City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	June 8, 2022
From:	Milton Chan, P.Eng. Director, Engineering	**File:**	10-6060-01/2022-Vol 01
Re:	**Ageing Utility and Road Infrastructure Planning – 2022 Update**		

Staff Recommendation

That the staff report titled, "Ageing Utility and Road Infrastructure Planning – 2022 Update", dated June 8, 2022, from the Director, Engineering be received for information.

for

Milton Chan, P.Eng.
Director, Engineering
(604-276-4377)

Att. 5

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Finance Department	☑	
Roads & Construction	☑	
Sewerage & Drainage	☑	
Water Services	☑	
Transportation	☑	
SENIOR STAFF REPORT REVIEW	**INITIALS:**	**APPROVED BY CAO**

Staff Report

Origin

Staff regularly reports to Council on the estimated long-term capital requirements for age-related infrastructure renewal. The last report was brought forward in 2019. This report updates those estimates to reflect current inventory, new inspection data, and changing infrastructure replacement costs.

This report supports the following strategies within Council's Strategic Plan 2018-2022:

Strategy #1 A Safe and Resilient City:

> *Enhance and protect the safety and well-being of Richmond.*
>
> *1.2 Future-proof and maintain city infrastructure to keep the community safe.*

Strategy #4 An Active and Thriving Richmond:

> *An active and thriving community characterized by diverse social and wellness programs, services and spaces that foster health and well-being for all.*
>
> *4.2 Ensure infrastructure meets changing community needs, current trends and best practices.*

Strategy #5 Sound Financial Management:

> *Accountable, transparent, and responsible financial management that supports the needs of the community into the future.*
>
> *5.1 Maintain a strong and robust financial position.*
>
> *5.2 Clear accountability through transparent budgeting practices and effective public communication.*

Background

This report outlines the current and long-term financial requirements for maintaining and replacing the City's ageing infrastructure. The goal is to ensure that the City has the capacity to meet the financial challenges of the present as well as the future, while maintaining current service levels.

The ageing utilities and roads infrastructure analysis is based on standard and observed service life of specific types of infrastructure. There are several local factors that can impact the actual useful life of a piece of infrastructure, such as soil type and quality of original installation. The long-term analysis is essential for long-term budget projections, but has limited use for identifying exact replacement dates for specific pieces of infrastructure. The 5-year capital plan identifies near-term infrastructure requirements through field observation and inspection results and is a better gauge of short-term infrastructure needs. The graphs that predict long-term

infrastructure requirements are basic guides on what the City should anticipate for long-term infrastructure costs, while the 5-year capital plans more accurately identify short-term budget requirements.

Existing Infrastructure

In managing the City's extensive network of infrastructure services, staff have developed water, sanitary, drainage, and pavement management computer models to predict infrastructure performance, upgrade requirements, replacement cycles, and replacement costs. Coupled with field-verified condition inspection and performance review, model data plays a key role in determining the City's infrastructure replacement and upgrade programs.

Table 1 is a summary of the City's inventory of water, sanitary, drainage, diking, and roads infrastructure. The replacement value assumes that infrastructure will be replaced or upgraded to meet the City's current requirements. Table 2 identifies current approved capital budget, funding sources, and reserve balances.

Long-term capital funding requirements have been updated to reflect changes in infrastructure replacement costs, inventory changes resulting from growth or capacity improvements, and new inspection data.

Table 1. Infrastructure Inventory

Infrastructure	Components	Funding Source	Replacement Value (2022 Dollars)
Water	636 km Pipes 13 PRV Chambers 60 Valve Chambers	Water Utility	$938M
Sanitary	569 km Pipes 153 Pump Stations	Sanitary Utility	$921M
Drainage and Diking	595 km Pipes 39 Pump Stations 61 km Culverts 155 km Watercourses 49 km Dikes	Drainage & Diking Utility	$2,235M
Roads and Road Assets (Non-MRN)	1,338 lane km asphalt 12 Bridges[1] 11,551 street lights[2]	General Revenue	$678M
Total			**$4,772M**

[1] Includes only bridge structures managed by the City's Engineering & Public Works department outside of the Major Road Network (MRN).
[2] Excludes BC Hydro lease lights not maintained by the City.

Table 2. 2022 Funding Levels and Reserves

Infrastructure Type	2022 Approved Utility Budget for Capital	Funding Source	Uncommitted Reserve Balance (May 31, 2022)
Water	$7.5M	Water Utility	$47.1M
Sanitary	$5.8M	Sanitary Utility	$32.0M
Drainage and Diking	$10.9M	Drainage & Diking Utility	$29.0M
Road and Road Assets (non-MRN)	$4.4M	General Revenue	N/A
Total	**$32.3M**		**$108.1M**

The infrastructure programs for Water, Sanitary, and Drainage & Diking are funded by the Watermain Replacement Reserve, Sanitary Sewer Reserve, and Drainage Improvement Reserve, respectively. Each reserve receives an annual contribution from the corresponding utility budget. Table 2 summarizes the current funding levels included in the 2022 Utility Budget along with the Uncommitted Reserve Balance as at May 31, 2022. Required annual funding levels are assessed as part of this report. There is a funding gap that will need to be addressed through future Utility Budgets. Going forward, staff will continue to present annual budget options to close existing funding gaps and, ultimately, maintain utility funding within the identified target range. Road and road assets (paving, street lights, and bridges) are not part of a utility and are funded from the City's General Revenue.

Analysis

Total Replacement Value and Schedule

Infrastructure replacement costs for the City's water, sanitary, drainage and diking, and road infrastructure over the next 100 years have been estimated and graphed in Attachments 1 to 4. The charts also present the current capital funding levels as well as the estimated long-term average annual capital funding levels (in 2022 dollars, excluding inflation) that are required to perpetually replace assets. Given the volatility of construction costs, infrastructure projects do not always follow general inflation trends. Therefore, inflation has not been included in the analysis and staff recommend the analysis continue to be reviewed regularly to identify and integrate changes in construction costs.

