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North Tahoe Public Utility District
Main Sewer Pump Station Master Plan

Introduction

The objective of the North Tahoe Public Utility District Main Sewer Pump Station Master Plan is to evaluate and recommend improvements for the four main sewer pump stations responsible for the export of sewage from the North Tahoe Public Utility District (District) service area to the Tahoe-Truckee Sanitation Agency water reclamation facility (T-TSA) for treatment. Included are a Capital Improvements Program and Implementation Plan for the recommended improvements and a suggested installation priority.

The District currently operates and maintains four (4) main sewer pump stations. The most easterly station, Secline, collects sewershed flows from its surrounding tributary area and pumps them west to the National station. The National station collects sewershed flows from its tributary area and the flow from Secline and conveys the combined flow to the Carnelian station. Similarly, sewershed flows in the area of the Carnelian station and the flow from the National station are collected at Carnelian, and the combined flows are pumped to the Dollar station. Dollar then pumps the combined sanitary sewer flow from the entire District service area, with the exception of a single satellite pump station, west over Dollar Hill to a gravity interceptor, the North Shore Export Line.

Each of the main sewer pump stations was designed for sewage flow rates far in excess of the actual flows the area produces now and even in excess of flows projected through the year 2029. This has resulted in pumping equipment and force mains that are over-sized for current needs. Oversized equipment leads to high energy costs from pump motors that are too large, do not operate efficiently and cycle on and off excessively. Oversized force mains result in low velocities and settling of solids within the pipe, leading to clogging, and extended retention time which contributes to odor problems.

In the years since the main pump stations were built, the District has retrofitted each station with at least one smaller pump; however, even these smaller pumps tend to be oversized for current flow rates and cycle on and off excessively.

In addition to the Capital Improvements Program and Implementation Plan, the Master Plan is comprised of Technical Memoranda 1, 2 and 3, as summarized in the following paragraphs.

Technical Memorandum 1

Technical Memorandum 1 includes discussion of data collection, flow monitoring, existing condition facility assessment, regulatory agency review, and risk assessment and risk management. The condition assessment for the structural aspects of all four main sewer pump stations showed a consistent damage pattern at each station: damage at pipe penetrations of the wet well structure, wet well interior surface damage due to exposure to raw sewage, and the existence of voids under the steel base plate of the dry well. Where these conditions are found, it is recommended that appropriate repairs be implemented as described in Section 3 of Technical Memorandum 1. Table 3.5 of Technical Memorandum 1 lists impaired check valves and isolation valves at each main pump station. It is recommended the District replace impaired valves to improve the operation and longevity of each pump station.

Technical Memorandum 2

Technical Memorandum 2 includes a discussion of design flow rate determination based upon flow meter data and the results of flow monitoring performed during the 2008 wet and dry seasons. A discussion of inflow and infiltration (I/I) rates experienced by the existing gravity collection system is also included. The estimated design flow rates resulting from Stantec's analysis of available flow data for each of the four main sewer pump stations are shown in Table I.1, Main Pump Station Design Flow Rates. Through a comparison of wet and dry season flow monitoring data, it was determined that approximately 36% to 44% of wet weather flow rates throughout the District service area may be attributed to I/I. The I/I rates listed are based upon a relatively short flow monitoring time span. See Technical Memorandum 2, Section 2 for additional discussion of I/I determination. See Technical Memorandum 2, Table 2.4, Inflow and Infiltration as a Percentage of Wet Weather Flow Rates, for a listing of the I/I wet weather flow rates estimated to be occurring in the service areas of the four main sewer pump stations. Installation of flow monitoring meters at each of the main pump stations, as recommended in Technical Memorandum 3, will allow a more accurate I/I determination over a longer time span. Because most I/I does not occur between the main sewer pump stations, but within other portions of the District service area, recommendations for I/I improvements should be made as part of future master planning efforts.

Technical Memorandum 3

Technical Memorandum 3 contains six sections. Section 1 provides general information regarding the four main sewer pump stations and briefly discusses the original system over-design which resulted in pumps and pipes too large for present day flows and even future projected flows through the year 2029.

Section 2 discusses the hydraulic criteria utilized for developing improvement alternatives. Recommendations for pump station improvements are based upon the criterion that each pump station must be capable of meeting a wide range of flow rates as well as the maximum anticipated flood flow. Table 2.1, Design Flow Ranges, lists the average dry season, peak wet season, and flood flow rates for the four main sewer pump stations. Several pump improvement alternatives are evaluated for each of the main pumping installations. The pump station improvement alternatives were additionally developed to meet the goal of installing multiple pumps of identical size at each pump station with variable frequency drive (VFD) units to modulate pump speed in accordance with flow rate and to minimize cycle times. For each of the pump alternatives discussed, plan and profile drawing exhibits are included in Appendix A. Hydraulic calculation spreadsheets are included in Appendix B, and pump data curves and dimension prints are provided in Appendix C.

