West Vancouver

AECOM

Stormwater Infrastructure Asset Management Plan

District of West Vancouver

May 18, 2010

AECOM

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Stormwater Infrastructure Asset Management Plan

FINAL REPORT

Prepared by:

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Project Number:

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Date:

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May 18, 2010 Project Number: 111066

Phil Bates, P. Eng.
Manager, Engineering Services
District of West Vancouver
750 17th Street
West Vancouver, V7V 3T3

Dear Phil,

Re: Final Stormwater Infrastructure Asset Management Plan

Please find attached our final report for West Vancouver's Stormwater Infrastructure Asset Management Plan. We thank you for the opportunity to work with you on this interesting project.

Sincerely,
AECOM Canada Ltd.

Nancy Hill, P.Eng.
Project Manager
Nancy.hill@aecom.com

Encl:

NH

Version Log

Version #	Revised By	Date	Description
1	NH	October 22,2009	1st complete draft
2	NH	November 3, 2009	Revised Financial Scenario
3	NH	February 4, 2010	Revised Plan based on West Vancouver's Dec 2009 comments and Jan 2010 revisions
4	NH	February 10, 2010	Revised based on West Vancouver's February 9th comments
5	NH	February 18, 2010	Revised based on West Vancouver's comments sent February 16th.
6	NH	February 24, 2010	Revised based on West Vancouver's comments sent February 24th.
7	NH	May 18, 2010	Corrected total replacement value.

Signature Page

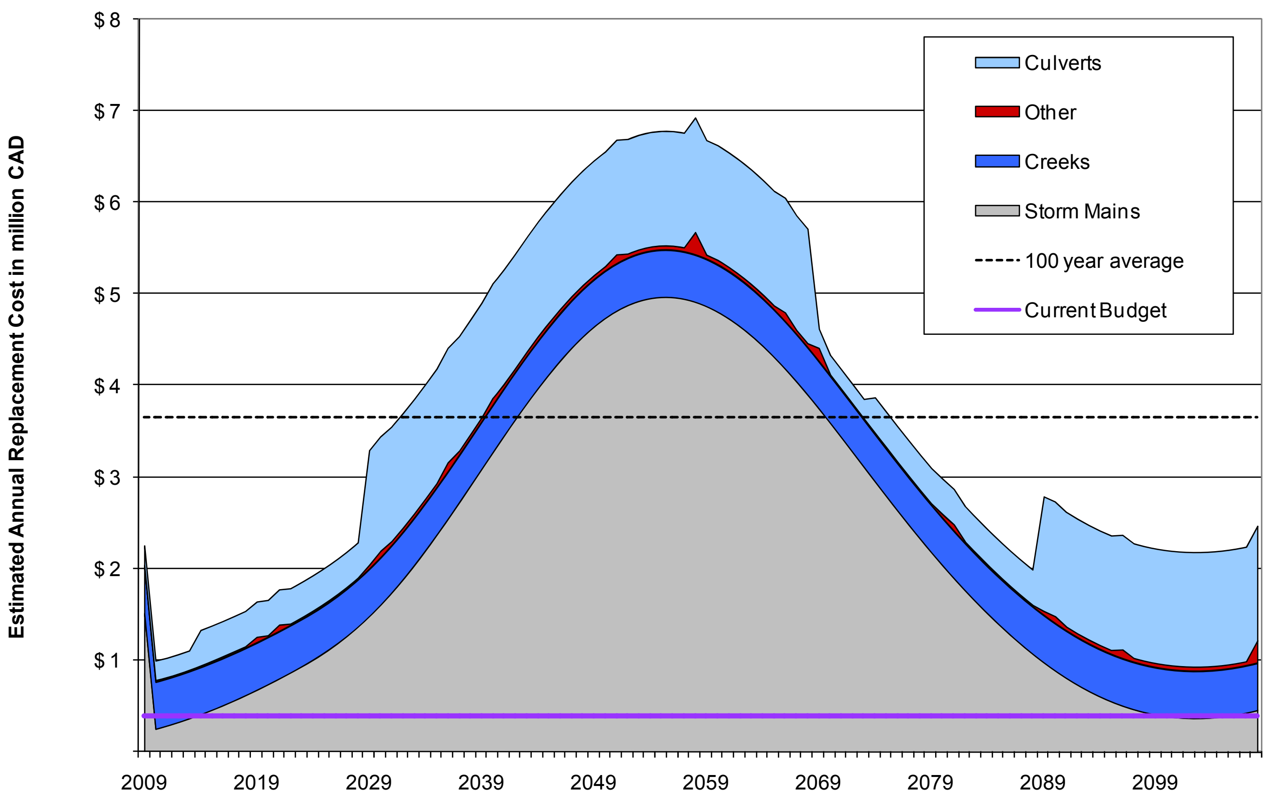
Report Prepared By:	Report Reviewed By:
	