The current analysis indicates that construction cost increases have been significant in recent years, with cost inflation being well above the consumer price index (CPI). As a result, replacement values have been updated to account for this continuing trend.

The funding requirement range represents the estimated level of uncertainty in the long-term annual capital funding levels, which is due to a number of variables, including:

- potential overlap with capacity-based improvements due to development or climate change;

- variability in the potential service life of the infrastructure;
- variability in economy and the cost of infrastructure replacement; and
- unanticipated or emergency events that initiate early infrastructure replacement or repairs in excess of operating budget provisions.

Water

Staff estimate a long-term annual capital funding requirement of $10.4 million (Attachment 1) for the City's water infrastructure. Since 2001, Council has endorsed increases in annual Water Utility capital funding from $3.0 million to its current level of $7.5 million. Achieving the long-term annual capital funding requirement will facilitate proactive management of the City's water assets, reducing overall costs while reaching a high level of service. Proactive replacement programs have mitigated ageing infrastructure issues and maintained a low watermain break rate, minimizing service disruptions and property damage from broken watermains.

The primary focus of the City's watermain replacement program is the replacement of ageing asbestos cement (AC) water pipes with new PVC or HDPE pipes, which offer longer service lives, better seismic resilience, and higher chemical resistance in Richmond's corrosive soil conditions. Approximately 36% of the City's watermains are AC pipes. Since 2011, the watermain replacement program has replaced 74 kilometers of AC pipes, which is approximately 25% of the AC pipe inventory. Replacement of ageing AC pipes will remain the primary focus of the City's watermain replacement programs for approximately the next 30 years.

Water pressure management extends the service life of AC watermains. The City introduced a pressure management program in 2014. The program has resulted in a 7% decrease in water losses through reduced pipe cracking and leakage in the water distribution system. This reduction in water losses results in approximately $1.5 million in cost savings to the City each year through reduced Metro Vancouver water purchase costs. Staff will continue to review costs and benefits of additional pressure management strategies to maximize system efficiency.

The City's water meter program is funded through the Water Utility and has been very successful. To date, 100% of single-family, 50% of multi-family, and 100% of industrial, commercial and institutional (ICI) properties have been metered. One of the benefits of water metering is the ability to identify property-side water leakage and provide incentives for leak repair. Since 2015, 1,601 properties have repaired leaks and applied for leak rebates, totalling approximately two million cubic metres in annual leak reduction. This represents $1.6 million in savings on Metro Vancouver water purchases. Additionally, the fixed base meter reading network has now been universally deployed to read and gather real-time consumption data from 97% of the City's water meters, further improving the City's ability to detect private-side leakage.

Sanitary

Staff estimate a long-term annual capital funding requirement of $12.2 million for the Sanitary Utility (Attachment 2). Sanitary Utility capital funding has increased from $0.5 million annually in 2001 to a current capital funding level of $5.8 million annually. Bridging the funding gap will

be an important consideration for future utility budgets, in order to reduce deferral of the financial obligation to future years and the associate burden on future rate payers.

Inflow and infiltration (I&I) of rainwater and groundwater into the sanitary system reduces available system capacity for domestic sewage and municipal growth. I&I management is an important strategy for deferring or avoiding capacity-based system upgrades. The City maintains one of the lowest rates of I&I in Metro Vancouver, and this is a result of proactive sanitary sewer assessment and rehabilitation programs. The City assessed its complete gravity sewer inventory between 2002 and 2015. The assessment indicated the City's gravity sewers are generally in excellent condition and the defects identified have been addressed proactively through the capital program. The next cycle of assessments is in progress.

The City operates and maintains 153 sanitary pump stations. In the past 18 years, the City has constructed eight new sanitary pump stations, rebuilt five sanitary pump stations, performed upgrades on 15 sanitary pump stations and installed new pumps at 91 pump stations.

The impact of grease on municipal sanitary sewer collection systems is an on-going concern for the City. Following the Lansdowne Road sanitary forcemain failure due to a grease blockage in 2011, pressure sensors were installed throughout the sanitary system to identify grease build-up. Identifying grease build-up before it becomes critical facilitates a proactive grease maintenance program for forcemains and maintains a high level of service. Staff continue to conduct grease inspection for food establishments throughout the City and educate the public on the proper way of grease disposal.

Drainage and Diking

As identified in Attachment 3, staff estimate a long-term annual capital funding requirement of $30.3 million for drainage and diking infrastructure and the current annual capital allocation from the Drainage and Diking Utility is $10.9 million. Based on the Council endorsed accelerated flood protection program, the Drainage and Diking utility will be increased gradually to meet the target level of $30 million by 2031. Acceleration of the City's flood protection program allows for continual upgrades and improvements to address climate change induced sea level rise as well as anticipated increase in duration and intensity of storm events to increase flood resilience for the City.

Drainage

The required drainage capital funding level has increased due to inflation, emerging early box culvert deterioration issues, and improved understanding of drainage pump station costs.

The City has approximately 57 kilometers of box culverts, the majority of which are 40 to 50 years in age. The concrete box culverts have a design life of 100 years; however, some joints are failing prematurely which has led to the development of sinkholes, often in highly travelled routes. Staff are proactively managing the condition of box culverts by identifying and repairing deteriorating joints early on to extend their useful service life and minimize long-term replacement costs. The box culverts are inspected on a 7-year preventative maintenance cycle. In

addition, Council has supported a number of capital projects related to box culvert repairs. Since 2015, approximately $11.2 million have been allocated to repairs of failed box culverts.

In 2018, condition assessments were completed for 39 drainage pump stations. The estimated replacement costs have increased due to increased seismic mitigation and regulatory requirements, along with significant increases in construction costs.