Section 3 utilizes estimated design flow rates developed in Technical Memorandum 2 to determine the number and capacity of pumps in each main pump station alternative. Design alternatives were developed based upon a desire to reuse existing facilities to the extent possible as well as limit the disruption to service and inconvenience to the public that would occur due to major construction projects in and around Highway 28, the main thoroughfare through North Lake Tahoe. In general for each main pump station, two major categories of alternatives are presented: 1) installing new pumps in the existing pump station dry wells; or 2) converting to submersible pumps in existing or new wet wells. For each of the main alternatives, two or more variations based upon different makes and types of solids handling pumps are discussed. A pump station evaluation matrix, Table 3.6, was used to assist with ranking the pumping alternatives considered at each pump station. Each evaluation category was assigned a ranking of 1 through 5, with the larger number representing less risk or a more desirable condition. The ranking number assigned to each evaluation category is subjective and could be expected to vary somewhat based upon the reviewer's viewpoint; however, the total ranking provided by the evaluation matrix does assist with identifying the more desirable alternatives. The highest ranking was achieved by Alternative 1C, utilizing dry pit chopper pumps and existing force mains. The lowest-ranked alternatives reviewed were Alternative 2A, wet well with submersible pumps, and Alternative 2B, wet well with pump intake pre-rotation. The installation of appropriately sized vertical pedestal-mounted chopper pumps in the existing dry wells (Alternative 1C) is recommended for the retrofits at National and Carnelian, and the installation of horizontal non-clog dry pit pumps (Alternative 1A) is recommended at the Dollar station. While pump replacement options are explored for Secline, it is recommended that the Secline station be moved within five years to provide a state-of-the-art pumping system, and to allow the installation of three appropriately-sized chopper pumps. *Table E.1* shows a summary of the pump replacement recommendations.

TABLE E.1
Pump Replacement Recommendation Summary
Main Sewer Pump Station Master Plan

Pump Station	*Number of Pumps*	*Power per Pump (Horsepower)*	*Description*
Secline[1]	2	50	Alternative 1C (Tech Memo 3, Sec. 3.3): Replace existing dry pit pumps with new dry pit Vaughn chopper-type non-clog pumps, motors and VFD[2] control. Pumps are vertical pedestal-mounted.
National	3	40	
Carnelian	3	50	
Dollar	4	150	Alternative 1A (Tech Memo 3, Sec. 3.1): Replace existing dry pit pumps with new dry pit non-clog pumps, motors and VFD control. Pumps are mounted horizontally.

Source: Stantec Consulting

Note: [1] Recommended pump replacements are for the existing stations; however, it is recommended that Secline instead be relocated within 5 years. The new station should be designed to allow installation of three pumps to increase system redundancy and reliability.

[2] VFD – Variable frequency drive

Based on interviews with District operations staff, the Vaughan E-Series chopper pump currently installed at the Carnelian pump station has been operating successfully with minimal maintenance requirements. Further, the horsepower requirements for these pumps are comparable to those required for the non-clog dry pit pumps as discussed in Alternative 1A, meaning there would be minimal long-term power cost savings associated with using the non-clog pumps rather than chopper pumps. For these reasons, the Vaughan chopper pumps are a better overall selection. At the time of this writing, a pump (by Vaughan or any other manufacturer) meeting the high-head requirements experienced at the Dollar station could not be located; therefore, the horizontal dry pit pumps presented in Alternative 1A are recommended for this site.

The installation of smaller parallel force mains (Alternative 1B) as presented in Technical Memorandum 3 would offer a significant benefit by increasing pumping flexibility and maintaining self-cleaning pipe velocities at lower flows. Installation of the parallel force mains is recommended within 5 to 10 years, as explained in the Capital Improvements Program and Implementation Plan. The Dollar 22-inch force main, not currently in use, should be reconditioned to allow its use and increase system redundancy.

Section 3 also contains a discussion of additional considerations relating to the main pump stations including: the use of VFDs, pump control, ancillary equipment and future modifications to force mains.

