URBAN SYSTEMS MEMORANDUM

DATE:	January 29, 2025
TO:	Joel Clary, P.Eng.
CC:	Adrien d'Andrade, P.Eng.
FROM:	Kara Labelle, Alex Kempa, Mark Stafford, P.Eng.
FILE:	3275.0021.01
SUBJECT:	Sanitary Sewer Asset Management Plan: Infrastructure Prioritization & Capital Planning

1.0 INTRODUCTION

The Sanitary Sewer Asset Management Plan is a comprehensive, 20-year guide for managing the utility with regard to capital and select project improvements. This memo summarizes the results of a risk-based infrastructure assessment guided by the methodology outlined in the *Esquimalt Sanitary Sewer Asset Management Plan: Risk Prioritization* (August 14, 2024), attached in Appendix A to create a list of priority renewal projects for linear infrastructure and lift stations in the Township of Esquimalt (the Township). The outcomes of the risk assessment are integrated into various funding scenarios to help facilitate discussions with Finance and Council. As recommended herein, these discussions will focus on raising infrastructure funding needs, managing risk levels, and efficiently delivering projects to support the long-term service delivery of the sanitary sewer system. In addition to capital prioritization, the Township's operation and maintenance practices for the sewer system were reviewed, with recommendations to maintain and/or enhance service delivery based on best practices or insights from Township staff. The results from this review are appended and include high level cost estimates to give an order of magnitude understanding of the funding required to align with industry standards.

2.0 ASSET MANAGEMENT

The Township owns, operates, and maintains approximately 57.3 km of gravity sewers, 3.8 km of forcemains, and 13 pump stations. Each year, Engineering and Public Works replaces or refurbishes portions of this infrastructure to maintain system performance. Approximately 23% (based on pipe length) of the Township's linear sanitary sewer network has exceeded its design life, indicating an existing backlog of asset replacement. Based on discussion with the Township, historic capital spending levels for sanitary sewer rehabilitation drastically fluctuate, as rehabilitation efforts are primarily reactive. For the purpose of setting a baseline in this report, staff recommended using $1M. Further information on capital spending for the sanitary sewer is included in Section 4.0.

The total value of the Township's gravity assets, forcemains, and pump stations, based on the unit rates reported in the *Sanitary Asset Management Plan Unit Cost Estimating* (August 12, 2024) technical memo appended to this report, are approximately $223.3 M, $6.6 M, and $15.6 M, respectively. Many municipalities use a life-cycle planning approach to support capital planning and ensure adequate funding is invested and evenly distributed, year over year. For instance, the estimated service life of linear sewer assets ranges from 50 – 85 years depending on the material type. The life-cycle planning approach evenly distributes capital investments over this 50-to-85-year period which translates to an annual investment of roughly 1-2% of the total value of linear sewer infrastructure. In comparison, lift stations have a relatively shorter service life, (typically around 35 years), which means the annual investment is relatively higher (roughly 3 – 5% annually). Applying this approach to Esquimalt's linear assets and lift stations would require a minimum annual investment of approximately $3.5 M and $0.4 M respectively, for a total average annual life cycle investment (AALCI) of $3.9 M. The AALCI becomes a key metric for comparison in Section 4.0 which explores the gap between existing spending levels, the cost of capital needs determined through the risk assessment, and sustainable funding levels based on the AALCI. Closing the gap between existing spending and funding targets is largely influenced by the existing cost recovery mechanisms funding service delivery. Therefore, the following section provides an overview of the Township's current sanitary sewer funding sources.

2.1 SANITARY SEWER FUNDING MECHANISMS

The Township currently funds sanitary sewer rehabilitation through property taxes. A portion of the Township's annual property tax revenue is allocated to the maintenance and improvement of public infrastructure, including the sanitary sewer system. These funds support capital projects like the construction of new sewer lines, pump stations, or upgrades to existing infrastructure. Currently, there is no utility fee specific to sanitary sewer use within the Township (e.g., a sanitary sewer user fee). Overall, a dedicated utility fee can help ensure there is adequate funding to address important cost pressures, leading to a more equitable and sustainable funding model for maintaining and operating a utility.

Understanding the funding sources and fee structure of Esquimalt's sanitary sewer system is essential for identifying factors that can be adjusted to meet risk-based capital requirements and achieve sustainable funding goals. Related recommendations are outlined in Section 5.0.

3.0 RISK ASSESSMENT RESULTS

Risk rankings consider and weigh an asset's likelihood to fail, which is determined by condition and capacity, and the associated consequence should it fail, informed by a triple bottom line evaluation of financial, social and environmental risks. These rankings are assigned on a scale from priority 1 through priority 3 for linear assets and lift stations, defined as follows.

- **Priority 1 (P1):** Projects that exhibit the highest level of risk, associated with an elevated likelihood of failure triggered by both condition <u>and</u> capacity concerns, and an elevated consequence of failure.
- **Priority 2 (P2)** Projects not already captured by P1 that have a moderately high level of risk driven by either:
  - A high likelihood of failure (triggered by condition <u>and</u> capacity) but less severe consequence, relative to P1 assets.
  - A moderate likelihood of failure (trigged by condition <u>or</u> capacity, but not both) and a high consequence of failure.
- **Priority 3 (P3):** Projects that exhibit modest risk, driven by a moderately high likelihood of failure (triggered by condition <u>or</u> capacity, but not both) but with less severe consequences of failure.
- **Non-Ranked:** all other projects in the sewer network.

These priority rankings are first assigned to assets based on existing conditions (e.g., existing flows), referred to as the existing scenario. Assets prioritized under the existing scenario are required to address deficiencies, driven by condition and/or capacity concerns that exist today. Typically, assets identified as priorities under the existing scenario are recommended for renewal in the next 10 years. This process is repeated for the future scenario which identifies renewal needs to accommodate increases to sewer flows from population growth, and deteriorating asset condition. Assets flagged for renewal under the future scenario are typically recommended for replacement in years 11 – 20.

