



City of Richmond

Report to Committee

To: Public Works and Transportation Committee

Date: June 26, 2015

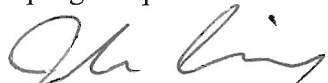
From: John Irving, P.Eng. MPA
Director, Engineering

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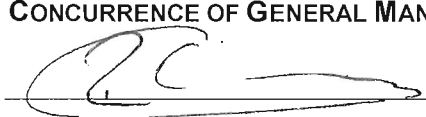

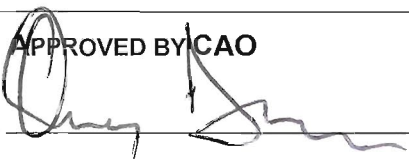
Re: Ageing Infrastructure Planning - 2015 Update

Staff Recommendation

That staff utilize the attached "Ageing Infrastructure Planning – 2015 Update" report dated June 26, 2015 from the Director, Engineering as input in the annual utility rate review and capital program process.


John Irving, P.Eng. MPA
Director, Engineering
(604-276-4140)

Att. 5

REPORT CONCURRENCE		
ROUTED TO:	CONCURRENCE	CONCURRENCE OF GENERAL MANAGER
Finance Department	<input checked="" type="checkbox"/>	 7
Roads & Construction	<input checked="" type="checkbox"/>	
Sewerage & Drainage	<input checked="" type="checkbox"/>	
Water Services	<input checked="" type="checkbox"/>	
Transportation	<input checked="" type="checkbox"/>	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	INITIALS: 	APPROVED BY CAO 

Staff Report

Origin

The Engineering Department previously reported to Council the estimated long-term capital requirements for age-related infrastructure renewal in July 2001, March 2006, June 2011 and August 2013. This report updates those estimates to reflect current inventory, evolving theory on infrastructure service life and changing infrastructure replacement pricing.

Background

This report supports Council's 2014-2018 Term Goal #6 Quality Infrastructure Networks:

Continue diligence towards the development of infrastructure networks that are safe, sustainable, and address the challenges associated with aging systems, population growth, and environmental impact.

6.1. *Safe and sustainable infrastructure.*

6.2. *Infrastructure is reflective of and keeping pace with community need.*

This report supports Council's 2014-2018 Term Goal #7 Strong Financial Stewardship:

Maintain the City's strong financial position through effective budget processes, the efficient and effective use of financial resources, and the prudent leveraging of economic and financial opportunities to increase current and long-term financial sustainability.

7.2. *Well-informed and sustainable financial decision making.*

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

Existing Infrastructure

In managing the City's extensive network of infrastructure services, staff have developed sanitary, drainage, water and pavement management computer models to predict infrastructure performance, upgrade needs, 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, and roads infrastructure. The replacement value assumes that infrastructure will be replaced using the existing size or upgraded where current infrastructure does not meet the City's current minimum size requirement.

Staff has reported ageing infrastructure assessments to Council in 2001, 2006, 2011 and 2013. The 2001 and 2006 reports to Council identified that infrastructure replacement funding levels

were insufficient to maintain existing service levels over the long-term. The 2006 report proposed a number of strategies to address funding shortfalls, and a strategy of gradual rate increases to close the identified funding gaps was adopted. Substantial progress has been made since 2006. The funding gap in the Water utility was closed in 2011 and the Drainage utility funding entered the target range in 2015. The funding gap in road paving (non-Major Road Network) has remained constant since the 2013 Ageing Infrastructure report but the Sanitary funding gap has widened by the construction price index inflation rate. Going forward, staff will continue to present annual budget options that continue to close the existing funding gaps and ultimately maintain utility funding within an identified target range.