Section 4 discusses the District's Supervisory Control and Data Acquisition (SCADA) system with regard to its existing and future ability to accommodate the recommended pump station alternatives. The following major components are covered: data acquisition, user interface,

alarming, historization, remote access, supervisory control and input/output capacity. The current SCADA system is adequate for current operations with regard to data acquisition; however, installation of SCADA equipment allowing the ability to gather pump flow rate and speed data for future VFD installations and the ability to monitor emergency generator status is recommended. The existing SCADA system user interface, alarm system, and historization interface are sufficient for current and future operation; however, existing remote access data acquisition and screen refresh rates are extremely slow. It is recommended that system bandwidth be increased to improve the remote accessibility. The existing SCADA system does not provide the ability for supervisory control. It is recommended that future SCADA improvements allow for the ability to remotely start and stop pumps, change pump lead/lag status, and adjust wet well levels and VFD speeds. Installation of VFDs will require analog output ability which the existing system lacks. Analog output modules will be needed at each pump station when variable frequency drives are installed. The VFDs will also allow a redundant Ethernet connectivity which could be used by the SCADA system for monitoring and control. Flow monitoring at each pump station can be readily accomplished by utilizing clamp-on Doppler flow meters; however, finding a suitable location for the meters within the pump station dry wells may be difficult with regard to meeting the requirements relating to setback from pipe flow turbulence.

Section 5 provides an assessment of electrical service capacity at each pump station for present and future needs. Each pump station is reviewed in turn.

The Secline pump station utilizes a trailer mounted portable generator. While the generator is in good condition, its conductors leading to the transfer switch should be reinstalled in code compliant conduit. If the Secline station were to remain in its current location, it would be recommended that the generator be permanently installed on a concrete pad; however, since the Secline station will likely be moved within the next few years, the permanent generator hookup is not recommended at this time. Secline's existing electrical service equipment is adequate to serve existing and future loading, but the existing generator may be undersized for future VFD pump loading.

A permanently installed generator serves both the National pump station and the nearby water treatment plant. When emergency power is needed the generator can only power one pump at the National pump station and one pump at the water treatment plant, which presents a risk to the District during times of peak demand. It is recommended that a generator load performance test be conducted to verify the generator's capability of operating at full load for a sustained period of time and to determine if an additional generator is required at the water treatment plant or a larger generator is required to serve both the sewer pump station and the water treatment plant.

The Carnelian pump station's electrical system is currently at full capacity. The existing permanently installed generator cannot serve the entire pump station operations at peak design flow rates; however, the existing electrical equipment will be adequate to serve future reduced loads. It is recommended that a load performance test be conducted to verify the station's capability of operating at full load for a sustained time period.

The Dollar pump station is equipped with a permanent indoor generator which is not capable of serving the entire existing or future Dollar and Dollar Addition pump operations at full load or peak design flow rates. The recommended future pump improvements at the Dollar station will require substantially less operating current. The existing electrical service equipment, other than the emergency generator, will therefore be adequate to meet future load requirements. It is recommended the District upgrade the existing emergency power capacity by retaining the existing generator to serve normal operational loads and by adding a second generator to provide emergency power during peak flow periods.

Overall, the existing lift station electrical equipment is adequately sized to service the recommended future pump loading. The Existing electrical equipment is in reasonably good condition, although most equipment is nearing the end of its normal service life and obtaining replacement parts will become more difficult in the future. Except for the Secline pump station whose electrical equipment may be relocated in the near future, it is recommended the District consider modernizing the electrical service equipment at this time.

Section 6 discusses the construction of a hydraulic model of the District's sewage collection and export system to quantify existing and expected future system performance of the four main sewer pump stations. This section documents construction and calibration of the hydraulic model and presents both the existing sewage export system and proposed pump station design alternatives evaluation results. After the hydraulic model was assembled, it was calibrated by comparing simulated system flow and pressure results to field observations recorded during wet well drawdown tests. The model accurately predicted actual steady state flow rates and pressures to within two percent or better. The model was also calibrated for extended period simulation (EPS) which can be used to estimate sewage travel times between pump stations.

The pipe roughness C-factor for the Carnelian force main needed to be reduced to obtain model results that matched pump test results. The reduced C-factor needed for calibration of the model indicates a high head loss in the force main possibly caused by a rough pipe interior, a blockage or air entrainment. It is recommended that testing of the existing air release / air vacuum valves in the Carnelian force main be conducted to verify that they are working properly.

The hydraulic model was also adjusted to allow it to perform fluid transient analysis. Velocity and pressure changes resulting from an event such as the starting and stopping of a pump can result in water hammer or other undesirable conditions that can damage pipes and fittings. Results from the existing system steady-state and EPS analyses indicate the sewage travel time from the Secline pump station to the Dollar force main varies from 28 to 33 hours. Transient analysis of the existing system indicates that the potential for water column separation in the Secline force main might occur if the Secline pumps were suddenly shut down. Additionally, transient analysis indicates negative pressures within the Carnelian force main occur at several locations, even though pressures generated are acceptable. The following fluid transient mitigation measures are recommended:

- Secline pump station and force main – Install a 1,500 gallon hydropneumatic tank at the Secline pump station. Replace existing check valves with an oil-cushioned swing check valve, or another acceptable non-slam check valve, to avoid valve slam.