Since the early 2000s, the City has rebuilt or performed significant upgrades on 19 of 39 drainage pump stations. The Horseshoe Slough, Shell Road North and No. 7 Road South drainage pump stations have been upgraded recently while the construction for the drainage pump stations at Steveston Highway and Gilbert Road and Steveston Highway and No. 3 Road are nearing completion. The City's capital program includes seven additional pump station replacements proposed over the next five years. The remaining Lulu Island drainage pump stations will be rebuilt or receive significant upgrades over the next 20 years provided that capital funding levels are maintained or improved. Pumping capacity upgrades and requirements are identified using the City's drainage system computer hydraulic model.

The City continues to adapt and mitigate the impacts of climate change through upgrades of pump stations, storm sewers, agricultural drainage and irrigation, and implementation of stormwater retention infrastructure.

Diking

The City is, on average, one meter above mean sea level and protected by 49 kilometers of dike. Current climate change science estimates that sea levels will rise by 1.0 metre by 2100 and 0.2 metre of subsidence is expected over the same time period. The Flood Protection Management Strategy identifies strengthening and raising the City's perimeter dike to 4.7 metres geodetic elevation (approximately 1.2 metre above current elevations) as the priority response to sea level rise. All new dikes are designed to accommodate a further height increase to 5.5 metres to address sea level rise beyond 2100.

The City's Dike Master Plan addresses this need by recommending dike upgrade options for each dike section throughout the City. Dike Master Plan Phases 1, 2, 3 and 5 have been developed, and public and stakeholder consultation for Phase 4 is currently in progress.

The City raised 650 metres of the south dike, between No. 3 Road and Gilbert Road, in 2020, and is currently upgrading 1.5 kilometres from No. 3 Road to 400 m West of No. 4 Road and near No. 9 Road. Upcoming upgrades include 1.2 kilometres of the south dike between No. 4 Road and No. 5 Road. Moving forward, the City aims to upgrade approximately one kilometre of dike each year.

Staff will continue to upgrade the perimeter dike in accordance with the Dike Master Plan and bring forward accelerated projects as a part of the annual capital program for Council consideration. Provincial and international studies on climate change will continue to be monitored and reviewed, and any significant changes will be assessed and incorporated into

future iterations of the Flood Protection Management Strategy and Dike Master Plan for Council consideration.

Drainage and Diking Funding

In the early 2000s, Council endorsed the Drainage and Diking Utility and has progressively increased annual capital funding levels from $0.6 million to its current level of $10.9 million. Through the Drainage and Diking Utility and senior government grant funding, the City has dedicated over $120 million to completing flood protection projects, including pump station and dike upgrade projects, over the past 10 years.

As outlined in the staff report titled, "Accelerated Flood Protection Program Update", dated March 4, 2022, from the Director, Engineering, a target annual revenue level of $30 million by 2031 was endorsed for the Drainage and Diking Utility, in order to support a 50 year implementation period, improving the City's diking infrastructure well in advance of the current anticipated climate change impacts. In order to achieve the required capital funding level, the Flood Protection System fee will be increased through the annual utility budget and rates process beginning in 2023.

The total cost to complete the dike upgrades is currently estimated at $1 billion, which includes costs associated with land acquisition, design and construction, and restoration along the perimeter dike. This estimated value should be used as an order of magnitude reference, considering highly variable factors such as construction and real estate costs, superdikes, and regulatory requirements. Staff will be able to further refine these cost estimates as the program develops and more projects are completed.

Historically, the City has seen significant cost savings and effective dike improvements through development along the dike corridor. An estimated 20% of dike improvements through development has been included in the funding calculations, and increasing the amount of development-assisted dike upgrades would reduce the required capital funding from the City.

Road and Road Assets

Staff estimate a long-term annual capital funding requirement for roads and road assets, including road pavement, street lights, and overpasses and bridges, to be $10.6 million, as identified in Attachment 4. Road and road assets are not part of a utility and are funded from the City's General Revenue. Since 2006, Council has endorsed increases in annual roadway capital funding levels from $2.6 million to its current value of $4.4 million. Achieving the long-term annual capital funding requirement will enable proactive road asset management by facilitating upgrades and replacements on a continual basis, ultimately reducing overall costs.

Road Pavement

The City's Asphalt Re-Paving Capital Program re-paves sections of City-owned non-Major Road Network (non-MRN) roads on an annual basis. The long-term annual re-paving funding

requirement for the City's non-MRN roads is estimated at $7.7 million, using average paving prices and predictions of road re-paving needs from the City's computerized Pavement Management System. Paving prices are heavily influenced by oil prices, which have had significant fluctuations over the past years. The fluctuating price of paving has a significant impact on the long-term capital funding requirements of the City's road network.

As identified in the March 29, 2017 staff report titled "Post Winter Roads and Paving Program Update", harsh winter conditions can have significant impacts on the condition of the City's roadways. Staff will continue to monitor on-going climate change weather trends and incorporate the impacts of any identified trends in subsequent infrastructure reporting. The results from the road condition data collected in 2017 have been used to refine both projections of annual capital funding levels and paving program priorities for capital planning.

Street Lighting

The City's street lighting system consists of approximately 11,500 streetlights and continues to grow with new development. The LED Replacement Capital Program replaced approximately 3,800 end-of-life high pressure sodium (HPS) light fixtures with LEDs to reduce energy consumption and improve efficiency. All four phases of this program have been completed and staff will continue to upgrade the remaining luminaires to LED through future capital programs.

The long-term annual capital funding requirement for the replacement of street lighting systems is approximately $2.7 million. Staff note that there could be significant variability in the useful service life of street lighting infrastructure based on the level of deterioration and that the service life used to inform the current analysis may be conservative. Additionally, decorative street lighting replacement is significantly more expensive than standard street lights and adding decorative street lights to the City's inventory will increase the cost associated with the replacement program.

Going forward, condition assessments will be performed for street lighting systems nearing the end of their service life to inform the street light replacement strategy and future capital programs. Results of this assessment will be incorporated into future ageing infrastructure reporting.