Table 1: Infrastructure Inventory

Infrastructure	Total Length	Other Features	Funding Source	Replacement Value (2015 \$)
Water	629 km	13 PRV Chambers 59 Valve Chambers	Water Utility	\$563 M
Sanitary	565 km	152 Pump Stations	Sanitary Utility	\$532 M
Drainage	622 km	39 Pump Stations 43 km Culverts 178 km Watercourses	Drainage Utility	\$1,080 M
Dike	49 km		Drainage Utility	\$200 M
Bridges	To Be Determined		To Be Determined	To Be Determined
Road Pavement (non-MRN)	1285 lane km	212,000 m ² Parking Lots	General Revenue	\$598 M
Total Replacement Value				\$3,046 M

Table 2: Annual Capital Infrastructure Funding and Reserves

Infrastructure Type	2015 Funding	Funding Source	Reserve Balance¹ (Dec 31, 2014)
Water	\$7.5 M	Water Utility	\$46.4 M
Sanitary	\$4.3 M	Sanitary Utility	\$39.5 M
Drainage and Dikes	\$10.4 M	Drainage Utility	\$44.5 M
Road Paving (non-MRN)	\$3.5 M	General Revenue	N/A
Total	\$25.7 M		\$130.4 M

¹ Includes committed funds.

Achieving the necessary funding levels to meet the City's drainage needs was completed through the annual utility rates review process, where infrastructure funding gaps were considered when establishing utility rates. Roads are not part of a utility and the paving budget is funded from the City's General Revenue. Road improvement requirements are addressed through the City's capital prioritization process.

Short-term and long-term infrastructure replacements and upgrades are planned utilizing asset management and capacity computer models developed for Richmond's extensive water, sanitary, drainage and roadway systems. This ensures that when ageing infrastructure deteriorates to the point where it is no longer economical to maintain, or it fails, it is replaced with infrastructure of sufficient size to meet the City's long-term needs.

Analysis

Total Replacement Value and Schedule

Attachments 1 to 4 show estimated infrastructure replacement costs for the City's water, sanitary, drainage, and road infrastructure over the next 75 years. The charts also show the estimated long-term average annual funding levels (in 2015 dollars, excluding inflation) that are required to perpetually replace assets as well as the current 2015 funding levels. The Funding Requirement Range represents the estimated level of uncertainty in the long-term annual funding levels, which is due to a number of variables including:

- potential overlap between capacity based improvements due to development or climate change;
- variability in the potential service life of the infrastructure;
- variability in the 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

The City is meeting its long-term funding target for water infrastructure replacement. *Attachment 1* predicts a long-term annual water infrastructure funding requirement of \$7.4 million. Current funding levels are \$7.5 million and are within the target range. Staff recommends that funding levels be maintained in the target range.

Approximately 50% of the City's watermain inventory is asbestos cement pipelines (AC). AC pipelines will be the focus of the City's watermain replacement programs for approximately the next 30 years. Engineering utilizes the combined results of pipe testing, watermain break rate statistics, leak detection, and literature review to estimate the useful life of the watermain inventory. Replacement watermain sizing is determined utilizing a computerized hydraulic model of the City's water system that incorporates future zoning and population densities identified in the 2041 Official Community Plan.

Between 2025 and 2040 replacement costs may exceed the long-term required funding level and, as a result, may require utilization of reserves and borrowing. In the long-term (75 year horizon), the required funding level will repay debts incurred and allow for continued water infrastructure renewal.

Water pressure management and other innovative measures are being implemented to extend AC watermain service life, which could yield significant benefits in the long run. An east-west water transmission system could facilitate an overall reduction in water pressure that maintains current levels of service including fire flow. Staff are reviewing the costs and benefits of implementing an east-west transmission system and will report the findings to Council in a subsequent report.

Sanitary

Attachment 2 predicts a long-term annual funding requirement of \$6.8 million for the sanitary utility and identifies \$4.3 million in sanitary replacement funding. Funding needs in 2030 and beyond will exceed current funding levels and, unless current funding levels are increased, the long-term annual funding level will increase beyond that caused by regular construction cost inflation factors.

The City has performed closed-circuit television (CCTV) inspection of 90% of the City's sanitary sewers and will CCTV inspect the remaining 10% in 2015. The results of the video inspection indicate that the gravity sewer system is in good condition, and *Attachment 2* indicates that the long-term replacement of these sewers will begin in earnest in approximately 25 years. Current funding levels are insufficient to fund these long-term renewal needs. Bridging this funding gap will be an objective of future budgets.