- National pump station and force main – Install a 1,000 gallon hydropneumatic surge tank at the National pump station. Install air release / vacuum relief valves upstream of the force main high point. Replace existing check valves with an oil-cushioned swing check valve, or another acceptable non-slam check valve, to avoid valve slam.

- Carnelian pump station and force main – Install a 1,000 gallon hydropneumatic surge tank at the Carnelian pump station. Install an air release / vacuum relief valve upstream of the force main high point. Replace existing check valves with an oil-cushioned swing check valve, or another acceptable non-slam check valve, to avoid valve slam.

Capital Improvements Program

A Capital Improvements Program (CIP) is included after Technical Memorandum 3. This section lists the recommended main sewer pump station improvements identified based upon information presented in the Master Plan and includes conceptual-level estimates of cost for installation of those improvements. Timing for implementation of the recommended improvements is dependent upon the District's available funding and tolerance for risk. The CIP as shown in Table 1.2, Capital Improvements Program, includes associated estimated improvement costs and will assist the District in establishing a phased, flexible Implementation Plan for timely installation of the recommended improvements. A summary of projects recommended in this report is shown in *Table E.2, Master Plan Project Summary*.

TABLE E.2
Master Plan Project Summary
Main Sewer Pump Station Master Plan

CIP No.	*Station*	*Item*	*Priority*
MSPS-1	Secline	Immediate Condition Improvements	Urgent
MSPS-2	Dollar	Immediate Condition Improvements	Urgent
MSPS-3	Secline	1,500 Gallon Hydropneumatic Tank	Urgent
MSPS-4	National	1,000 Gallon Hydropneumatic Tank	Urgent
MSPS-5	Carnelian	1,000 Gallon Hydropneumatic Tank	Urgent
MSPS-6	National	Two (2) New Combination Air Valves	Urgent
MSPS-7	Carnelian	One (1) New Combination Air Valve	Urgent
MSPS-8	National	Generator	Short-Term
MSPS-9	National	Condition Improvements	Short-Term
MSPS-10	Carnelian	Generator Study	Short-Term
MSPS-11	Carnelian	Condition Improvements	Short-Term
MSPS-12	Dollar	Additional Condition Improvements	Short-Term
MSPS-13	Secline	Facility Replacement / Relocation i. Relocate Facility ii. Secline Force Main Relocation iii. Add Satellite Pump Station iv. Add Force Main from Satellite Pump Station v. Beach Properties Conversion	Short-Term
MSPS-14	National	Pump Improvements	Short-Term
MSPS-15	Carnelian	Pump Improvements	Mid-Term
MSPS-16	Dollar	Pump Improvements	Mid-Term
MSPS-17	Secline	Dual Force Main	Mid-Term
MSPS-18	National	Dual Force Main	Mid-Term
MSPS-19	Carnelian	Dual Force Main	Mid-Term
MSPS-20	Dollar	Recondition 22-inch Force Main	Mid-Term

Source: Stantec Consulting

Note: Urgent = 0-1 years, Short-Term = 0-5 years, Mid-Term = 5-10 years

MSPS – Main sewer pump station

Summary

Implementing the recommended urgent, short-term and mid-term improvements described in the CIP will result in annual expenditures approximating those shown in Figure 2.1 of the Capital Improvements Program and Implementation Plan. Urgent recommended projects should be installed within one year, short-term projects within five years, and mid-term projects within five to ten years of the present. Maintenance items and protecting existing equipment through the installation of surge tanks and air release valves are the focus of the urgent projects. Short-term projects consist of additional maintenance work, relocating the Secline main sewer pump station and updating some electrical and pumping equipment in the other main sewer pump stations. Mid-term projects consist of completing pumping equipment upgrades and installing parallel force mains to increase system redundancy and reliability. Completion of the recommended Master Plan projects should allow the District to continue to serve its customers in an efficient and reliable manner.

The Main Sewer Pump Station Master Plan is part of a larger sewer master plan update. The Capital Improvements Program and Implementation Plan should be re-evaluated as part of future periodic District master planning document updates. In particular, estimated construction costs for mid-term projects should be re-evaluated as additional information becomes available.

End of Executive Summary

North Tahoe Public Utility District
Main Sewer Pump Station Master Plan

Summary of Recommended Main Sewer Pump Station Improvements

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DATE:	July 31, 2009
PROJECT NUMBER	180101130

Introduction

Main sewer pump station improvements have been identified based upon the information presented in Technical Memoranda 1, 2 and 3 and a summary of the Master Plan project recommendations is presented here. Implementation timing for the recommended improvements is dependent upon risk tolerance and available funding. This section lists the recommended projects and provides conceptual level cost estimates to assist the District in establishing a phased, flexible Implementation Plan for installation of the recommended improvements.