In addition to priority rankings, linear assets are also assigned priority triggers, which identify the reason for asset prioritization. These triggers are further described below and are included as a field in the enclosed list of risk assessment results:

- **Capacity**: The asset is deemed capacity deficient only.
- **Condition:** The asset is deemed condition-deficient only. Condition is informed by CCTV data, or by asset age if CCTV data is not available.
- **New main**: The asset does not currently exist within the Township's network, and is proposed as a new asset to resolve a capacity deficiency elsewhere.
- **Capacity project:** The asset becomes capacity deficient as a result of an upstream upgrade that releases backlogged flows. Without upstream upgrades, assets with this trigger are otherwise operating sufficiently under existing conditions. To account for these instances, project numbers are assigned to assets required to resolve hydraulic deficiencies. All assets with the same project number must be resolved together to address deficiencies. Therefore, all assets with a common project number are assigned the same priority ranking based on the highest risk asset in the group. For example, if a project consists of two pipes, one that is not prioritized, and one that is ranked a P1, both pipes in this project receive a modified prioritization ranking of P1. A project number field is included in the enclosed risk results for gravity assets.
- **Abandon:** The asset is to be abandoned as part of a project to resolve a capacity deficiency in the network. The asset may or may not be deficient itself.
- **Capacity deficiency resolved through rerouting upstream flow:** The asset is capacity deficient but does not require upgrade as upgrades recommended elsewhere in the network will resolve its deficiency.
- **Plug**: The asset is to be deactivated ("plugged")

The existing and future prioritization results are discussed in following subsections. A more comprehensive list of individual asset prioritization ratings are included in the accompanied attachment. This file also specifies other critical and supporting information for each prioritized asset including (but not limited to):

- Likelihood of failure score – including condition and capacity scores
- Consequence of failure scores – including financial, social, and environmental scores
- Priority rating – as described above
- Priority trigger – as described above
- Existing and future replacement cost. Where existing costs reflect like-for-like replacement (i.e., no capacity upgrades) and demonstrate the existing value of the utility, and future replacement cost which accounts for pipe upsizing, where deficiencies have been identified.

3.1 EXISTING SCENARIO PRIORITY SUMMARY

The following section discusses the prioritization results for gravity mains, forcemains, and pump stations based on existing conditions. The locations of the prioritized assets are displayed in Figure 1.

3.1.1 Gravity Mains

Table 1 outlines the gravity mains recommended for renewal to address existing condition and/or capacity deficiencies. In total, approximately 13.2 km of pipe are recommended for replacement, equating to approximately 23% of the Township's total network length. It should be noted that the costs included in Table 1 reflect full asset replacement, and account for any pipe upgrades needed to resolve capacity deficiencies identified by the hydraulic model. In some cases, alternative renewal options, such as relining or point repairs, may be considered for condition-deficient pipes, granted there are no capacity deficiencies associated with that asset. Given the high number of condition-driven assets, discussed further below, alternative approaches to full replacement should be evaluated for suitability on a case-by-case basis. Therefore, to remain conservative, the recommended costs herein assume full replacement.

As shown in Table 1, P3 assets account for the majority of prioritized assets (approximately 12% of the total network length), followed by P2 assets (approximately 6% of the total network) and P1 assets (approximately 5% of the total network). Assets triggered solely by condition account for 93% and 97% of the P2 and P3 assets, respectively. Overall, approximately 75% of the prioritized assets (based on replacement cost) are triggered by condition only, emphasizing the deteriorating nature of the Township's sewer network.

It should be noted that of all assets triggered by condition, only one of these assets is triggered based on age (SGM0060, ranked as P3), the remaining condition-triggered priorities are informed by closed circuit television (CCTV) inspection. Because assets are known to both out- and under-serve their design lives, this influences the confidence of capital decisions based on age, whereas CCTV inspection offers a more accurate assessment of asset condition and therefore improves the confidence of capital decision making. Although not a major consideration for the existing scenario priorities, in general, it is recommended that any asset triggered by condition, informed by age (i.e. SGM0060), be inspected by CCTV ahead of complete replacement to confirm the extent and timing of the upgrade. As a best practice, the Township should also aim to complete point repairs or rehabilitation of assets that are structurally failing based on CCTV inspection within 1-year of inspection.

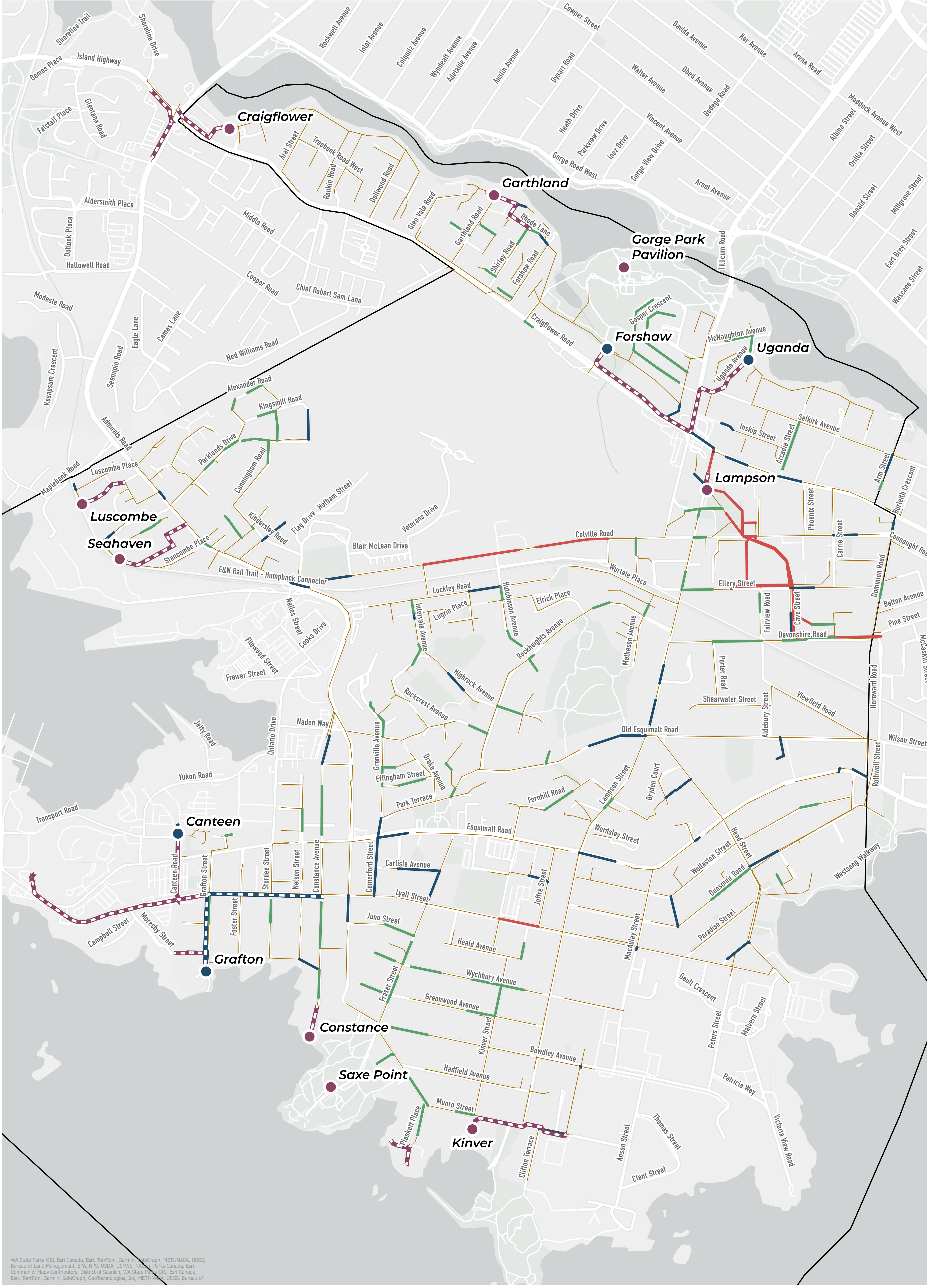
It should be noted that the following assets are trigged under the existing scenario based on condition, however, require upgrades in the future scenario to resolve capacity deficiencies: SGM0945 and SGM0037. These pipes are flagged to assist the Township in proactive planning, and to avoid a scenario where these assets undergo like-for-like replacement to resolve condition concerns, followed shortly by the need for additional capacity to accommodate future growth. Under existing conditions, these assets have prioritization rankings of P2 and P3, respectively, and total nearly 146 m in length, and $0.74 M in renewal costs (including upgrades) which are captured in the Table 1 summary.