Although there is no imminent backlog for the replacement of sanitary gravity sewers, the City's older sanitary forcemains and pump stations will soon need to be rehabilitated or replaced to prevent infrastructure failure and maintain current service levels. This is particularly a focus for

areas of the City where housing density is increasing, such as the City centre, and where older sanitary pump stations exist with only a single pump arrangement (opposed to a modern pump station containing two pumps that provides redundant capacity in the case of pump failure). Following the Lansdowne Road sanitary forcemain failure due to a grease blockage, capital funds were used to install pressure sensors throughout the sanitary system that assist in monitoring grease build and identifying costly infrastructure failures before they occur.

Drainage

The City is in the target range for long-term funding of drainage infrastructure replacement. *Attachment 3* predicts a long-term annual funding requirement of \$11.0 million for the drainage utility and identifies current annual funding of \$10.4 million. The City achieved the necessary long-term funding level for drainage infrastructure by increasing the Drainage Utility rate by \$10 per year since 2003. While the current level of funding is adequate, on-going focus is required to maintain this position against construction cost inflation factors and as the City's drainage needs evolve. As part of the 2016 utility rate setting process, staff will bring forward for Council's consideration alternate rate strategies that improve the overall equity of the Drainage Utility rate and maintain funding levels in the target range through rate increases to sectors that may not be paying an equitable share.

Staff have identified new Drainage utility ageing infrastructure challenges that include joint failures in some of the City's box culverts that manifest themselves as sink holes in road surfaces. The box culverts themselves are still structurally sound and are not at the end of their estimated service life; however, the failing joints are problematic. In 2015, an individual box culvert joint repair cost in excess of \$250,000. As failing joints are becoming an increasing problem, this cost is unsustainable under current operating levels and will increase short-term capital spending. In 2015, staff will trial a slip lining project on the No. 1 Road box culvert as part of the approved 2015 capital plan. Staff will report on the success of this trial in a subsequent report to Council.

In the last 12 years, the City has rebuilt 15 of its 39 drainage pump stations and has performed significant upgrades on a further 5 in order to meet the City's long-term needs. Over the next 20 years the remaining Lulu Island drainage pump stations will be rebuilt or receive significant upgrades provided the funding levels are maintained or improved. The City's drainage system computer hydraulic model has identified pumping deficiencies and the rebuilt stations have significant pumping capacity upgrades that are based on model results. Since 2008, the City has obtained \$12.1 million of provincial and federal grant funding that substantially offset drainage pump station upgrade costs. In addition to pump station upgrades, drainage program priorities relate to upgrading the City's major storm sewers leading to box culverts, laneway drainage, agricultural drainage, agricultural irrigation and implementation of stormwater retention infrastructure to mitigate the impact of intense storms.

Dikes

The 2008-2031 Richmond Flood Protection Strategy identifies climate change induced sea level rise as a future threat to be mitigated. Staff estimate conventional dike upgrade costs to address the predicted 100-year sea level rise scenario to be in the order of \$300 million.

Phase 1 of the Dike Master Plan was completed in 2103 and addresses a strategy for future dike improvements for Steveston and the Southern West Dike. The Phase 1 report indicates that diking improvements required to protect Steveston will be in the order of \$55 million over next 50 years, which is 18% of the estimated overall Lulu Island dike improvement cost. The Phase 1 plan was endorsed by Council at the regular Council Meeting on April 22, 2013.

Staff are in the process of developing Phase 2 of the Dike Master Plan to identify the specific long-term dike upgrades for North Dike and the northern West Dike. Financial requirements from the Phase 2 study will be reported through subsequent reports to Council as this information is developed.

Roads

The non-MRN long-term annual re-paving funding requirement is estimated at \$4.7 million (see *Attachment 4*). Annual funding levels for non-MRN roads is \$3.5 million, \$1.2 million below the identified long term requirement. Paving prices are heavily influenced by oil prices, which have had significant fluctuations over the past nine years. The fluctuating price of paving has a significant impact on the long-term funding requirements identified in this report. *Attachment 5* documents the fluctuating cost of asphalt paving between 2006 and 2014. Average paving prices identified in *Attachment 5* were applied to road pavement need predictions from the computerized City's Pavement Management System to determine the long-term funding requirements. The Pavement Management System indicates that current funding levels will be adequate to maintain the roadways at the current service level for the next five years; however, there will be a significant shortfall over the subsequent five years unless funding levels are improved. Staff will provide further updates as part of future capital programs.

