third Party Actions (WEIGHT 40)

The value range for this criterion is the number of pump station-related SSOs **not** caused by Major Storm Events, Operator Error, or Third Party Actions during the past 5-year period.

Value Range	Rank
>4 SSOs	10
2 or 3 SSOs	8
1 SSO	3
0 SSOs	0

3) Excessive Pump Run Time (WEIGHT 10)

Do the pumps at the pump station experience excessive pump run time within the data range analyzed?

Value Range	Rank
Yes	10
No	0

4) Number of Days with High Level Alarms (WEIGHT 20)

The value range for this criterion is the number of days that the pump station had at least one recorded high level alarm within the data range analyzed.

Value Range	Rank
>5 Days	10
2 to 4 Days	8
1 Day	3
0 Days	0

Pressure Reducing Stations

The qualifying criteria to prioritize pressure reducing stations (PRSs) for Condition Assessment Activities are listed in Table 3-3. Fifteen of the 16 PRSs in the HRSD system were included in the prioritization model for pressure reducing stations, as the Lucas Creek PS does not function as a PRS even though it has the capability. The Lucas Creek PS is included in the Wet Well Pump Station Prioritization.

Table 3-3. Pressure Reducing Station Qualifying Criteria

Qualifying Criteria	Description	Weighting Factor
Pump Station Size Based on Capacity	Pump Station size based on pump card data specific to installed pumps, with the assumption that the largest pump is out of service.	40
Pump Station Age	Pump Station age based on record drawings.	60
TOTAL AVAILABLE POINTS		100

The prioritization criteria were applied to each of the 15 pressure reducing stations analyzed, using a consistent ranking methodology as follows.

1) Pump Station Size Based on Capacity **(WEIGHT 40)**

What is the *relative* size of the wet well pump station (in pumping capacity) as compared to the total number of pressure reducing stations in the HRSD system?

Value Range	Rank
Very Large (>25 MGD)	10
Large (18 – 25 MGD)	8
Medium (15 – 18 MGD)	3
Small (<15 MGD)	1

2) Pump Station Age **(WEIGHT 60)**

The value range for this criterion is the general age of the facility. Although components of the facility may have been replaced since the original construction, the overall facility age base on Record Drawings has been used in this process.

Value Range	Rank
>35 Years Old	10
30 to 35 Years Old	8
20 to 29 Years Old	3
<20 Years Old	1

3.2.2 Screening Results

The prioritization of the pumping facilities was based on the sum of the individual criteria weighting points, with the highest total points representing the pumping facilities with highest priority for Condition Assessment Activities. As this is a desktop model based on a variety of data, the accuracy to predict precise priority for Condition Assessment Activities is low. The fact that a particular facility received a higher score in this model does not imply that it is in worse condition than a lower ranking facility. Instead, HRSD has utilized this data to separate the pumping facility assets into three groups (Group 1, Group 2, and Group 3) for prioritization of Condition Assessment Activities. The results of this screening are shown in Appendix B, Table B-6 with the schedule detailed in Section 3.4.

SCADA screening corresponds to the pumping facility screening and Condition Assessment Activities will be performed according to the same prioritization.

3.3 Gravity System Screening

HRSD has been conducting condition assessment activities of its gravity sewer mains for a number of years. The approximately 50 miles of gravity sewer pipes are inspected periodically and certain higher risk segments are inspected annually. Since September 2005, the CCTV inspections have and will continue to utilize PACP compliant terminology and methods for defect rating and categorization. HRSD may use PACP Compliant Inspection conducted since September 2005 in lieu of new inspections. This existing program has previously identified significant defects which have been scheduled for rehabilitation and/or replacement. New significant defects are infrequently found as a result of this on going program.

HRSD has developed a prioritization for the field inspection of the gravity systems, giving higher weight to those with a previous history of sanitary sewer overflows as well as using the results of downstream flow monitoring to identify total rainfall derived infiltration/inflow and peak factors. Table C-3 in Appendix C lists the SSOs associated with each of HRSD's gravity mains. Information from the Flow Monitoring Program was also used to develop an association between each gravity main and the data recorded from flow monitors downstream. To complete the prioritization, the maximum RDII value in gallons from three storm events documented in the Flow Monitoring Program was identified, as well as the maximum observed wet weather peak factor on average daily flow.