Table 1: Existing Scenario (Years 1-10) Priorities and Triggers

EXISTING PRIORITIZATION AND TRIGGERS	ASSET COUNT	LENGTH (KM)	PERCENT OF PRIORITIZATION CATEGORY (BY LENGTH)	REPLACEMENT COST (2024 $)
P1	**39**	**2.74**		**10,574,000**
Condition and capacity	2	0.18	6.57%	883,000
Capacity[1]	9	0.58	21.17%	3,086,000
New main	10	0.71	25.91%	3,446,000
Capacity project only, no other triggers	6	0.51	18.61%	2,433,000
Abandon	11	0.62	22.63%	-
Plug[2]	1	0.13	4.74%	725,000
P2	**60**	**3.70**		**16,518,000**
Condition and capacity project	1	0.10	2.70%	536,000
Capacity	1	0.004	0.10%	21,000
Condition	56	3.44	92.97%	15,087,000
Capacity project only, no other triggers	2	0.16	4.32%	874,000
P3	**105**	**6.76**		**23,318,000**
Condition and capacity project	1	0.05	0.74%	204,000
Condition	101	6.57	97.19%	22,457,000
Capacity project only, no other triggers	2	0.07	1.04%	226,000
Condition, and capacity deficiency resolved through rerouting upstream flow	1	0.07	1.04%	431,000
TOTAL	**204**	**13.20**		**50,410,000**

[1] *Recall, P1 assets are triggered by condition and capacity deficiencies. The assets in this category (P1 capacity) are capacity-deficient (but not condition deficient), however, receive a priority ranking of P1 because they are part of a project group that contains a P1 pipe, driven by condition and capacity. As a reminder, assets in a common project group must be resolved together to resolve deficiencies and are therefore assigned the priority ranking of the highest risk asset in the group.*

[2] *Related to catchment reallocation to address CRD allocation deficiency for head connection.*



URBAN SYSTEMS

Project #: 3275.0021.01
Author: RB
Checked: KL
Status:
Revision: A
Date: 2024 / 12 / 16

0 100 200 300
Meters

Coordinate System: NAD 1983 UTM Zone 10N

Scale: 1:11,500 (When plotted at 11"x17")

Data Sources:
- Township of Esquimalt
- GeoAdvice
- Urban Systems Ltd.

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Legend

Gravity Main Prioritization
- P1
- P2
- P3
- Gravity Main

Forcemain Prioritization
- P2

Force main

Pump Station Prioritization
- P2
- Pump Stations

Township Boundary

Township of ESQUIMALT

Sanitary Asset Management Plan

Existing Prioritization

U:\Projects_VIC\3275\0021\01\D-Design\GIS\Projects\Pro_Projects\Pro_Projects.aprx\Figure XX Existing Prioritization

3.1.2 Pump Stations and Forcemains

Table 2 outlines the pump stations recommended for renewal to address existing condition and/or capacity deficiencies. The condition of each lift station was determined through site inspections completed in 2023 that evaluated the condition of approximately 33 sub-components, typically found as part of a lift station, across four functional disciplines, including civil, mechanical, electrical, and structural components. The individual condition scores for each component along with their importance weighting (representing their criticality to station operation) were used to determine overall condition scores for each lift station. The likelihood of failure scoring ranged from 1 to 5, where 1 indicates the lowest likelihood of failure due to condition, and 5 indicates the highest likelihood of failure due to condition. Additional details on this evaluation process and the lift station condition assessments are provided in the *Lift Station Condition Assessment Report* (Urban Systems, 2025).

For stations triggered by capacity deficiencies (e.g. Grafton, Forshaw, and Canteen), the upgrade costs in Table 2 conservatively reflect full station replacement, assuming that the entirety of the station will require upgrading/replacement to accommodate additional capacity needs. This means that upgrades to any capacity-triggered station will also resolve any condition-improvements identified in the *Lift Station Condition Assessment Report*. For stations triggered solely by condition deficiencies (e.g. Uganda), the replacement cost reflects the cost of addressing the specific component deficiency identified in the *Lift Station Condition Assessment Report* (e.g. kiosk improvements, valve chamber upgrades etc.) It is understood that for the Uganda pump station, condition-related upgrades have been initiated, and costs included in Table 2 reflect budgetary pricing provided during the scope development phase of the project. For more information on component replacement needs at each station, please refer to the *Lift Station Condition Assessment Report*.

It should be noted that while the Constance station is not prioritized in the existing or future scenario (i.e. it is not considered condition or capacity deficient by the risk methodology), field inspections have identified the station as needing a Human Machine Interface (HMI) replacement. Although the criticality of this component alone is not enough to trigger the station as a priority, replacement of the HMI is recommended when funds become available, and is therefore included in Table 2. It should also be noted that while the Lampson, Luscombe, and Kinver stations also exhibit existing condition-deficiencies based on field inspections, these stations are not prioritized under the risk methodology until the future scenario (unlike Constance which is not prioritized over the next 20 years). Therefore, the replacement needs for Lampson, Luscombe, and Kinver stations (totaling $228,000) are reported with future scenario results in Section 3.2.2.