Bridges

The City has a number of bridges and overpasses that range in size and use from pedestrian bridges in parks to the No. 2 Road Bridge. Staff completed assessment of eight of the City's bridges and overpasses over the last two years. Further assessment and valuation of City-owned bridges will be completed by the end of 2015.

The No. 2 Road Bridge is a significant piece of municipal infrastructure with an estimated replacement value of \$73 million. As the No. 2 Road Bridge is situated within the region's Major Road Network (MRN) it is eligible for regional maintenance and replacement funding. The City currently receives regional funding to operate, maintain and rehabilitate the bridge deck, which includes an allowance for re-paving. It does not, however, receive funding to maintain the bridge structure. This is a regional issue that has been a concern since Translink's establishment. Alongside the region's other municipalities, City staff are participating on Translink's Operation, Maintenance and Rehabilitation Sub-Committee to secure adequate bridge maintenance and rehabilitation funding.

Detailed assessment of the No. 2 Road bridge's condition was completed in 2013 by visual inspection and non-destructive testing to identify a long-term maintenance program. No

immediate safety issues were identified during inspection; however, several maintenance issues were addressed.

The Bridgeport overpass was inspected in 2014 and it was identified that the bridge deck is in need of repair. Council approved a \$1.1 million budget funded by the MRN Provision to repair the bridge deck and the project is scheduled for completion by the end of 2015.

The Cambie overpass was inspected in 2014 and it was identified that the bridge ramps are settling. A project will be brought forward in the 2016 Capital Plan for Council's consideration to replace some of the abutment material with light-weight fill to remedy this issue. Translink does not recognize this bridge to be part of the MRN, but as the bridge exists due to Cambie Road crossing Knight Street, an MRN route, staff will liaise with Translink to try and change this status.

Street Lighting

The City's street lighting system is growing and has become a significant asset. Approximately 200 street light poles in the Seafair and Richmond Gardens sub-divisions have reached the end of their service life, and in 2015 Council approved \$132,000 as phase one of a 5-year program to replace ageing poles. Pole failures have also been identified on the No. 2 Rd Bridge. A comprehensive evaluation of the street lighting inventory is in progress and street lighting condition will be included in subsequent ageing infrastructure reporting.

Required Funding Levels

Table 3 summarizes current and required annual infrastructure replacement funding levels, in 2015 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: Infrastructure Funding Levels

Infrastructure Type	2015 Actual Annual Funding Level	Required Annual Funding Level	Funding Range	Funding Source	Estimated Additional Funding Required
Water	\$7.5 M	\$7.4 M	\$6.8 M - \$8.6 M	Water Utility	No Shortfall
Sanitary	\$4.3 M	\$6.8 M	\$6.2 M - \$7.5 M	Sanitary Utility	\$2.5 M
Drainage*	\$10.4 M	\$11.0 M*	\$10.2 M - 12.7M	Drainage Utility	\$0.6 M
Road Paving (non -MRN)	\$3.5 M	\$4.7 M	\$3.9 M - \$5.6 M	Primarily General Revenue	\$1.2 M
Totals	\$25.7 M	\$30.3 M			\$4.3 M

*Long-term dike replacement costs are yet to be determined and are excluded

Funding Strategies

Adequate annual funding levels will allow the City to implement proactive and sustainable infrastructure replacement programs. The proactive replacement of infrastructure enables the City to smart sequence utility replacement and use competitive bidding to ensure the best value for money. Replacing infrastructure at its time of failure has proven to be considerably more expensive than proactive replacement and is more disruptive to residents, City services and programs.

Closing the current \$4.3 million funding gap is achievable within the next decade or sooner. Putting this amount into rate-payer terms, Richmond has approximately 70,000 businesses and households that pay utility rates. An annual increase of \$10 to each rate-payer would close the gap in approximately 6 years. An annual increase of \$20 to each rate-payer would close the gap in approximately 3 years.

Staff have pursued available federal and provincial grants from programs such as the Building Canada Plan and BC's Flood Protection Program and will continue to do so. While grant funding has been helpful over the last few years, as a funding source, grants will always be unpredictable and therefore non-sustainable.

Development also facilitates significant infrastructure replacement that has a positive impact on the City's overall ageing infrastructure picture. 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 not considered a sustainable resource for ageing infrastructure replacement.