Overpasses and Bridges

The City owns 12 non-MRN overpasses and bridges, maintained by Engineering and Public Works. These include:

- 5 roadway overpasses or bridges; and
- 7 pedestrian bridges.

A table listing the non-MRN overpasses and bridges is included as Attachment 5.

The City's various non-MRN overpasses and bridges are inspected regularly, the results of which inform annual capital funding requirement projections. Regular inspection and maintenance will

extend the lifespan of the structure, thereby reducing overall lifecycle costs and enhancing user safety and comfort.

Distributed assets, such as roadway paving and street lighting, require annual capital funding from General Revenue, which allows a percentage of the assets to be replaced each year. The bridge assets, however, are point assets that require short, intense rehabilitation or replacement and are better completed on a one-time basis as required. Attachment 5 outlines an overpass and bridge maintenance strategy that highlights the one-time nature of bridge upgrades or replacement projects. Staff predict that a long-term annual capital funding of $0.19 million is required for routine maintenance and inspection of bridge assets, and a total of $18.5 million will be required over the next 100 years for major bridge rehabilitation and replacements.

The No. 2 Road Bridge, Bridgeport Road Overpass, and Cambie Road Overpass at Knight Street are significant pieces of municipal infrastructure with a total replacement value of approximately $101 million. These structures are situated within the region's Major Road Network (MRN), which is designed to connect provincial highway systems with local road networks, and are eligible for regional maintenance and replacement funding.

The City receives regional funding for the operation, maintenance, and rehabilitation of pavement and bridge decks within the MRN. TransLink awarded the City grant funding to upgrade the Cambie Road Overpass at Knight Street in 2019 through the MRN Structures Funding Program. The construction of the project was substantially completed in Spring 2022. City staff also participate in Translink's Operation, Maintenance and Rehabilitation Sub-Committee and will continue to work with TransLink to secure adequate bridge maintenance and rehabilitation funding.

Road and Road Asset Funding

The total long-term annual capital funding requirement for roads and road assets is currently estimated to be $10.6 million, as identified in Attachment 4.

Based on typical roadway design life information, significant road paving will be required over the next five years. Area-specific verification will be completed as part of the 5-year capital planning process. The results from the City-wide asphalt surface condition assessment inform the City's existing and future capital paving programs. Staff will continue to bring forward paving program funding recommendations that will include on-going capital funding combined with one-time allocation of surpluses to meet the five year capital needs of the roadway paving program.

Private development servicing agreements contribute significantly to the City's re-paving needs. Over the past five years, the City has secured an average of approximately $9 million per year in roadway assets through servicing agreements. While parts of this involve the introduction of new assets through new road construction, some of this work rebuilds or expands existing roadways that would otherwise require repaving through the City's annual paving program. Unlike utility infrastructure where development-driven replacement work does not typically coincide with infrastructure that is beyond its useful life and hence does not significantly impact long term capital funding requirements, road pavement has a much shorter lifespan of 15 to 35 years. As

such, paving completed through development activities has notable impacts on ageing infrastructure replacement plans.

The overpasses, bridges and street lighting assets have begun to require increased capital funding as they are starting to show signs of deterioration and have been the focus of recent capital upgrade and replacement programs. These re-investments include a $1.1 million Bridgeport Road Overpass renovation project, $1.35 million Cambie Overpass at Knight Street approach rehabilitation project, and the four phase LED Street Replacement Plan totaling $1.3 million. The asset deterioration model indicates that these projects are the beginning of upgrade and replacement projects for overpasses bridges and street lighting assets. There is no dedicated capital funding for bridge asset replacements and street light LED upgrade program. The funding for them is determined as part of the annual budget process.

Roadway paving and street lighting assets are distributed assets that require ongoing dedicated capital funding, while bridge asset replacements are best funded through one-time expenditures. On this basis, roads and road assets will ultimately be funded through a combination of annual funding and one-time funding. Both on-going re-paving and street lighting programs, and one-time bridge repair projects will be included in capital and operating programs for Council's consideration.

Required Capital Funding Levels

Table 3 summarizes current and required annual infrastructure replacement capital funding levels, in 2022 dollars, as well as the current ageing infrastructure funding gaps. The City has made considerable infrastructure funding gains since initiating its strategy to close the funding gap in 2006.

Table 3: Capital Funding Levels

Infrastructure Type	2022 Approved Utility Budget for Capital	Required Annual Capital Funding Level	Target Funding Range	Funding Source	Estimated Additional Capital Funding Required
Water	$7.5M	$10.4M	$8.4M - $12.3M	Water Utility	$2.9M
Sanitary	$5.8M	$12.2M	$9.2M - $15.2M	Sanitary Utility	$6.4M
Drainage & Diking	$10.9M	$30.3M	$28.3M - $32.2M	Drainage & Diking Utility	$15.7M
Road and Road Assets (non-MRN)	$4.4M	$10.6M	$9.6M - $11.6M	General Revenue	$6.2M
Totals	**$32.3M**	**$63.5M**			**$31.2M**

Funding Strategies

Adequate annual capital funding levels will allow the City to implement proactive and sustainable infrastructure replacement programs. This enables the City to sequence utility replacement and use competitive bidding to ensure the optimal utilization of funding. Replacing failed infrastructure has proven to be considerably more expensive and disruptive to residents and City services than proactive replacement.

In recent years, the City has successfully applied for federal and provincial grants from programs such as the Community Emergency Preparedness Fund, National Disaster Mitigation Program, Disaster Mitigation and Adaptation Fund, Emergency Management BC Flood Protection Program, etc. and will continue seek such opportunities in the future. While grant funding has been helpful over the last few years, as a funding source, grants will always be unpredictable.

Development also facilitates significant infrastructure replacement that has a positive impact on the City's overall ageing infrastructure. However, development is subject to external forces such as the economy and does not always coincide with infrastructure that is beyond its useful life. Therefore, development is also not considered a sustainable resource for ageing utility infrastructure replacement.

Staff will present funding options and make a recommendations to Council as part of the annual utility rate review and budget process.