Nancy Hill, P.Eng.	David Main

Executive Summary

Within its stormwater system, the District of West Vancouver owns and maintains 235 km of stormwater mains and associated appurtences (manholes/connections etc.), 522 culverts, 26 km of streams (within municipal right of ways), 19 detention basins, 136 grates, 1 oil-grit separator and 5 rain gauges. The replacement value of the system is estimated at $333 million. The results of this study provide the District of West Vancouver with a long range forecast (100 years) of the financial resources required to support the renewal of all of West Vancouver's stormwater assets.

Figure ES.1 shows the stormwater system renewal requirements over the next 100 years in 2009 dollars. Current stormwater system renewal needs are estimated at $1 million per year but will increase to nearly $7 million per year by 2058. Currently, West Vancouver spends $400,000 per year to support the renewal of its stormwater system. Figure ES.1 also shows that on average the stormwater system will have replacement requirements of $3.7 million per year (which includes the backlog) over the next 100 years.

Figure ES.1 Stormwater System Annual Replacement Requirements 100 Year Forecast



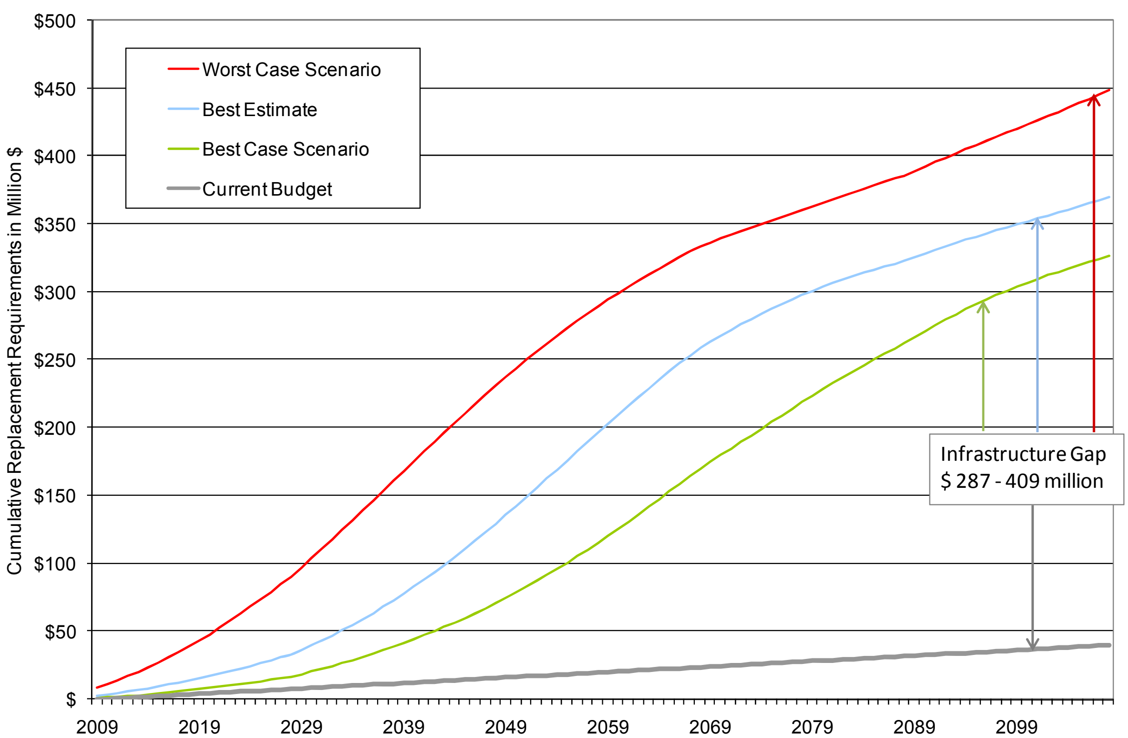
West Vancouver has approximately $2.2 million of 'backlog', which is shown in year 2009 in Figure ES.1. This backlog represents stormwater assets that are due for renewal, based on their age and/or condition, but have not yet been addressed.