Staff will present funding options and make a recommendation to Council as part of the annual utility rate review and capital program process. Significant progress has been made over the last decade in closing the funding gap, and continuation on this path will allow the City to effectively mitigate the challenge of ageing infrastructure.

Financial Impact

None.

Conclusion

Staff will continue to gather information to better predict infrastructure replacement schedules and funding peaks and will continue to explore new technologies and best practices. Staff will also continue to recommend that the utility funding gaps between current and required funding levels be closed over time through the annual budgeting process. The rate of increase and timeframe to close the funding gaps will be impacted by Metro Vancouver's regional Solid and Liquid Waste Management plans, which are non-discretionary costs imposed on the City. The funding shortfalls outlined in this report should be considered in conjunction with the City's Long-Term Financial Management Strategy.

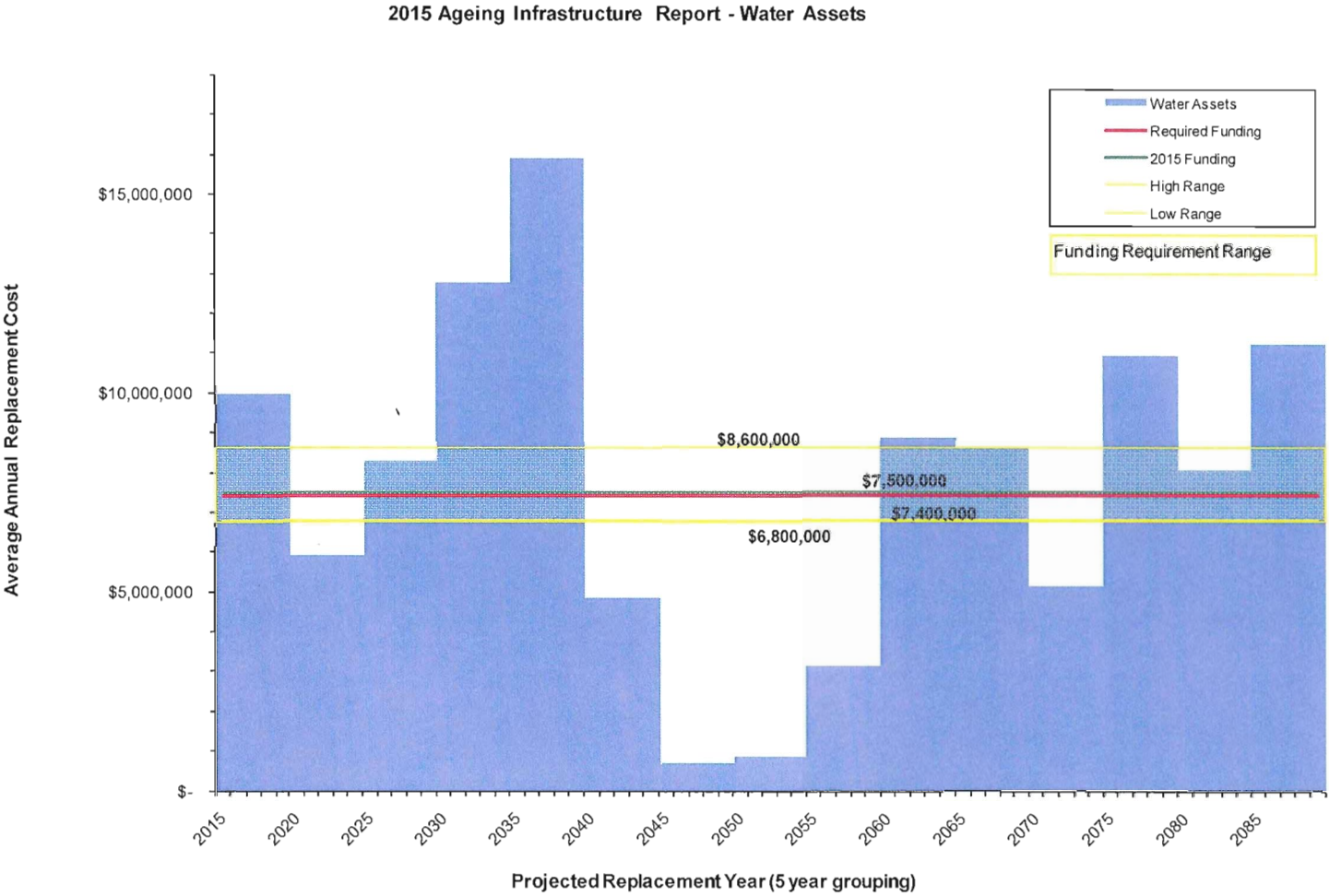


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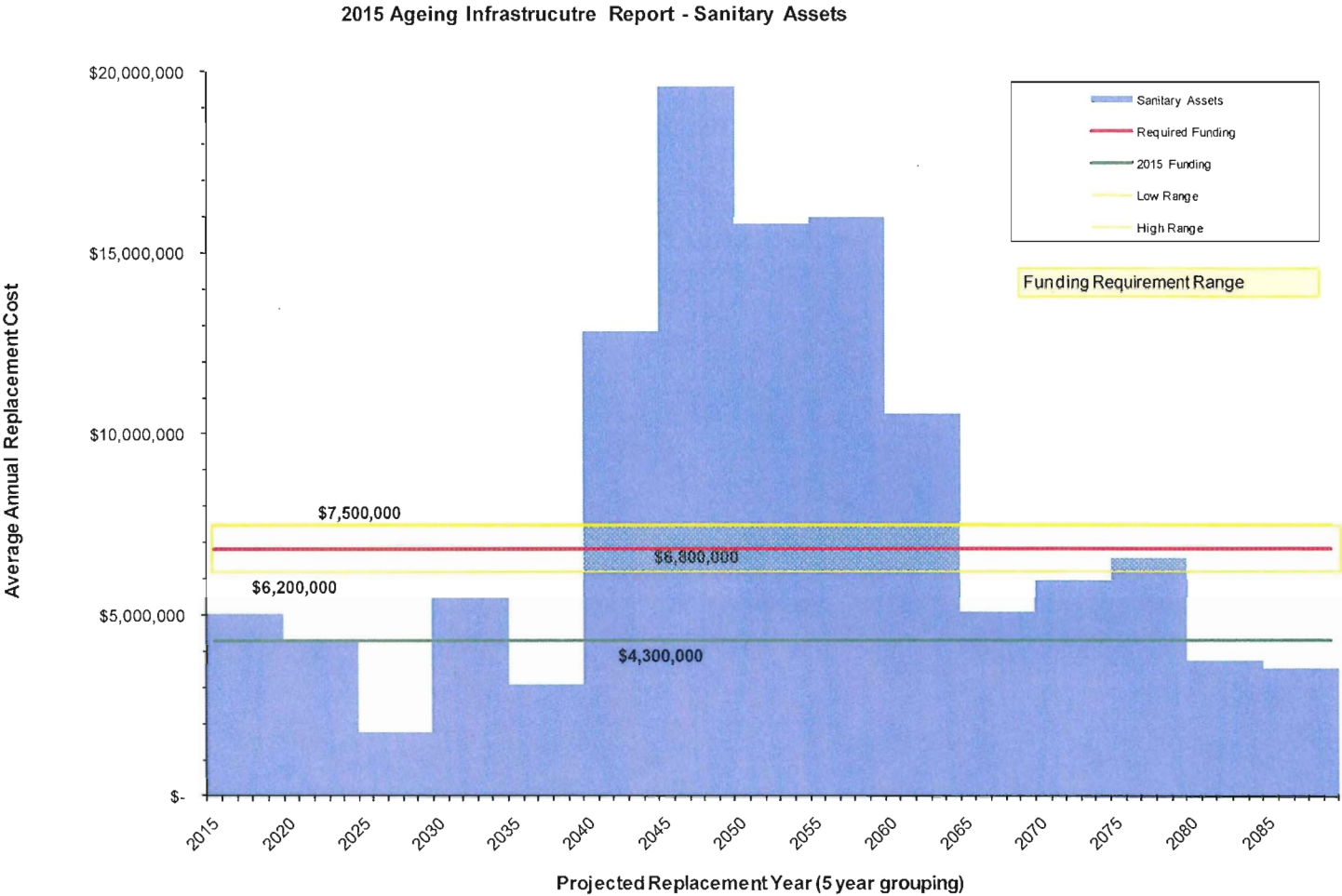
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Att.1: Ageing Infrastructure Report – Water Assets
Att.2: Ageing Infrastructure Report – Sanitary Assets
Att.3: Ageing Infrastructure Report – Drainage Assets
Att.4: Ageing Infrastructure Report – Non MRN Road Assets
Att.5: Historical Costs for Capital Paving Program (2006 – 2014)