Financial Impact

None.

Conclusion

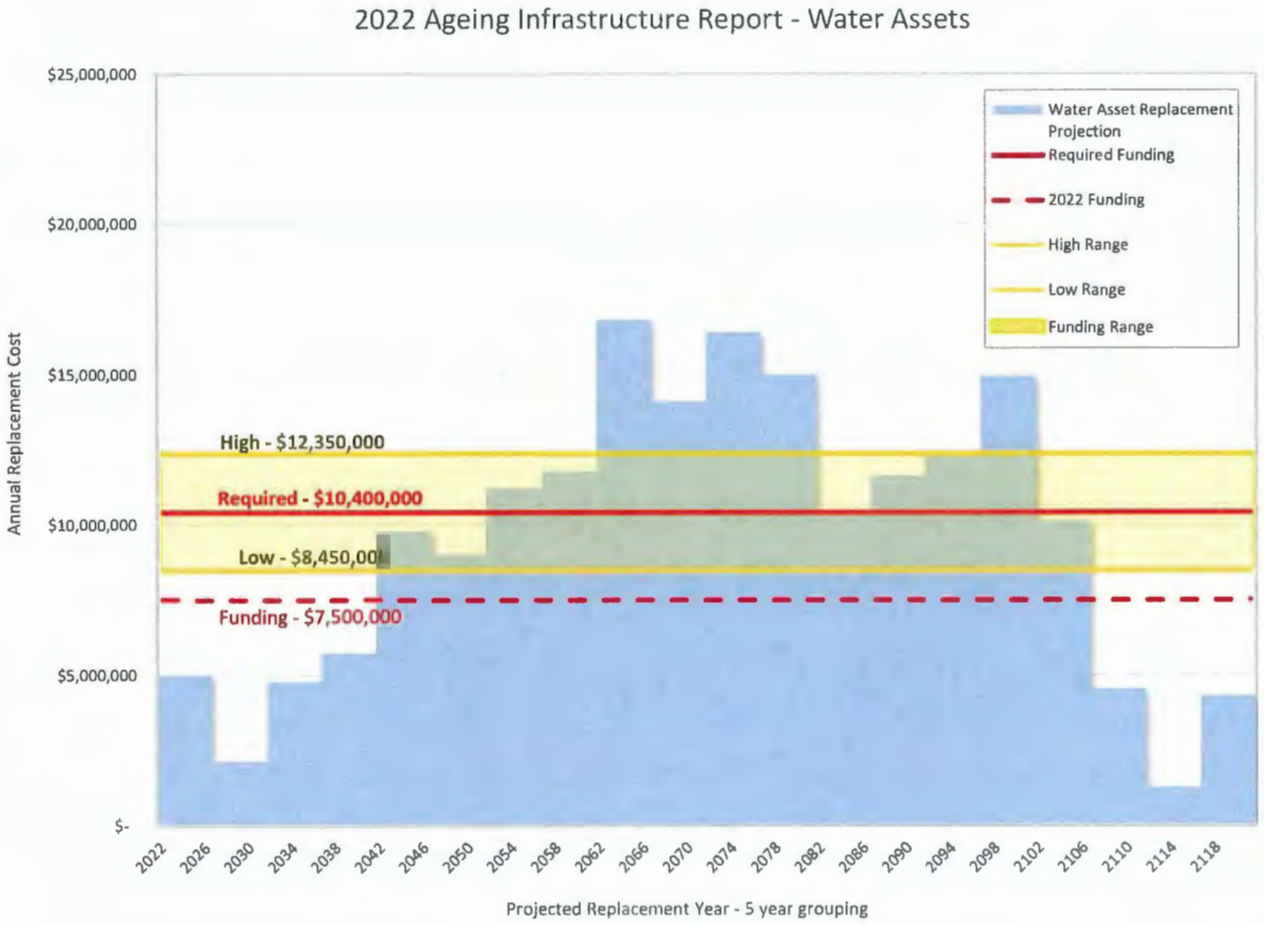
Staff will continue to refine and update infrastructure replacement requirements, and explore new technologies and best practices to positively impact lifecycle infrastructure costs. Additionally, staff will continue to address utility funding gaps through annual budgeting processes. The rate of increase and timeframe to close the funding gaps will be impacted by Metro Vancouver's regional charges for water and sewer, which are non-discretionary costs imposed on the City. The capital funding shortfalls outlined in this report should be considered in conjunction with the City's Long-Term Financial Management Strategy.

Jason Ho, P.Eng.
Manager, Engineering Planning
(604-244-1281)

JH:rd

Att.1: 2022 Ageing Infrastructure Report – Water Assets
Att.2: 2022 Ageing Infrastructure Report – Sanitary Assets

Att.3: 2022 Ageing Infrastructure Report – Drainage & Diking Assets
Att.4: 2022 Ageing Infrastructure Report – Road and Road Assets (non-MRN)
Att.5: Overpasses and Bridge