It is important to note that there were many data gaps with regard to the condition of West Vancouver's storm sewers and creeks. The financial projection in Figure ES.1 is based on assumptions where there was no data and on typical asset lifespan estimates. Changing these estimates will impact the capital renewal forecast as demonstrated in Figure ES.2.

Figure ES.2 shows how the anticipated renewal requirements (cumulative) compare with the existing renewal budget, under three lifespan scenarios. The first scenario represents a best estimate of the lifespan of West Vancouver's stormwater assets (as depicted in ES.1). The best case scenario shows the stormwater system renewal requirements if the assets last longer than expected and the worst case scenario shows the stormwater system renewal requirements if the assets don't last as long as expected. The difference between the renewal requirements and the existing budget is known as the "infrastructure gap".

Under all three scenarios there is an anticipated infrastructure gap ranging from $287 to $409 million over the next 100 years. Under the best case scenario West Vancouver has 10 years to begin preparing for an infrastructure gap, but under the worst case scenario West Vancouver needs to begin addressing its infrastructure gap immediately.

Figure ES.2 Projected Infrastructure Gap – Three Scenarios

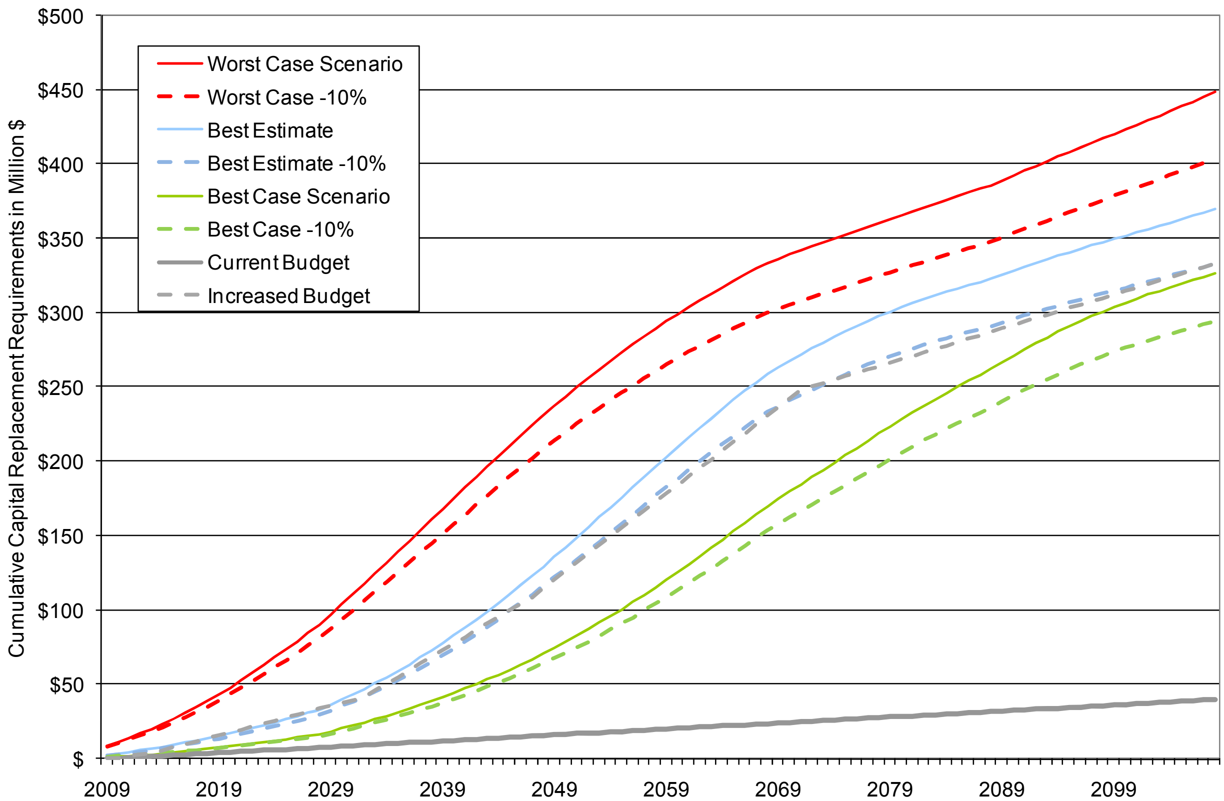


In general the anticipated infrastructure gap can be addressed by increasing the stormwater renewal budget and by optimizing the life cycle costs of assets. West Vancouver can reduce the lifecycle costs of its assets through an effective preventative maintenance program, by identifying the most cost effective renewal strategy for each asset, and by coordinating capital works wherever possible. In order to reduce costs in this manner, West Vancouver needs to collect and make use of more information about the condition and attributes of its stormwater mains and creeks within public right-of-ways. Therefore it is critical that the District implement its storm sewer condition assessment program and initiate a creek assessment program.

This study has adhered to present day best practices for performing strategic level asset management. A "needs-based" approach has been taken to estimate annual resource requirements that give consideration to our current knowledge of asset life spans and current replacement costs.