Section 1 – Recommendations

1.1 Ranking and Description of Master Plan Projects

An evaluation matrix, *Table 1.1*, was utilized to assist with ranking the various Master Plan projects. Each project in the evaluation matrix was assigned a ranking of 1 through 5 for an evaluation criterion with a given weighting. The weighting for each criterion was determined through interviews with District staff. For each alternative, the evaluation criterion weighting was multiplied by the 1 through 5 ranking, then added together to arrive at a total score.

Following the project ranking exercise, each of the 20 Master Plan projects was assigned a designation beginning with "MSPS" for Main Sewer Pump Station, as listed

in *Table 1.2* at the end of this Section. *Table 1.2* also lists for each project the estimated cost (2009 dollars), the various benefits each project would provide to the District, and one or more events which would trigger project construction. The following projects are listed in order of priority, with the most urgent projects which require immediate attention followed by those which should be implemented in the short-term (within 0 to 5 years) and those which should be implemented in the mid-term (within 10 years).

1.1.1 MSPS-1: Secline Immediate Condition Improvements (Urgent)

Since Secline is recommended to be relocated within the next five years, only certain immediate structural condition improvements should be performed. These consist of repairs A, B and C from Subsection 3.2.1 of Technical Memorandum 1.

1.1.2 MSPS-2: Dollar Immediate Condition Improvements (Urgent)

Per the visual observation performed for the structural aspects of the Dollar station, it is recommended that repairs A, B and C from Subsection 3.2.1 of Technical Memorandum 1 be performed immediately. The additional repairs outlined in Subsection 3.2.1 can be completed within 5 years.

1.1.3 MSPS-3: Secline 1,500 Gallon Hydropneumatic Tank (Urgent)

Secline does not currently have surge protection in the force main downstream from the main sewer pump station. Based upon the hydraulic analysis presented in Technical Memorandum 3, a 1,500 gallon surge tank should be installed. This tank can be relocated when the new Secline station is built.

1.1.4 MSPS-4 and 5: National and Carnelian 1,000 Gallon Hydropneumatic Tank (Urgent)

The antiquated surge valves serving National and Carnelian are corroded and do not function as originally anticipated. It is recommended that the valves and vaults serving each station be removed and a 1,000 gallon surge tank be installed in their place, as determined from the hydraulic analysis presented in Technical Memorandum 3.

1.1.5 MSPS-6: National - Two (2) New Combination Air Valves (Urgent)

Two air release / vacuum relief valves should be installed upstream of the high point in the National force main to eliminate full vacuum pressures in this area.

1.1.6 MSPS-7: Carnelian - One (1) New Combination Air Valve (Urgent)

One air release / vacuum relief valve should be installed upstream of the high point in the Carnelian force main to eliminate full vacuum pressures in this area.

1.1.7 MSPS-8: National Generator (Short-Term)

A new generator should be installed and the existing generator dedicated to the National water treatment station.

1.1.8 MSPS-9: National Condition Improvements (Short-Term)

The structural condition repairs A, B and C from Subsection 3.2.1 of Technical Memorandum 1 are recommended to be completed within the next five years at the National main pump station.

1.1.9 MSPS-10: Carnelian Generator Study (Short-Term)

A generator study should be performed to test the adequacy of the existing generator.

1.1.10 MSPS-11: Carnelian Condition Improvements (Short-Term)

The structural condition repairs A, B and C from Subsection 3.2.1 of Technical Memorandum 1 are recommended to be completed within the next five years at the Carnelian main pump station.

1.1.11 MSPS-12: Dollar Additional Condition Improvements (Short-Term)

The structural condition repairs D, E, F and G from Subsection 3.2.1 of Technical Memorandum 1 are recommended to be completed within the next five years at the Dollar main pump station. In addition, the crumbling retaining wall and sloughing slope at the Dollar site should also be repaired in the short-term.

1.1.12 MSPS-13: Secline Facility Replacement / Relocation (Short-Term)

Options for upgrading the pumping equipment in the Secline main pump station were explored in Technical Memorandum 3; however, the Secline station is nearing the end of its serviceable life. This station has considerably more superficial structural damage than the other main pump station facilities. In addition, the size of the dry well is only adequate for two pumps rather than the three desired for system redundancy. Most importantly, the Secline station is located on the beach adjacent to Lake Tahoe making flooding a concern; it has been reported by District staff that in at least one previous flood event, lake water has lapped against the fence surrounding Secline.