2022 Ageing Infrastructure Report - Water Assets
$25,000,000
$20,000,000
$15,000,000
$10,000,000
$5,000,000
$-
Annual Replacement Cost
Water Asset Replacement Projection
Required Funding
2022 Funding
High Range
Low Range
Funding Range
High - $12,350,000
Required - $10,400,000
Low - $8,450,000
Funding - $7,500,000
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2110
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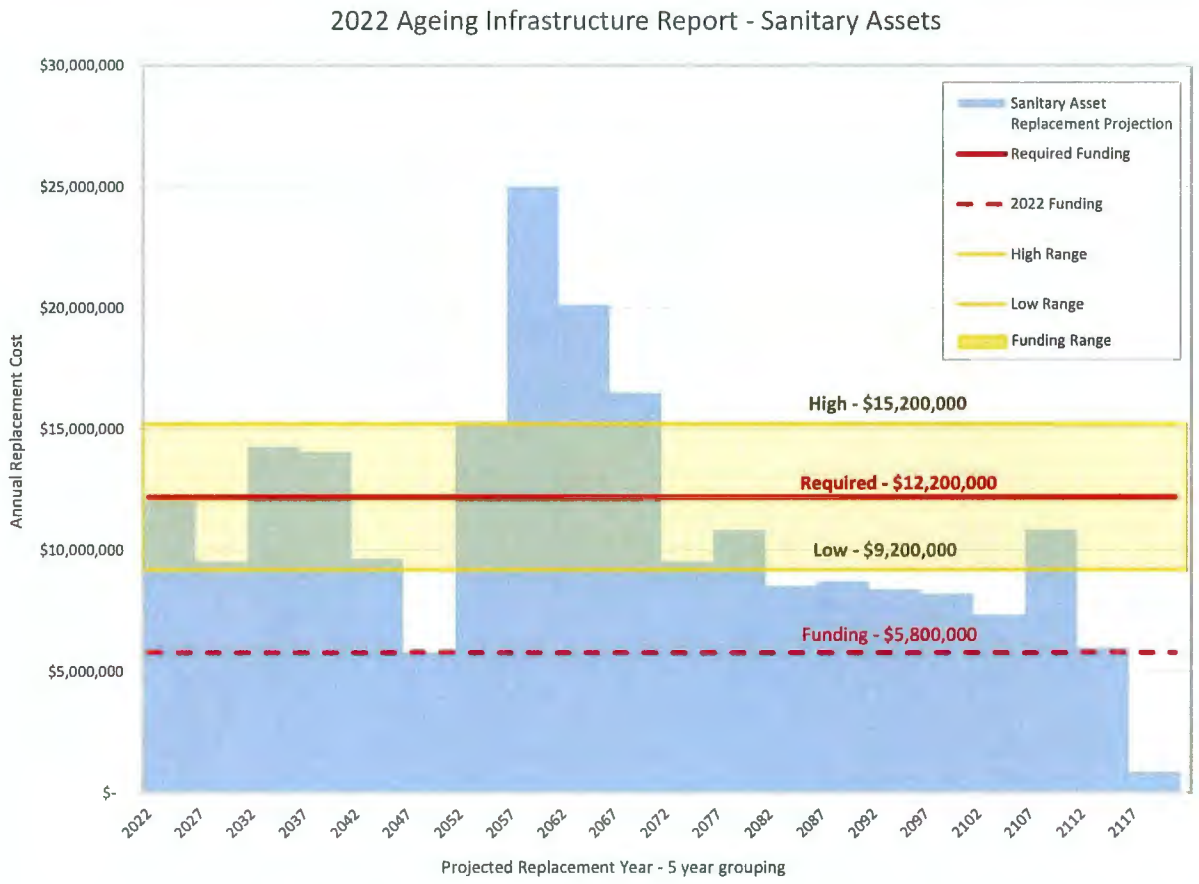
Projected Replacement Year - 5 year grouping