A prioritization summary is provided in Table C-5 that lists the scores for each of these criteria with a weighting factor assigned. Previous history of SSOs was assigned a weighting factor of 50 while the RDII and Peak Factor criteria were each assigned 25. The scores for each gravity main were calculated and sorted in descending order. The last column in Table C-5 indicates the cumulative total of linear feet of the gravity mains in descending order. HRSD will follow the prioritization order as a guideline but intends to focus on milestones in the schedule of total linear feet inspected. Because some gravity mains are adjacent to others in differing priority levels, some adjustment to the order is expected during Condition Assessment Activities by grouping adjacent segments and assigning the higher priority to the group. The schedule in Section 3.4 details the milestones for the gravity main inspection program. If a sanitary sewer overflow or line failure occurs during the execution of this program, HRSD will redirect its resources to investigate that asset in an expedited manner.

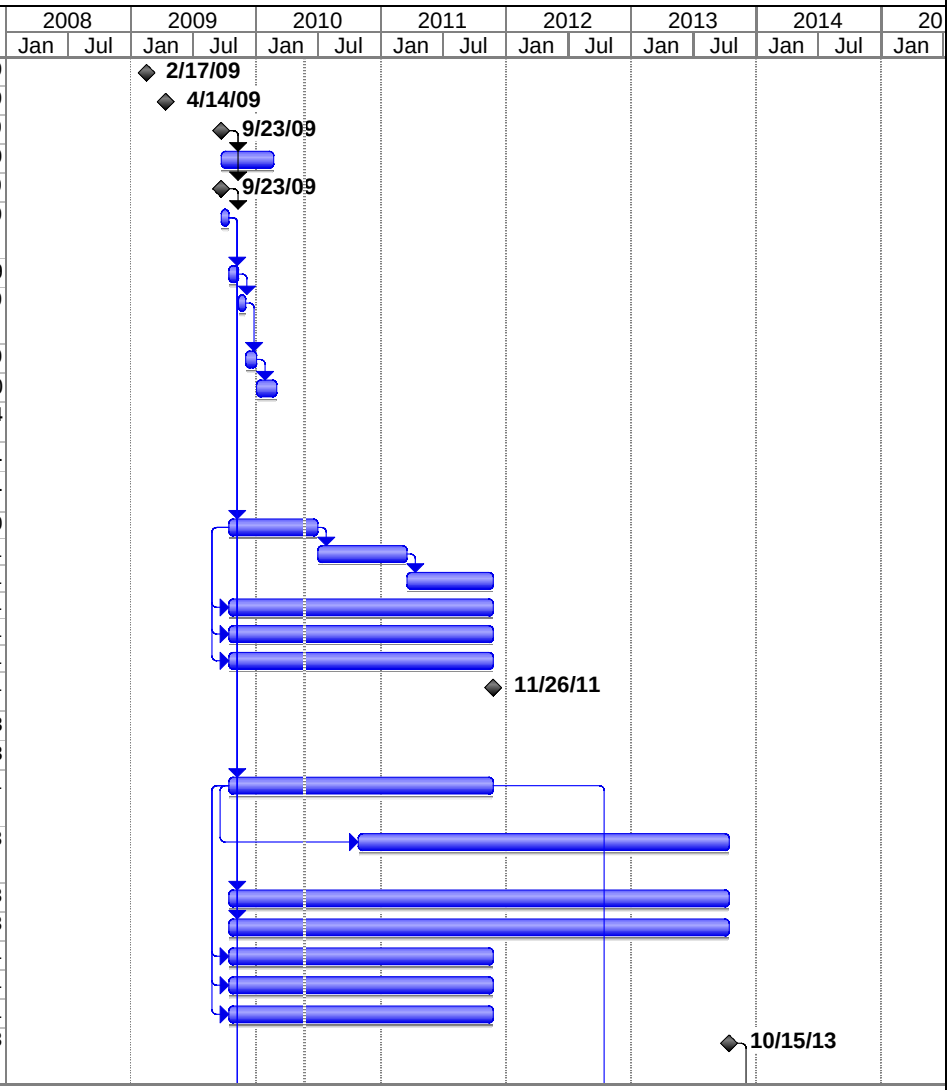
3.4 Condition Assessment Plan Implementation Schedule

A detailed assessment schedule has been developed based on the screening process described in Section 3 of this plan. The overall Condition Assessment Program schedule is included on Figure 3-1.