It is recommended that the Secline facility be relocated within the next five years. The recommended Secline facility replacement relocation is a five-part project and the costs associated with each part are shown in *Table 1.2*. When the new Secline main pump station is constructed, a portion of the force main downstream from the station will need to be relocated. The properties along the beach upstream of the old Secline station will need to have their sewer services re-routed to a main in Highway 28 and a new satellite pump station in the vicinity of Coon Street and Highway 28 will need to be constructed to pump these flows through a new force main to the relocated Secline main station.

1.1.13 MSPS-14 and 15: National and Carnelian Pump Improvements (Short-Term)

The pumping equipment at the National and Carnelian main pump stations is recommended to be replaced at each station with three identically-sized vertical pedestal-mounted dry pit chopper pumps with variable frequency drive (VFD) units to modulate pump speed according to demand, as presented in Technical Memorandum 3. Installation of identical pumps allows a redundant spare to be installed at each station, as well as permitting the pumps to operate in a lead/lag configuration to balance run time between them and thereby reduce maintenance. Retrofit activities at each station would include installing the new pumps, motors and VFD controls.

1.1.14 MSPS-16: Dollar Pump Improvements (Mid-Term)

The pumping equipment at the Dollar main pump station is recommended to be replaced with three identically-sized horizontal dry pit non-clog pumps with VFD units. At the time of this writing, Stantec has not been able to locate any chopper pumps that can satisfy the flow and pressure requirements at the Dollar main pump station. Similar to the National and Carnelian stations, retrofit activities at Dollar would include installing the new pumps, motors and variable frequency drive (VFD) controls.

1.1.15 MSPS-17: Secline Dual Force Main (Mid-Term)

Hydraulic modeling performed as part of Technical Memorandum 3 revealed that a 10-inch diameter force main serving the relocated Secline main pump station would provide optimal cleaning velocity (Table 3.6 of Technical Memorandum 3). Therefore, after Secline is relocated it is recommended the District install a 10-inch diameter force main parallel to the current 14-inch force main to increase system redundancy and reliability.

1.1.16 MSPS-18 and 19: National and Carnelian Dual Force Main (Mid-Term)

It was determined through hydraulic modeling that a 12-inch and 14-inch diameter force main would provide optimal cleaning velocity downstream of the National and Carnelian main pump stations, respectively. It is recommended that within the next 10 years these parallel force mains be installed to increase system redundancy and reliability.

1.1.17 MSPS-20: Dollar – Recondition 22-inch Force Main (Mid-Term)

The Dollar main pump station is served by a 16-inch force main installed in the 1990s which is correctly sized for current sewage flow rates. This main is aligned parallel to the original 22-inch force main, not in use at this time. The 22-inch main should be reconditioned using one of two methods: slip-lining with high density polyethylene (HDPE) pipe, or using Insituform Cast-In-Place Pipe (CIPP). The CIPP option is estimated to be more expensive, but may be more practical due to the steep grade of the Dollar force main and the ability to install the flexible CIPP without excavating a pit at either end of the line. For the purpose of this Master Plan, the approximate cost for the CIPP option is presented in *Table 1.2*.

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TABLE 1.1
Master Plan Project Ranking Summary
Main Sewer Pump Station Master Plan

		Secline				National						Carnelian						Dollar		
Description	*Weighting (%)*	*Immediate Condition Improvements*	*Surge Tank*	*Facility Replacement / Relocation*	*Dual Force Main*	*Condition Improvements*	*Two (2) Combination Air Valves*	*Surge Tank*	*Generator*	*Pump Improvements*	*Dual Force Main*	*Condition Improvements*	*One (1) New Combination Air Valve*	*Surge Tank*	*Generator Study*	*Pump Improvements*	*Dual Force Main*	*Immediate Condition Improvements*	*Additional Condition Improvements*	*Pump Improvements*
Sanitary Sewer Overflow Risk to Environment	14.6	4	5	4	4	3	5	5	4	4	4	3	5	5	4	4	4	4	3	4
Force Main Export Pipeline Breakage / Failure Risk	16.9	2	5	3	5	2	5	5	1	1	5	2	5	5	1	1	5	2	2	1
Pump Station Equipment Failure Risk (Incl. Sewage Backup)	10.8	5	5	5	1	3	5	5	5	5	1	3	5	5	5	5	1	5	3	5
Structural Failure Risk	9.2	5	1	4	1	4	1	1	1	1	1	4	1	1	1	1	1	5	4	1
Code Compliance (Incl. Personnel Safety and Chemical Risk)	10.8	5	1	5	4	4	1	1	4	4	4	4	1	1	4	4	4	5	4	4
Reliability and Redundancy	9.2	1	4	5	5	1	4	4	5	5	5	1	4	4	5	5	5	1	1	5
Capital Cost	0.8	3	3	1	1	3	3	3	3	3	1	3	3	3	3	3	1	3	3	3
Operation and Maintenance Costs (Incl. Standardization)	1.5	4	5	5	5	2	5	5	4	4	5	2	5	5	4	4	5	4	2	4
Ease of Construction (Incl. Property Considerations and Public Disruption)	1.5	5	3	1	1	5	3	2	4	4	1	5	3	2	4	4	1	5	5	4
Power Costs (Incl. Efficiency and Power Requirements)	3.1	1	2	5	1	1	1	1	5	5	1	1	1	1	5	5	1	1	1	5
Urgency	21.5	5	4	2	1	4	4	4	4	2	1	4	4	4	4	2	1	5	4	2
TOTAL		381.9	374.9	368.2	287	301.2	371.8	370.3	343.6	300.6	287	301.2	371.8	370.3	343.6	300.6	287	381.9	301.2	300.6