Table 2: Existing Scenario Priorities - Pump Stations

PUMP STATION	EXISTING PRIORITY	EXISTING PRIORITY TRIGGER	UPGRADE COST (2024 $)
Grafton	P2	Capacity	1,893,000
Uganda	P2	Condition	313,680
Forshaw (Nursery)	P2	Capacity	1,893,000
Canteen	P2	Capacity	1,373,000
Constance	N/A – Complete condition-based upgrades when funds become available		4,180
TOTAL			**5,477,000**

Note, for the Canteen Pump Station, an investigation regarding this station's capacity should be conducted prior to proceeding with station upgrades, as the Dockyard station (upstream of the Canteen pump station) was assumed to operate as an ideal pump, impacting the modelled capacity of Canteen. Additionally, despite this station being deemed deficient from a modeling perspective, field draw down tests indicated that the pumping capacity of the station, approximately 20L/s, greatly exceeds the future peak flow needs estimated at only 2.6 L/s. Despite this, modelling results have identified circumstances during which the Canteen station may exhibit limited or deficient capacity, such as when multiple stations (i.e. Grafton, Dockyard and Canteen) are running simultaneously (due to the high pressure in the shared forcemains along Lyall Street) and/or during periods of heavy rainfall combined with only a single pump operating. These circumstances likely represent short-lived, infrequent, and highly conservative conditions which are not anticipated to cause station flooding (however, pump capacity may be exceeded, and backup may occur). Once these conditions are relieved (i.e. lag pump turns on, and other stations drain relieving shared forcemain pressure etc.), the Canteen station is predicted to operate at a sufficient capacity. Discussions with Township staff also confirm that the Canteen station has not been known to exhibit significant capacity concerns. Therefore, while the Canteen station has been identified as a capital priority, this prioritization reflects a suite of rather conservative and unique scenarios. Therefore, further investigation into the influences of the Dockyard pump station should be confirmed, along with downstream impacts on the Canteen pump station before pursuing upgrades to Canteen. The Township should also consider developing a robust set of SCADA controls and pump station programming such that coordination between stations and pumping priority can be determined in scenarios such as this.

Table 3 outlines the forcemains recommended for renewal to address existing concerns. While the assets in Table 3 are not deficient under existing conditions in terms of capacity nor condition, the proposed upgrading of the Grafton pump station (see Table 2) will require the simultaneous upgrades to the associated forcemains (from 150mm to 250mm, as specified in the enclosed risk assessment results). As a reminder, based on the risk methodology, forcemain capacity is assessed based on forcemain velocity. While the existing velocities of all forcemains are currently sufficient, upgrading the capacity of the Grafton pump station triggers deficiencies in the Grafton forcemain requiring upgrades simultaneous with the pump station. Therefore, the Grafton pump station and forcemain share the same prioritization ranking of P2. Note that the proposed upgrade sizes of the force mains along Lyall Street (SGM0026 and SGM0027), should be confirmed to accommodate the incoming flows of the Dockyard station, prior to the replacement of these assets.

Table 3: Existing Scenario Priorities - Forcemains

ASSET ID	PUMP STATION	LENGTH (KM)	EXISTING PRIORITY	EXISTING PRIORITY TRIGGER	TOTAL UPGRADE COST (2024 $)
SFM0025	GRAFTON	0.25	P2	Upgrade with Grafton station (P2)	410,000
SFM0026	GRAFTON	0.04	P2		68,000
SFM0027	GRAFTON	0.34	P2		586,000
TOTAL		**0.63**			**1,064,000**

3.2 FUTURE SCENARIO PRIORITY SUMMARY

The following section discusses the prioritization results for gravity mains, forcemains, and pump stations based on future conditions. The locations of the prioritized assets are displayed in Figure 2.

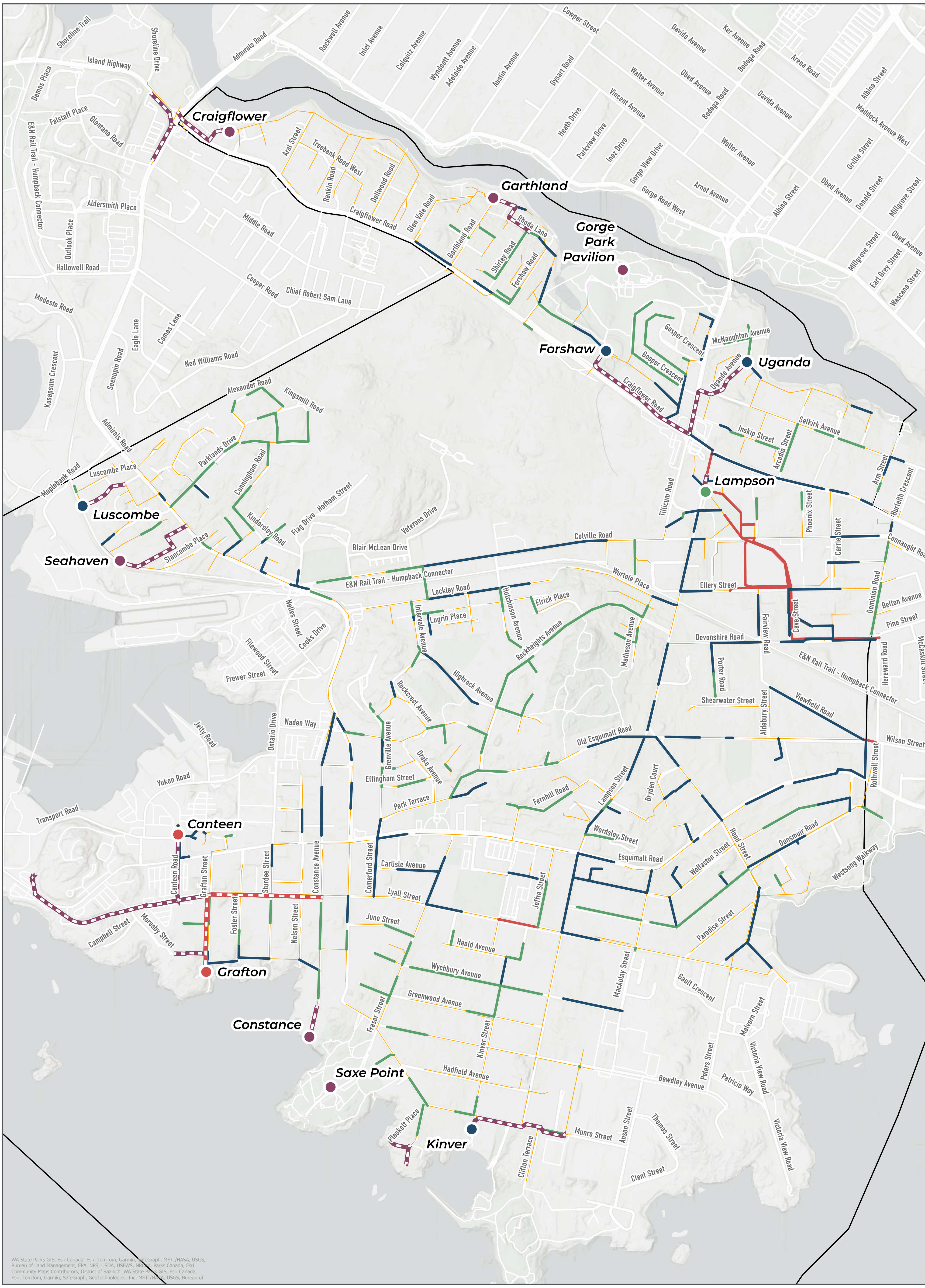
3.2.1 Gravity Mains

Table 4 outlines the gravity mains recommended for renewal to address future condition and/or capacity deficiencies driven by increases in flow from population growth and deteriorating asset condition. In total, approximately 13.1 km of additional pipe is recommended for upgrade in the future scenario, equating to approximately 22.5% of the Township's total network. Overall, the length of pipe prioritized in the future scenario is similar to that prioritized under existing conditions.