Figure 3-1. Program Schedule
(on following page)

HRSD CONDITION ASSESSMENT PROGRAM
PRELIMINARY CONDITION ASSESSMENT REPORT
FIGURE 3-1. PROGRAM SCHEDULE

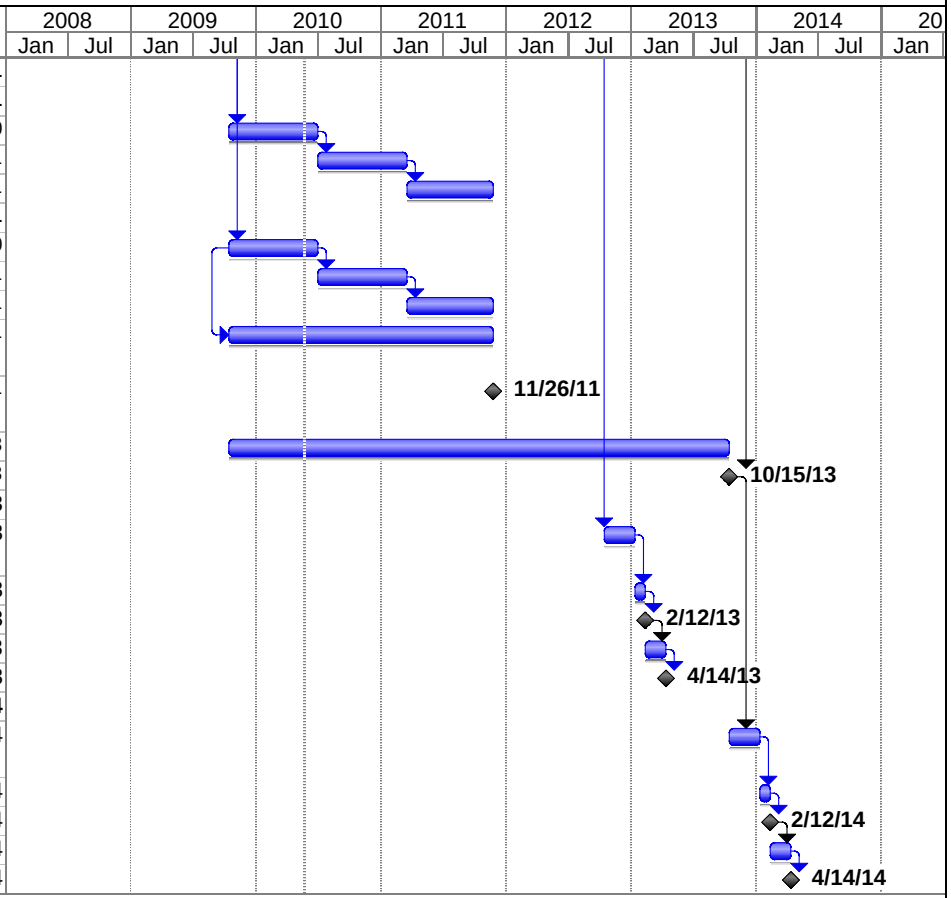
ID	Task Name	Duration	Start	Finish
1	Submittal of Condition Assessment Plan	0 days	Tue 2/17/09	Tue 2/17/09
2	Receipt of Comments from EPA	0 days	Tue 4/14/09	Tue 4/14/09
3	Submittal of revised Condition Assessment Plan	0 days	Wed 9/23/09	Wed 9/23/09
4	Approval from EPA/DEQ	153 days	Wed 9/23/09	Tue 2/23/10
5	Submittal of Preliminary Condition Assessment Report	0 days	Wed 9/23/09	Wed 9/23/09
6	Receipt of Comments from EPA/DEQ on Preliminary Condition Assessment Report	22 days	Wed 9/23/09	Thu 10/15/09
7	Prepare and submit revised PCAR	28 days	Thu 10/15/09	Thu 11/12/09
8	Receipt of Comments from EPA/DEQ on Preliminary Condition Assessment Report	21 days	Thu 11/12/09	Thu 12/3/09
9	Prepare and submit revised PCAR	32 days	Thu 12/3/09	Mon 1/4/10
10	Approval from EPA/DEQ on PCAR	59 days	Mon 1/4/10	Thu 3/4/10
11	**Condition Assessment Activities**	**1642 days**	**Thu 10/15/09**	**Mon 4/14/14**
12	**Pumping Facility Condition Assessment**	**772 days**	**Thu 10/15/09**	**Sat 11/26/11**
13	**Pumping Facilities Condition Assessment**	**772 days**	**Thu 10/15/09**	**Sat 11/26/11**
14	Group 1 Inspections (22 PS and 5 PRS)	260 days	Thu 10/15/09	Fri 7/2/10
15	Group 2 Inspections (22 PS and 5 PRS)	260 days	Fri 7/2/10	Sat 3/19/11
16	Group 3 Inspections (22 PS and 5 PRS)	252 days	Sat 3/19/11	Sat 11/26/11
17	Pump Draw-down Tests (66 PS)	772 days	Thu 10/15/09	Sat 11/26/11
18	Flood Analysis	772 days	Thu 10/15/09	Sat 11/26/11
19	Lightning Strike Protection Evaluation	772 days	Thu 10/15/09	Sat 11/26/11
20	Complete Pumping Facility Condition Assessment	0 days	Sat 11/26/11	Sat 11/26/11
21	**Force Main Condition Assessment**	**1461 days**	**Thu 10/15/09**	**Tue 10/15/13**
22	**Force Main Field Inspection**	**1461 days**	**Thu 10/15/09**	**Tue 10/15/13**
23	Group 1 Force Main Inspections (~80,000 feet)	772 days	Thu 10/15/09	Sat 11/26/11
24	Group 2 Force Main Inspections (~63,000 feet)	1083 days	Thu 10/28/10	Tue 10/15/13
25	Ferrous Pipe D/S of HRSD PS Inspections	1461 days	Thu 10/15/09	Tue 10/15/13
26	Reservoir FM Segments	1461 days	Thu 10/15/09	Tue 10/15/13
27	Inspect Force Main Appurtenances	772 days	Thu 10/15/09	Sat 11/26/11
28	Exposed Pipelines (Aerials, etc.)	772 days	Thu 10/15/09	Sat 11/26/11
29	Evaluate Cathodic Protection	772 days	Thu 10/15/09	Sat 11/26/11
30	Complete FM Condition Assessment Field Activities	0 days	Tue 10/15/13	Tue 10/15/13