TABLE 1.2
Capital Improvements Program
Main Sewer Pump Station Master Plan

						Benefits						
CIP No.	*Station*	*Item*	*Estimated Cost (2009 Dollars)*	*Priority*	*Recommended Time Frame*	*Maintain asset*	*Reduce risk of sanitary sewer overflows*	*Increase reliability and redundancy*	*Increase efficiency*	*Reduce odor and corrosion*	*Reduce risk of pump station equipment failure*	*Trigger*
MSPS-1	Secline	Immediate Condition Improvements	$230,000	Urgent	2010	x						Safety
MSPS-2	Dollar	Immediate Condition Improvements	$240,000	Urgent	2010	x						Safety
MSPS-3	Secline	1,500 Gallon Hydropneumatic Tank	$234,000	Urgent	2010	x	x	x			x	Desire enhanced system protection
MSPS-4	National	1,000 Gallon Hydropneumatic Tank	$234,000	Urgent	2010	x	x	x			x	Desire enhanced system protection
MSPS-5	Carnelian	1,000 Gallon Hydropneumatic Tank	$234,000	Urgent	2010	x	x	x			x	Desire enhanced system protection
MSPS-6	National	Two (2) New Combination Air Valves	$39,000	Urgent	2010	x	x	x				Desire enhanced system protection
MSPS-7	Carnelian	One (1) New Combination Air Valve	$20,000	Urgent	2010	x	x	x				Desire enhanced system protection
MSPS-8	National	Generator	$200,000	Short-Term	2011		x	x				Desire increased reliability
MSPS-9	National	Condition Improvements	$240,000	Short-Term	2010-2011	x						Increased structural degradation
MSPS-10	Carnelian	Generator Study	$6,000	Short-Term	2011		x	x				Desire increased reliability
MSPS-11	Carnelian	Condition Improvements	$240,000	Short-Term	2010-2011	x						Increased structural degradation
MSPS-12	Dollar	Additional Condition Improvements	$170,000	Short-Term	2010-2011	x						Increased structural degradation
MSPS-13	Secline	Facility Replacement / Relocation i. Relocate Facility ii. Secline Force Main Relocation iii. Add Satellite Pump Station iv. Add Force Main from Satellite Pump Station v. Beach Properties Conversion	 $2,500,000 $1,000,000 $1,500,000 $1,000,000 $1,000,000	Short-Term	2011-2014		x	x	x	x	x	Flood avoidance
MSPS-14	National	Pump Improvements	$590,000	Short-Term	2015	x	x	x	x	x	x	Velocity (odor and corrosion); lack of available parts; improved control
MSPS-15	Carnelian	Pump Improvements	$629,000	Mid-Term	2016	x	x	x	x	x	x	Velocity (odor and corrosion); lack of available parts; improved control
MSPS-16	Dollar	Pump Improvements	$1,212,000	Mid-Term	2017	x	x	x	x	x	x	Velocity (odor and corrosion); lack of available parts; improved control
MSPS-17	Secline	Dual Force Main	$700,000	Mid-Term	2016-1018		x	x		x		Velocity (odor and corrosion); force main breaks; desired redundancy
MSPS-18	National	Dual Force Main	$1,709,000	Mid-Term	2018-2019		x	x		x		Velocity (odor and corrosion); force main breaks; desired redundancy
MSPS-19	Carnelian	Dual Force Main	$2,736,000	Mid-Term	2018-2020		x	x		x		Velocity (odor and corrosion); force main breaks; desired redundancy
MSPS-20	Dollar	Recondition 22-inch Force Main	$385,000	Mid-Term	2019	x	x	x				Force main breaks; desired redundancy
Total			**$17,048,000**									