In contrast to priorities triggered under existing conditions, P2 assets account for the majority of prioritized assets in the future scenario (approximately 14% of the total network length), followed by P3 assets (approximately 9% of the total network) and P1 assets (approximately 0.1% of the total network). Approximately 96% of the prioritized assets (based on replacement cost) are triggered by condition only.

Similar to the existing scenario results, assets triggered by condition deficiencies in the future are predominately informed by CCTV, whereby existing CCTV scores are ranked on a scale of 0 – 5 (0 indicating no defects, and 5 indicating defects requiring immediate attention) and increased by a score of 1 to a maximum of 5 to account for pipe deterioration over the next 10 plus years. There are relatively more age-based priorities in the future scenario (48 pipes in total) compared to the existing scenario. These age-based priorities are distributed across priorities P2 and P3 and equate to approximately $13.9 M in replacement value. As a reminder, prioritized assets triggered solely by age should be inspected through CCTV ahead of replacement to confirm the pipe's condition. This consideration is incorporated into the recommendations presented in Section 5.0.

Costs in Table 4 conservatively reflect full asset replacement, however as stated in Section 3.1.1, alternative renewal options, such as relining, may be considered for assets deemed condition deficient, on a case-by-case basis.



URBAN SYSTEMS

Project #: 3275.0021.01
Author: RB
Checked: KL
Status:
Revision: A
Date: 2024 / 12 / 16

0 100 200 300
Meters

Coordinate System:
NAD 1983 UTM Zone 10N

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Legend

Gravity Main Prioritization
- P1
- P2
- P3
- Gravity Main

Forcemain Prioritization
- P1
- Force main

Pump Station Prioritization
- P1
- P2
- P3
- Pump Stations
- Township Boundary

Township of ESQUIMALT

Sanitary Asset Management Plan

Future Prioritization

U:\Projects_VIC\3275\0021\01\D-Design\GIS\Projects\Pro_Projects\Pro_Projects.aprx\Figure XX Future Prioritization

Table 4: Future Scenario (Years 11-20) Priorities and Triggers

FUTURE PRIORITIZATION AND TRIGGERS	ASSET COUNT	LENGTH (KM)	PERCENT OF PRIORITIZATION CATEGORY (BY LENGTH)	REPLACEMENT COST (2024 $)
P1	**2**	**0.04**		**157,000**
Condition and capacity	1	0.03	75.00%	126,000
Capacity[3]	1	0.01	25.00%	31,000
P2	**116**	**8.04**		**35,512,000**
Capacity	4	0.23	2.86%	1,037,000
Condition	108	7.60	94.53%	33,496,000
Capacity project only, no other triggers	2	0.11	1.37%	456,000
Condition, no capacity upgrade recommended, minimal surcharging	1	0.04	0.50%	253,000
Condition, and capacity deficiency resolved through rerouting upstream flow	1	0.06	0.75%	270,000
P3	**74**	**4.97**		**17,431,000**
Capacity	1	0.01	0.20%	47,000
Condition and capacity project	1	0.14	2.82%	515,000
Condition	72	4.82	96.98%	16,870,000
TOTAL	**192**	**13.05**		**53,100,000**

3.2.2 Pump Stations and Forcemains

Table 5 outlines the pump stations recommended for renewal to address future deficiencies and includes the Kinver, Lampson, and Luscombe pump stations. The condition of these stations was assessed through field inspections, and like the CCTV scores, were increased by a score of 1, to a maximum of 5 to account for deteriorating condition into the future. All pump stations identified for renewal in the future scenario are triggered by condition only (i.e. no stations are capacity-deficient). As such, the replacement costs shown in Table 5 represent the estimated costs of the specific components requiring replacement as identified through the field inspections.

[3] *While linear assets which are only capacity deficient cannot achieve a P1 by the risk methodology (i.e. only condition and capacity triggered assets can achieve the highest priority), if the asset is associated with a project that has a P1 asset within it, it will be assigned a P1 ranking as well.*

As discussed in Section 3.1.2, the risk methodology has classified the Kinver, Lampson, and Luscombe pump stations as future priorities, however field inspections have revealed component-based condition deficiencies exist today. These stations were not prioritized under the existing scenario through the risk methodology as the existing condition of the deficient *components* were not critical enough to influence the *entire* station's condition score such that the full station prioritization was triggered. This is a result of either a limited number of deficient components at a station, or those components were not deemed particularly critical to station operation, corresponding to a lower weighting of their condition scores in the calculation of the station's total condition score. Additional details related to the calculation of a station's condition score are provided in the *Lift Station Condition Assessment Report*. Overall, while the stations identified in Table 5 may be prioritized in the future scenario, it is suggested that deficient components identified through the field inspections be replaced as soon as funds become available within the next 10-years. As such, the replacement cost for these three stations is allocated under the first 10-years of the capital plan in Section 4.0.

Table 5: Future Scenario Priorities - Pump Stations

PUMP STATION	FUTURE PRIORITY	FUTURE PRIORITY TRIGGER	UPGRADE COST (2024 $)
Kinver	P2	Condition	130,200
Lampson	P3	Condition	42,500
Luscombe	P2	Condition	55,090
TOTAL			**228,000**

In contrast to the existing scenario results, no force mains are recommended for upgrade within the future scenario.

4.0 CAPITAL PRIORITIZATION

This section combines the findings from Section 2.0: Asset Management, and the risk assessment results from Section 3.0 to provide an understanding of planned budgets, and how these compare to sustainable funding levels (the AALCI), and prioritized capital needs. These metrics are displayed over a 20-year time frame in Figure 3 and further discussed below. Given the high proportion of condition-triggered deficiencies, the cost of condition-triggered projects have been categorized into those informed by CCTV and those informed by asset age (i.e. lacking CCTV data). The remaining project costs represent projects driven by triggers other than condition only, as defined in Section 3.0.