Date: Thu 5/20/10 | 1 | Task | Milestone

HRSD CONDITION ASSESSMENT PROGRAM
PRELIMINARY CONDITION ASSESSMENT REPORT
FIGURE 3-1. PROGRAM SCHEDULE

ID	Task Name	Duration	Start	Finish
31	**Gravity Sewer System Condition Assessment**	**772 days**	**Thu 10/15/09**	**Sat 11/26/11**
32	**CCTV Inspections (PACP)**	**772 days**	**Thu 10/15/09**	**Sat 11/26/11**
33	Cumulative footage of 90,000 feet	260 days	Thu 10/15/09	Fri 7/2/10
34	Cumulative footage of 180,000 feet	260 days	Fri 7/2/10	Sat 3/19/11
35	Total remainder footage (~94,000 feet)	252 days	Sat 3/19/11	Sat 11/26/11
36	**Manhole Inspections (MACP)**	**772 days**	**Thu 10/15/09**	**Sat 11/26/11**
37	Cumulative of 450 manholes	260 days	Thu 10/15/09	Fri 7/2/10
38	Cumulative of 900 manholes	260 days	Fri 7/2/10	Sat 3/19/11
39	Total remainder manholes (~1,360)	252 days	Sat 3/19/11	Sat 11/26/11
40	Smoke and Dye Testing Program (as-needed for CCTV)	772 days	Thu 10/15/09	Sat 11/26/11
41	Complete Gravity Sewer System Condition Assessment	0 days	Sat 11/26/11	Sat 11/26/11
42	Prompt Repair Program	1461 days	Thu 10/15/09	Tue 10/15/13
43	Complete Condition Assessment Activities	0 days	Tue 10/15/13	Tue 10/15/13
44	**Final Condition Assessment Report**	**120 days**	**Mon 10/15/12**	**Tue 2/12/13**
45	Prepare Final Condition Assessment Report (on CA Activities through 8/15/12)	90 days	Mon 10/15/12	Sun 1/13/13
46	Prepare Action Plan	30 days	Sun 1/13/13	Tue 2/12/13
47	Submit Final Report to EPA/DEQ	0 days	Tue 2/12/13	Tue 2/12/13
48	EPA/DEQ to approve Final Report	60 days	Tue 2/12/13	Sat 4/13/13
49	Begin Implementation of Action Plan	0 days	Sun 4/14/13	Sun 4/14/13
50	**Final Condition Assessment Report Update**	**120 days**	**Tue 10/15/13**	**Wed 2/12/14**
51	Prepare Final Condition Assessment Report Update	90 days	Tue 10/15/13	Mon 1/13/14
52	Prepare Action Plan Update	30 days	Mon 1/13/14	Wed 2/12/14
53	Submit Final Report Update to EPA/DEQ	0 days	Wed 2/12/14	Wed 2/12/14
54	EPA/DEQ to approve Final Report Update	60 days	Wed 2/12/14	Sun 4/13/14
55	Begin Implementation of Action Plan Update	0 days	Mon 4/14/14	Mon 4/14/14



Task Milestone

Hampton Roads Sanitation District
1436 Air Rail Ave
Virginia Beach, VA 23455