2022 Ageing Infrastructure Report - Sanitary Assets
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$25,000,000
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Annual Replacement Cost
Sanitary Asset Replacement Projection
Required Funding
2022 Funding
High Range
Low Range
Funding Range
High - $15,200,000
Required - $12,200,000
Low - $9,200,000
Funding - $5,800,000
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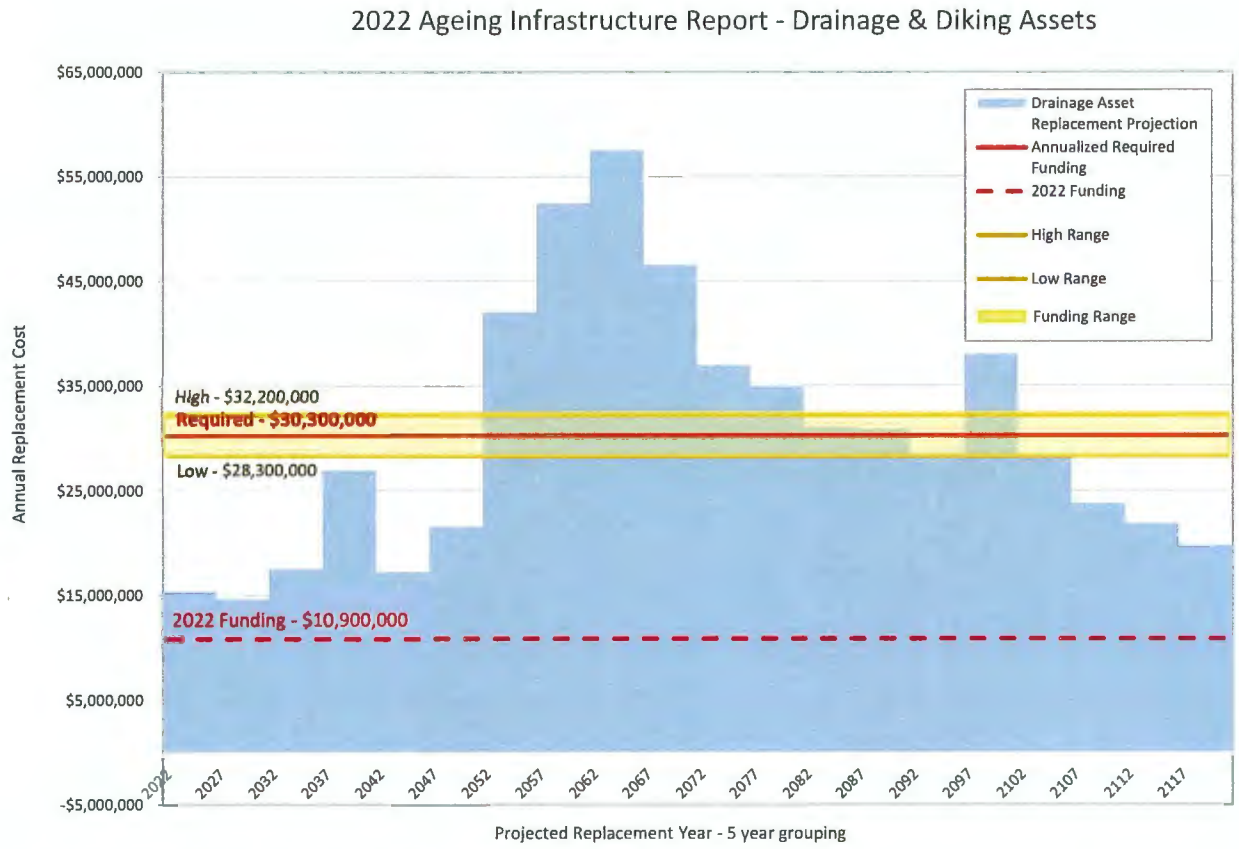
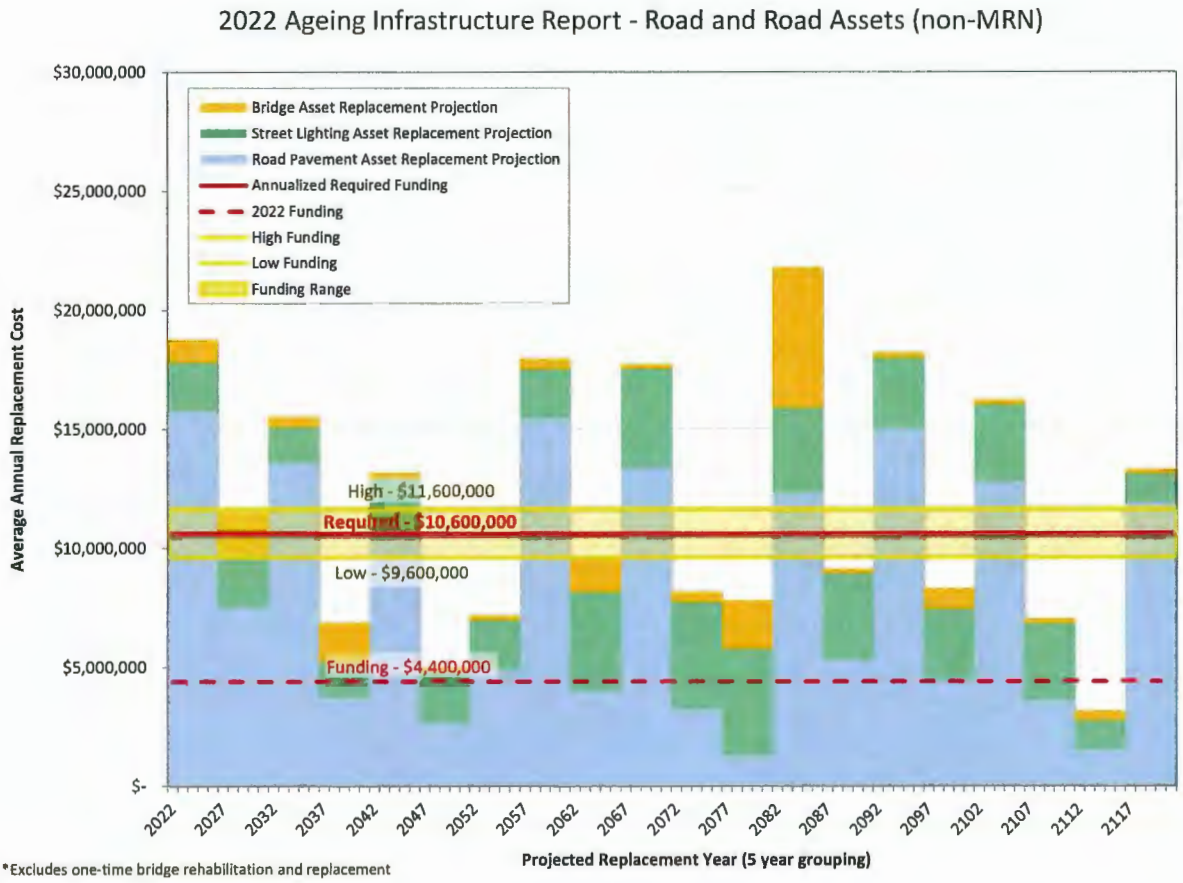
Projected Replacement Year - 5 year grouping



*Annualized Required Funding level may decrease upon the award of senior government grant funding


2022 Ageing Infrastructure Report - Road and Road Assets (non-MRN)
Bridge Asset Replacement Projection
Street Lighting Asset Replacement Projection
Road Pavement Asset Replacement Projection
Annualized Required Funding
2022 Funding
High Funding
Low Funding
Funding Range
$30,000,000
$25,000,000
$20,000,000
$15,000,000
$10,000,000
$5,000,000
$-
Average Annual Replacement Cost
High - $11,600,000
Required - $10,600,000
Low - $9,600,000
Funding - $4,400,000
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2052
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Projected Replacement Year (5 year grouping)
*Excludes one-time bridge rehabilitation and replacement

Overpasses and Bridges

List of Non-MRN Overpass and Bridge Inventory

Name	Location	Feature Crossed	Type
Bird Road Bridge	11040 Bird Road & Shell Road Rail Crossing	Watercourse	Pedestrian
Chatsworth Road Bridge	6380 Chatsworth Road	Watercourse	Pedestrian
Finn Road East Bridge	13020 Gilbert Road	Watercourse	Roadway
Fraserside Gate Bridge	Fraserside Gate & Westminster Highway	Watercourse	Roadway
Hollybridge Way Bridge	River Road & Hollybridge Way	Watercourse	Roadway
Horseshoe Place Bridge	Horseshoe Place South of Horseshoe Way	Watercourse	Roadway
Lancing Road Bridge	5440 Lancing Road	Watercourse	Pedestrian
Princess Street Bridge	Dyke Road fronting and Princess Street	Watercourse	Pedestrian
West Dyke Trail Bridge 1	West End of Francis Rd (West Dyke Trail)	Watercourse	Pedestrian
West Dyke Trail Bridge 2	West End of Williams Rd (West Dyke Trail)	Watercourse	Pedestrian
West Dyke Trail Bridge 3	10431 Springhill Crescent	Watercourse	Pedestrian
Woodward Slough Bridge	No. 4 Road and Finn Road	Watercourse	Roadway

Bridges and Overpasses Maintenance Strategy

The table below illustrates a high-level rehabilitation and replacement strategy for the City's bridge inventory over the next 100 years. The strategy involves routine inspection and maintenance of the structures at an annualized cost of $43,000 each year, replacement of the structure at the end of its service life, and a major rehabilitation to extend the service life for larger bridges.