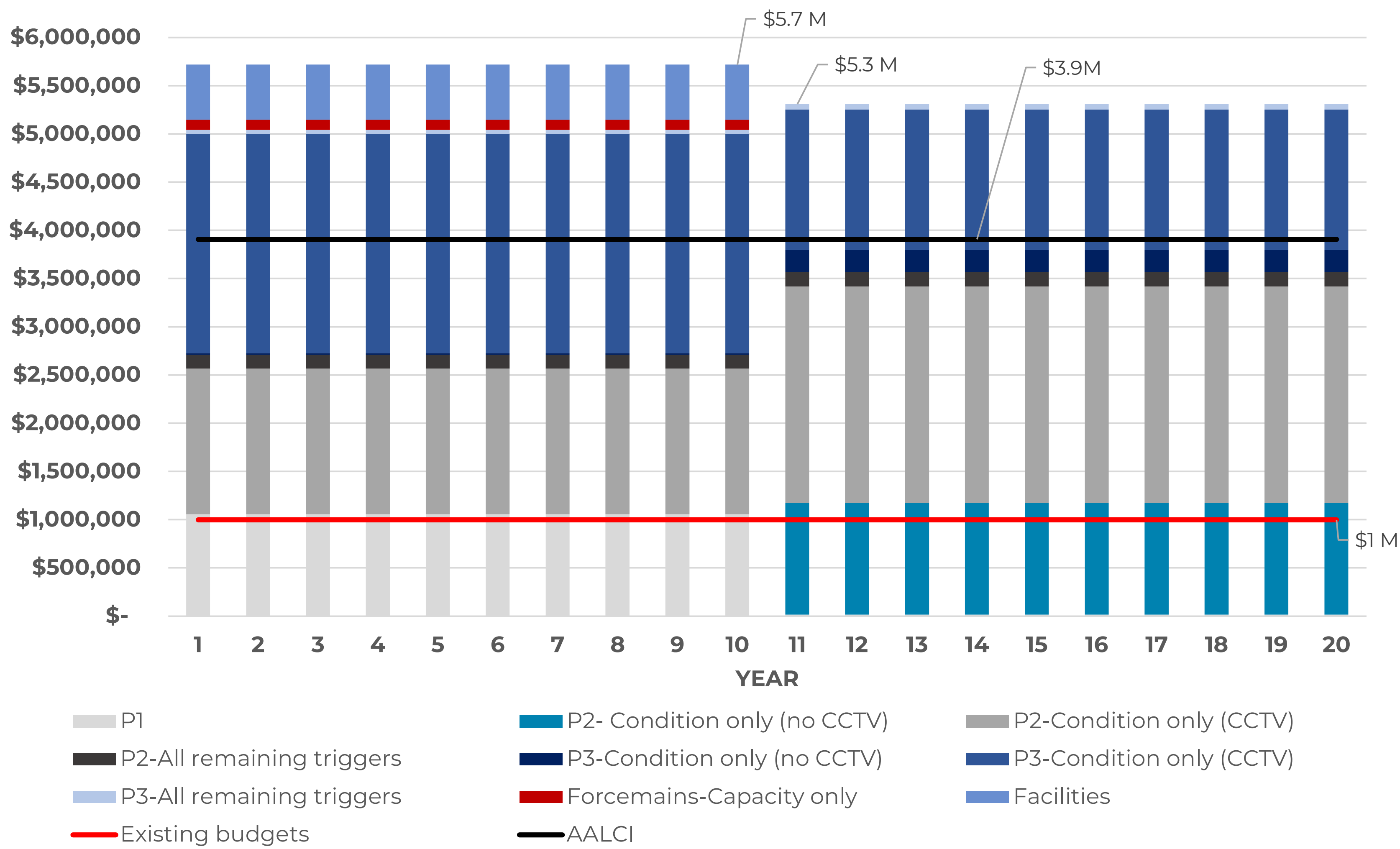

Figure 3: Capital Prioritization Summary, 20-Year Outlook

Figure 3 illustrates the following concepts:

- Existing and future deficiencies signal annual investment needs of approximately $5.7 M for years 1-10 and $5.3 M for years 11-20.
  - Note that the annual investment need of $5.7 M for the first 10-years includes the costs associated with component upgrades for the Constance, Kinver, Lampson, and Luscombe pump stations. Although not prioritized under the existing scenario, these stations have existing, component-specific condition deficiencies of approximately $232,180 (refer to Tables 2 and 5). These upgrades should be addressed following the replacement of other prioritized assets in years 1 - 10, as funds become available or as cost-saving opportunities emerge.
- Based on historic capital spending levels of roughly $1 M annually, there exists a gap in annual spending and capital replacement needs. Over the first 10-year horizon, this gap is approximately $4.7 M, annually, and approximately $4.3 M annually over the second 10-year horizon. This signals that a significant increase in funding levels is needed to mitigate deficiencies.
- The gap between existing spending levels ($1 M) and the AALCI ($ 3.9 M) is approximately $ 2.9 M annually. The $2.9 million gap indicates a funding shortfall of approximately 75% compared to the required investment. This shortfall means the Township is not currently investing sufficiently in the rehabilitation and replacement of its aging infrastructure, causing a growing backlog of deferred rehabilitation. As a result, the Township may face increasing risks associated with infrastructure failure, higher emergency repair costs, and potential service disruptions.
- The majority of P1 projects are triggered under the existing scenario (years 1-10). Total replacement costs for P1 projects equates to approximately $10.6 M and $0.2 M for the existing and future horizons, respectively.
  - Although total project costs significantly exceed existing budgets, current spending appears sufficient to complete nearly all P1 projects under the existing scenario (gap of $0.06M per year) and all future P1 projects. This means current funding levels are close to accomplishing the most critical projects over the next 20 years. As a reminder, all P1 projects over the next 20 years are focused on gravity main replacement.
- The majority of prioritized linear assets are triggered by condition deficiencies compared to capacity, for both the existing and future scenarios (75% and 96%, respectively, based on replacement value of prioritized gravity assets). In general, there exists a high-level of confidence in the prioritization of these condition-deficient assets as they are primarily informed by CCTV data, rather than asset age.
  - Recall, in Sections 3.1.1 and 3.2.1, only 0.3% of existing prioritized assets (by length), and 26% of the future prioritized assets (by length), are solely prioritized based on asset age. Age-based renewals account for roughly $0.2 M over the first 10-years and roughly $13.9 M over the second 10-year horizon.
- No forcemain upgrades are recommended in the future scenario. Overall, pump station and forcemain upgrades in the existing scenario comprise only a small portion (12%) of the total project costs.

Over time, infrastructure repair and replacement haven't kept pace with aging systems, leading to a growing backlog of needs. Current spending falls short of what's required to close the gap. Addressing this will require thoughtful increases in spending, guided by the community's tolerance for risk. Additionally, enhancing capacity to manage and deliver larger capital projects will be key as the scale of work expands.

4.1 FUNDING CONSIDERATIONS

Based on the capital needs presented herein and shown in Figure 3, several funding scenarios have been reviewed to help close the gap between existing spending levels, and capital needs. All scenarios assume an annual increase to current funding levels (~$1M) but differ by the rate of increase and the maximum funding levels achieved over 20 years. These scenarios highlight the trade-offs between capital investment and risk tolerance, with more aggressive funding approaches reducing infrastructure risk through higher annual increases, while modest increases defer investments, heightening long-term risks. Each of the scenarios are briefly described below and are displayed in Figure 4.