Attachment 1

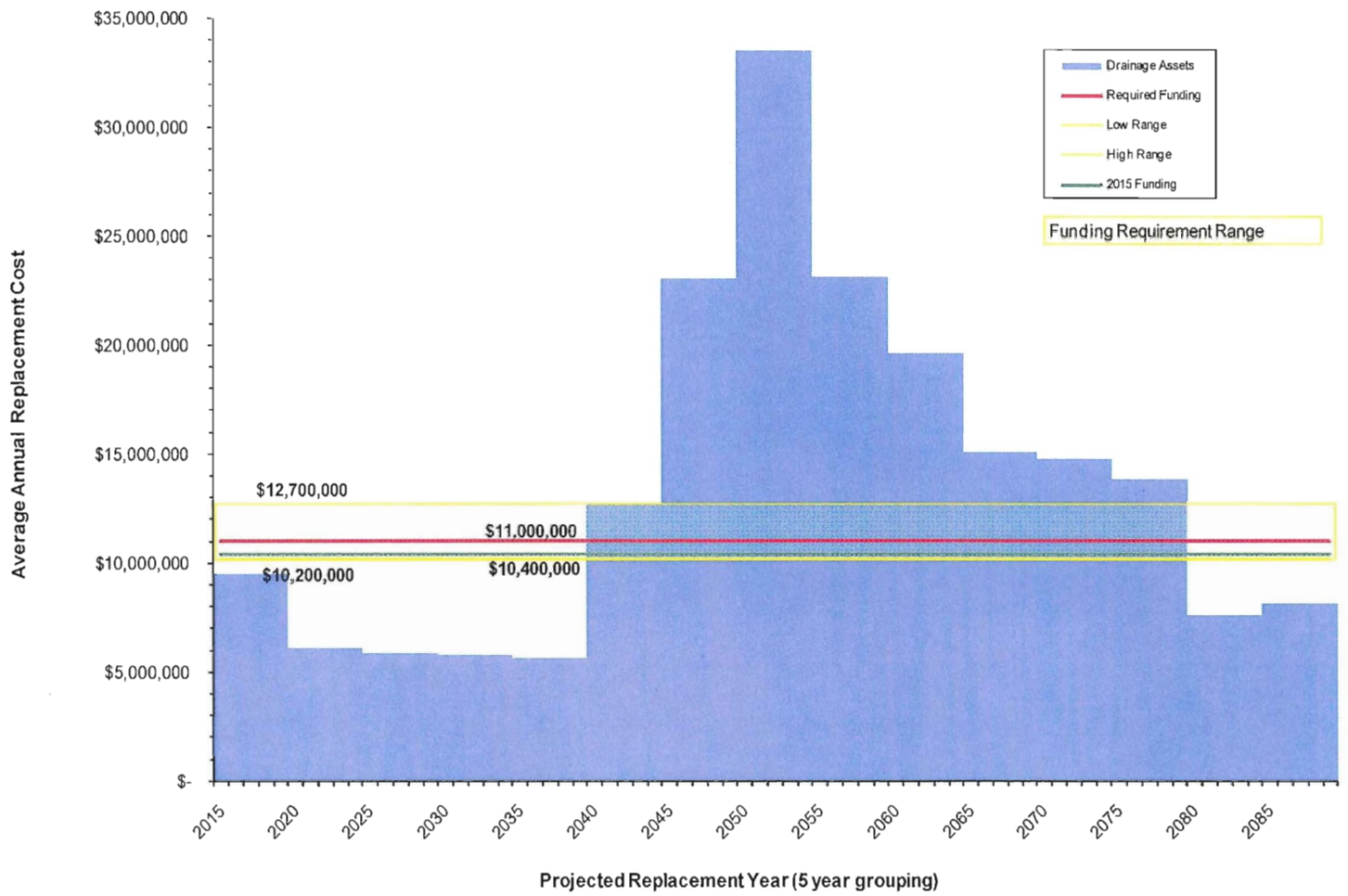


Attachment 2



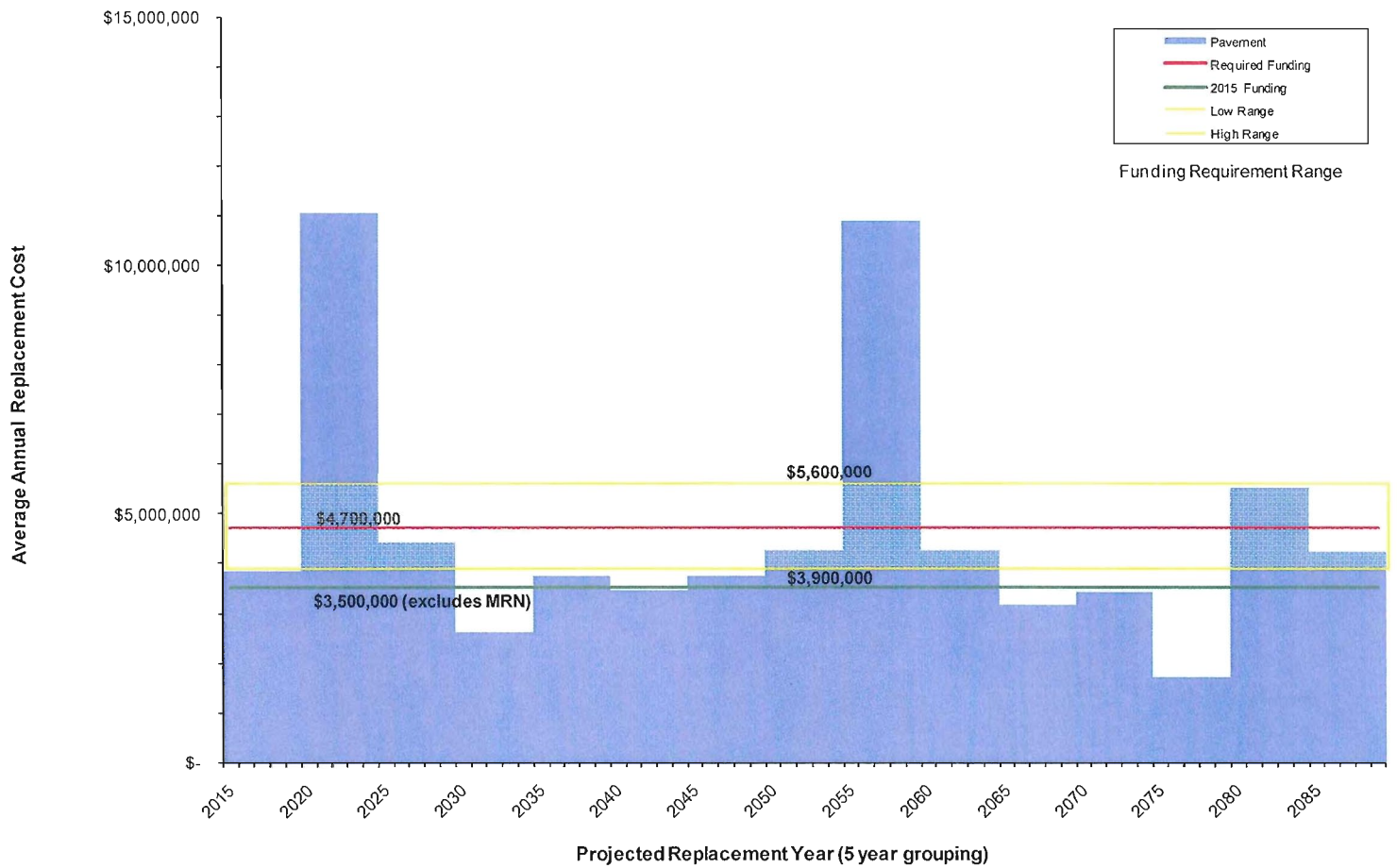
Attachment 3

2015 Ageing Infrastructure Report - Drainage Assets



Attachment 4

2015 Aging Infrastructure Report - Non-MRN Road Assets



Attachment 5

Historical Costs for Capital Paving Program (2006 - 2014)