Name	Estimated Replacement Cost	Estimated Rehabilitation Cost	Replacement Year	Rehabilitation Year
Bird Road Bridge	$145,683	$29,137	2035	2060
Chatsworth Road Bridge	$56,907	$11,381	2025	N/A
Finn Road East Bridge	$693,069	$138,614	2030	2080
Fraserside Gate Bridge	$1,460,624	$292,125	2040	2030
Hollybridge Way Bridge	$3,300,631	$660,126	2085	2065
Horseshoe Place Bridge	$1,153,324	$230,665	2030	2065
Lancing Road Bridge	$40,973	$8,195	2025	N/A
Princess Street Bridge	$113,815	$22,763	2080	2030
West Dyke Trail Bridge 1	$796,704	$159,341	2085	2065
West Dyke Trail Bridge 2	$212,075	$42,415	2065	2045
West Dyke Trail Bridge 3	$144,292	$28,858	2025	N/A
Woodward Slough Bridge	$430,347	$86,069	2025	2060
Total	**$8,548,445**	**$1,709,689**		

The annual capital funding level requirement of $190,000 for bridges and overpasses is calculated as the total rehabilitation and replacement cost averaged over each asset's service life. This value presents an average annual expenditure only and does not reflect actual recommended annual capital funding levels. Unlike linear infrastructure such as piping or road pavement, replacement of each bridge structure must occur as a singular project and cannot be divided into annual components. For example, replacement of the Hollybridge Way Bridge must be carried out as a one-time expenditure of approximately $3.3 million. The delivery of the replacement program over 100 years is illustrated in Figure 1 below.

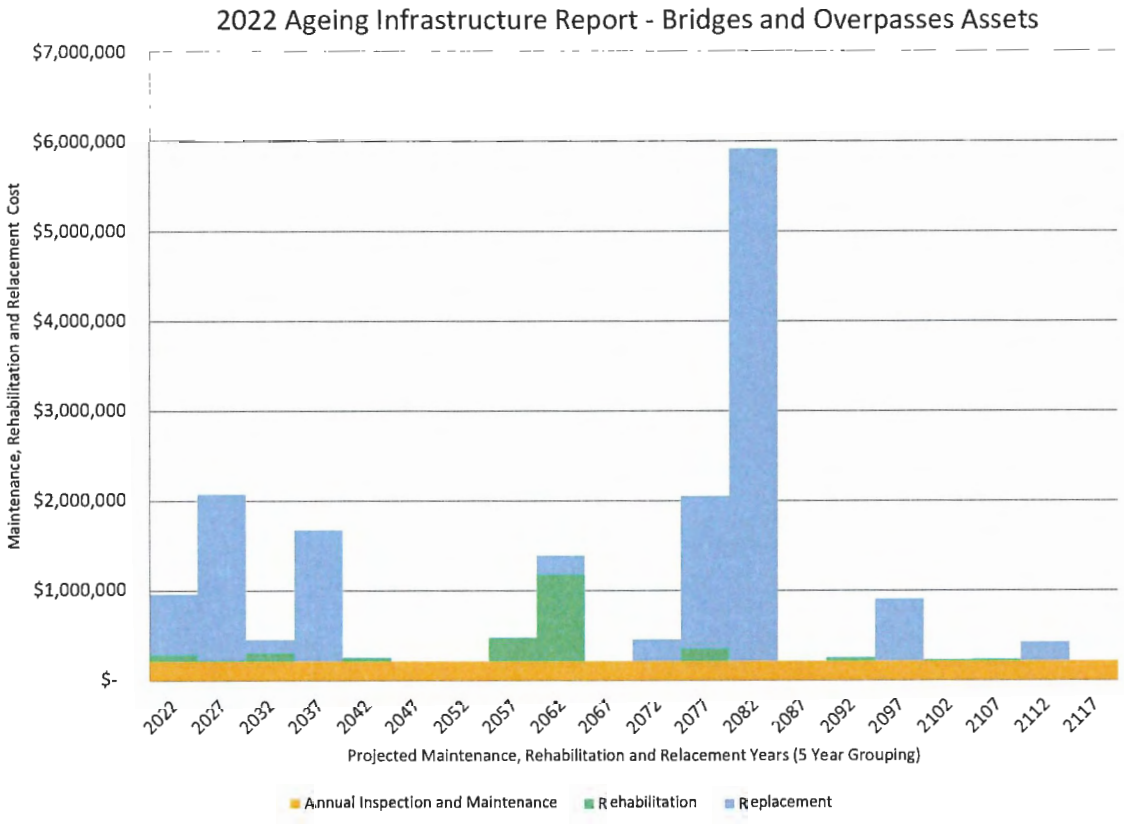

Figure 1. Delivery of the replacement program over 100 years

Based on the high level strategy established, annualized capital funding of approximately $43,000 should be allocated towards routine inspection and maintenance of bridge assets, and requests for one-time expenditures for rehabilitation or replacement of bridge structures would come forward in 2025, 2030, 2040, 2080, 2085, and 2100. Where replacement of multiple structures is required within the same year, such as in 2085, staff will review the potential to distribute work over several years. The maintenance strategy will continue to be refined as ongoing inspection work is completed to assess the remaining lifespan of the structures.