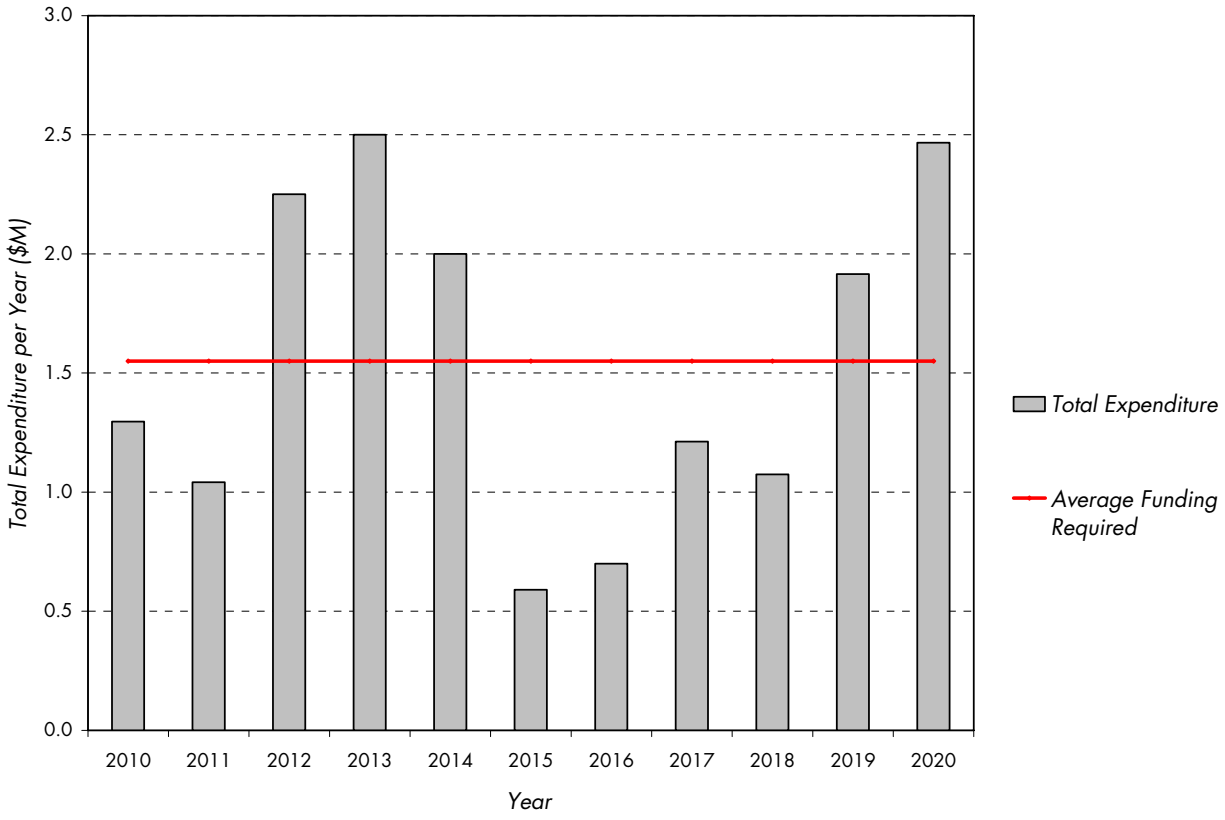
Urgent = 0-1 years Short-Term = 0-5 years Mid-Term = 5-10 years

Source: Stantec Consulting

Section 2 – Implementation Plan

One possible 10-year implementation plan resulting from the recommendations discussed in Section 1 is shown in *Figure 2.1*.

FIGURE 2.1
Implementation Plan
Main Sewer Pump Station Master Plan



Section 3 – Net Present Value Analysis

A net present value analysis was conducted for the recommended Master Plan projects using anticipated capital expenditures up to the year 2020. This analysis included the capital costs presented in *Table 1.2*. The inflation and internal rate of return assumed for this analysis was 5.5%. The analysis indicates a net present value totaling approximately 13 million dollars for implementing all recommended improvements included in the Capital Improvements Program.

Section 4 – Summary

Implementing the recommended urgent, short-term and mid-term projects described in Section 1 will result in annual expenditures similar to those shown in *Figure 2.1*. Maintenance items and protecting existing equipment through the installation of surge tanks and air release valves are the focus of the urgent projects. Short-term projects consist of additional maintenance work, relocating the Secline station and updating some electrical and pumping equipment in the main pump stations. Mid-term projects consist of completing pumping equipment upgrades and installing parallel force mains to increase system redundancy and reliability. Completion of the recommended Master Plan projects should allow the District to continue to serve its customers in an efficient and reliable manner.

The Main Sewer Pump Station Master Plan is part of a larger sewer master plan update. The Capital Improvements Program should be re-evaluated as part of future periodic District master planning document updates. In particular, estimated construction costs for the mid-term projects should be re-evaluated as additional information becomes available.

End of Capital Improvements Program and Implementation Plan