- **Achieve existing scenario capital needs ($5.7 M) by year 10**. This scenario reflects the second-most aggressive funding strategy and requires existing spending levels to increase by 470% over the next 10-years. This corresponds to an increase in current spending of approximately $0.52 M, or 52%, on an annual basis. Once the funding levels reach existing capital needs in year 10, this funding level remains constant for years 11 – 20. Adopting this strategy would allow all existing and future capital priorities to be funded by year 23 (assuming no projects arise reactively).
- **Achieve the AALCI ($3.9 M) by year 10.** Recall, the AALCI represents the average annual life cycle investment and evenly distributes the capital replacement needs of an asset over its service life to help build an appreciation for sustainable funding needs. This scenario reflects the least aggressive funding strategy and requires existing spending levels to increase by 290% over the next 10-years. This corresponds to an increase in current spending of approximately $0.32 M, or 32%, on an annual basis. Once the funding levels reach the AALCI in year 10, this funding level remains constant for years 11 – 20. Adopting this strategy would mean existing and future capital priorities are not fully funded until year 32 (assuming no projects arise reactively), resulting in a moderate amount of deferral and long-term risk compared to the other scenarios explored.
- **Increase property taxes by 1% annually**. This scenario reflects the current annual increase to property taxes within the Township which would result in approximately $368,000 dedicated to capital funding annually, to be distributed amongst various capital works categories, such as sewer, roads, drainage, water etc. For the purposes of this analysis, it has been assumed, conservatively, that the entirety of the $368,000 would be dedicated towards sewer capital funding only. This approach maximizes funding through tax allocation to ensure sewer capital priorities are addressed as quickly as possible. However, in reality, this annual increase in funding for capital works will be distributed to other infrastructure categories, lengthening the time to reach the maximum sanitary capital funding needs. For simplicity, we have also assumed a constant annual increase of $368,000 until the maximum capital funding need of $5.7M (annually) is reached in year 14. By this time, existing spending levels will have increased by roughly 470%. Overall, these assumptions reveal that even by allotting the full capital funding amount towards sewer alone for years 1-14, existing and future capital priorities are not fully funded until year 25 (assuming no projects arise reactively), resulting in some deferral and long-term risk, but only half the amount of the AALCI funding scenario presented above. This scenario represents the second least-

aggressive funding scenario, and offers insight on the long-term impacts of the Township's current funding practices.

- **Increase property taxes by 2% annually**. This scenario reflects the annual rate increase to property taxes explored by the Township as part of their Financial Sustainability Analysis (2024), which would result in approximately $736,000 dedicated to capital funding annually, to be distributed amongst various capital works categories, such as sewer, roads, drainage, water etc. Consistent with the previous scenario presented, it has been assumed, conservatively, that the entirety of the $736,000 would be dedicated towards sewer capital funding only, increasing existing funding levels by approximately 470% by year eight. We have also assumed that once the funding levels reach the annual capital requirements of the existing scenario ($5.7M), they remain constant. This scenario represents the most aggressive funding scenario. Adopting this strategy would allow all existing and future capital priorities to be funded by year 22 (assuming no projects arise reactively), resulting in the lowest amount of deferral and long-term risk of all the scenarios evaluated.

Table 6 compares the funding scenarios described above and displayed on Figure 4 in terms of capital projects funded and deferred. This comparison reflects a purely financial perspective and does not consider other resources necessary to complete capital works (e.g. labourers, equipment, management etc.). Additionally, these scenarios assume that no new or unexpected capital priorities arise during the subject time period.

Table 6: Financial Comparison of Funding Scenarios

Scenario	Existing Scenario (Year 1 – 10)	Future Scenario (Year 11 – 20)	Costs of Deferred Projects (Year 1 – 20)
Achieve Existing Capital Needs by Year-10	• 59% of all existing projects funded • Total funding: $33.6 M	• 108% of all future projects funded • Total funding: $57.2 M	$19.51 M
Achieve the Average Annual Life-Cycle Investment (AALCI) by Year-10	• 43% of all existing projects funded • Total funding: $24.5 M	• 74% of all future projects funded • Total funding: $39.1 M	$46.7 M
Increase Property Taxes by 1% Annually	• 46% of all existing projects funded • Total funding: $26.6 M	• 104% of all future projects funded • Total funding: $55.2 M	$28.6 M
Increase Property Taxes by 2% Annually	• 69% of all existing projects funded • Total funding: $39.6 M	• 108% of all future projects funded • Total funding: $57.2 M	$13.5 M

As expected, when funding levels increase more aggressively, fewer capital projects are deferred, leading to a reduction in future failure risks. Alternatively, more modest funding increases result in a larger backlog of deferred projects, indicating a greater acceptance of risk and a more reactive strategy for addressing capital needs. However, even the most aggressive scenarios fail to fund all capital projects within a 10-year period, nor *all* capital projects within a 20-year period. This is largely due to current spending levels relative to the existing backlog of deficient infrastructure. As such, some project deferral is inevitable from a financial perspective whereby projects identified in the existing scenario will require deferral to the future period, when funding becomes available, and/or the risk of failure becomes too high to reasonably defer any further. Similarly, some projects identified in the future scenario will require deferral past the 20-year horizon, and again, addressed when funding becomes available, or the risk of failure becomes too high.

When considering deferral, it is important to acknowledge the role of borrowing as a potential mechanism to address funding shortfalls. While this analysis does not factor in recurring borrowing as long-term strategy, it recognizes that loans may serve as a bridge for the Township to address emergency failures. This is common practice to address funding shortfalls but is not an optimal strategy to finance long-term funding needs.

Even with significantly increased funding, fully catching up on infrastructure needs within the next 10 to 15 years will be challenging. Some level of deferral is expected as part of Esquimalt’s capital implementation plan, which is common for local governments in British Columbia and across Canada. Moving forward, the Township will need to focus on raising more funds for infrastructure, accepting some level of risk, and ensuring priority projects are delivered efficiently. Until a comprehensive financing discussion takes place with Finance and Council, the Township should be prepared to rely on loans for emergency failures while projects are being deferred.

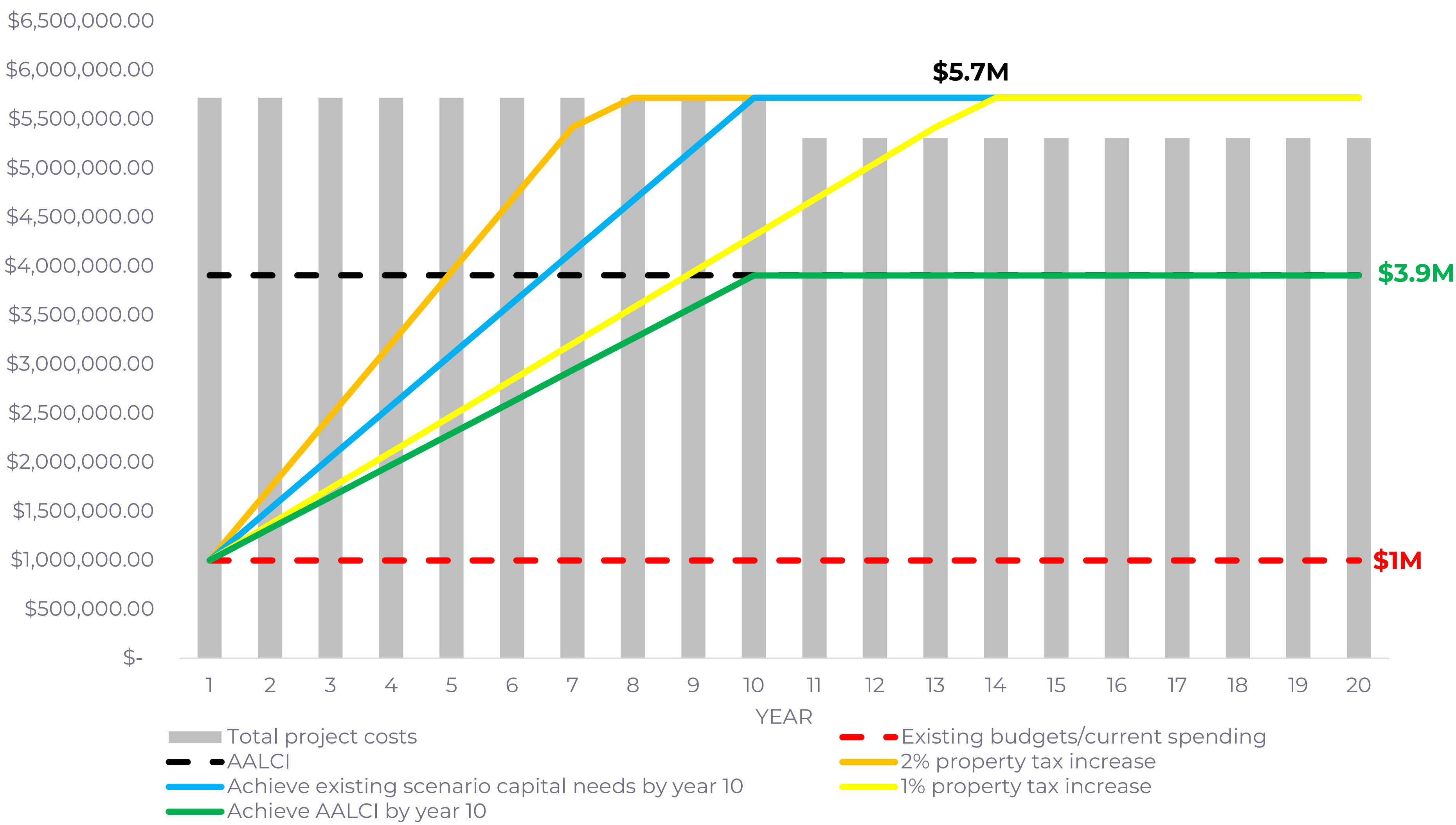

Figure 4: Funding Scenarios for Sanitary Sewer Capital Projects

5.0 RECOMMENDATIONS SUMMARY

The following recommendations arise from the findings of this risk assessment and are aimed to support the Township in making confident and consistent capital decisions, and to ensure investments are strategically dedicated towards the areas they are needed most:

- Work with the Township's Finance Department to review the sanitary sewer funding scenarios outlined in Section 4.1 along with the considerations below. Prepare to increase spending levels, balancing the trade-offs between capital investment and risk tolerance.
  - At a minimum, over the long-term, the Township should focus on achieving sustainable funding targets (the AALCI) and should account for this investment level within sanitary utility budgets. The AALCI value should be regularly reassessed to account for inflation, asset upgrades, and new assets introduced into the network,
  - Maximize funding to sewer infrastructure through the current property tax funding mechanism by increasing the property tax allocation for sanitary capital needs, raising overall property taxes and therefore the proportion dedicated to the sanitary sewer system, or implementing a combination of both strategies, and
  - Create targeted reserve values that align with anticipated capital needs.
- Address capital projects identified under the existing scenario, in order of prioritization (P1 assets, followed by P2 and P3). When projects share a common prioritization ranking and resources are limited, consider the following to help discern which project to proceed with next:
  - Align sewer priorities with other corridor upgrades (e.g., water mains, roads, etc.) to optimize resource allocation and realize cost savings. This includes reviewing local-to-regional opportunities for optimized service delivery (e.g., collaborating with the CRD on localized projects, and/or the City of Victoria vis a vis water upgrade projects),
  - Confirm with Public Works staff where there are routine maintenance issues or challenges. If clusters of assets emerge in a common area, address these together as a single project, and
  - Address condition-driven assets confirmed by CCTV inspection ahead of those prioritized based on age, as these assets are known to be condition deficient. As a reminder, prioritized assets triggered solely by age should be inspected through CCTV ahead of replacement to confirm the pipe's condition.
- To support the delivery of higher volumes of capital projects, the Township should develop a targeted list of key stakeholders to facilitate streamlined and high-quality service delivery. This list should include project managers, administrative staff, Public Works and contractors. More specifically the Township should:
  - Define clear roles and responsibilities for staff involved in capital works to ensure accountability and clarity.

  - Assign a dedicated staff member to keep information systems up to date as work progresses, including the integration of real-time field data into project identification and delivery processes (e.g., repair records, CCTV inspections etc.),
  - Hire a dedicated capital project manager to oversee planning, delivery, and coordination of the expanded sewer program, and
  - Build internal capacity for engaging with external consultants and contractors to improve oversight and decision-making.
- Regardless of the funding scenario selected, infrastructure deferral is expected. The Township should prepare for this by:
  - Adapting current maintenance practices (refer to Appendix B - Sanitary Sewer Asset Management Plan: Operations and Maintenance Practices Review) with the aim of preserving/extending asset life as long as possible, and
  - Being prepared to borrow funds for reactive infrastructure replacement, as needed.
- Use the outcomes of this assessment to identify a list of eligible development cost charge (DCC) projects, including the appropriate benefit allocation to support fund raising for capacity-triggered capital projects.
- Retrofit lift stations to include back-up generators. The cost per generator will depend on the horsepower of the station, however, the Township should budget approximately $55,000 - $75,000 per station. The timing of these retrofits should be determined as the Township completes their emergency response plan – a recommendation from the attached Operations and Maintenance Practice review.
- Re-CCTV any pipes near the end of their service lives, or in an area with known inflow and infiltration issues every 5-years. Target complete CCTV inspection of the entire network every 10 years.
- Initiate detailed facility condition assessments every 5 years, using the results of these inspections to inform/update the prioritization of facility renewal.
- Complete sanitary sewer network model updates every 5 years and/or when network conditions change significantly, or if new information arises which is relevant to the model.
- Complete the risk-assessment process, at a minimum, every 5 years and incorporate the latest data (e.g., storm main physical inspection data, pump station condition, model results, etc.) to improve near-term decision-making confidence.

Sincerely,

URBAN SYSTEMS LTD.

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/kl/ak
Enclosure

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