The relationships shown in Figure ES.3 illustrate the benefit of reducing lifecycle costs by 10% for each scenario, and provides a potential funding strategy that satisfies theoretical asset replacement requirements. This solution reflects one possible way that resources could be implemented throughout their lifecycle, not necessarily how those resources would be provided. Consideration has not been given to factors that might either accelerate renewal efforts (e.g. elevation of risk or criticality, resource levelling, opportunistic cost sharing), or decelerate renewal efforts (e.g. short term affordability). Additional factors, including future reserve policies, remain a subject for continued public debate. Ultimately, a "budget-based" approach to asset management will govern the extent to which West Vancouver will manage assets in a sustainable fashion over the short and long term.

Figure ES.3 Addressing the Infrastructure Gap



The results of this study illustrate the need for West Vancouver to fund its storm sewer condition assessment program, to prioritize assets for rehabilitation and to increase its stormwater capital renewal budget. Effective communication is critical to educate and engage stakeholders to assist in meeting the upcoming challenges associated with the management of the District's infrastructure.

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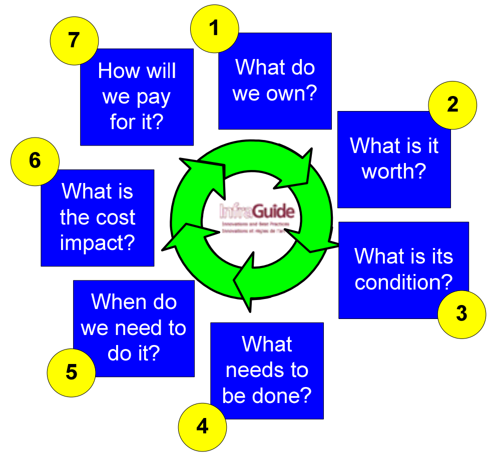
1. Introduction

Figure 1.1 Seven Questions of Asset Management



The District of West Vancouver commissioned this study to develop a long range forecast (100 years) of stormwater infrastructure renewal requirements to ensure the financial sustainability of its infrastructure in perpetuity.

To help West Vancouver meet its objectives, AECOM developed this Asset Management Plan using the "Seven Questions of Asset Management" approach that is recommended by InfraGuide's "Best Practice for Managing Infrastructure Assets". The results of each of the seven steps shown in Figure 1.1 are outlined in this report.

This project leveraged work recently completed to satisfy PSAB reporting requirements and is being complemented by similar plans for West Vancouver's water and sanitary systems. The results of this plan can be used to assist in developing infrastructure renewal budgets, identifying replacement priorities, determining funding sources and communicating infrastructure needs to stakeholders.

This plan covers all components within West Vancouver's stormwater system; namely 235 km of stormwater mains, 3,400 manholes, 522 culverts, 26 km of streams (within municipal right of ways), 19 detention basins, 136 grates, 1 oil-grit separator and 5 rain gauges.

The renewal forecast for this study was completed using an MS-Excel based Capital Asset Planning (CAP) model. An electronic version of this model, with instructions for updating it, will be provided to West Vancouver. A print out of the stormwater system inventory from the model is provided in Appendix A. It is important to note that this model and the findings in this report provide a current "snapshot" of West Vancouver's stormwater infrastructure. If the system changes, for example, by the renewal of a storm main, then the model needs to be updated accordingly.

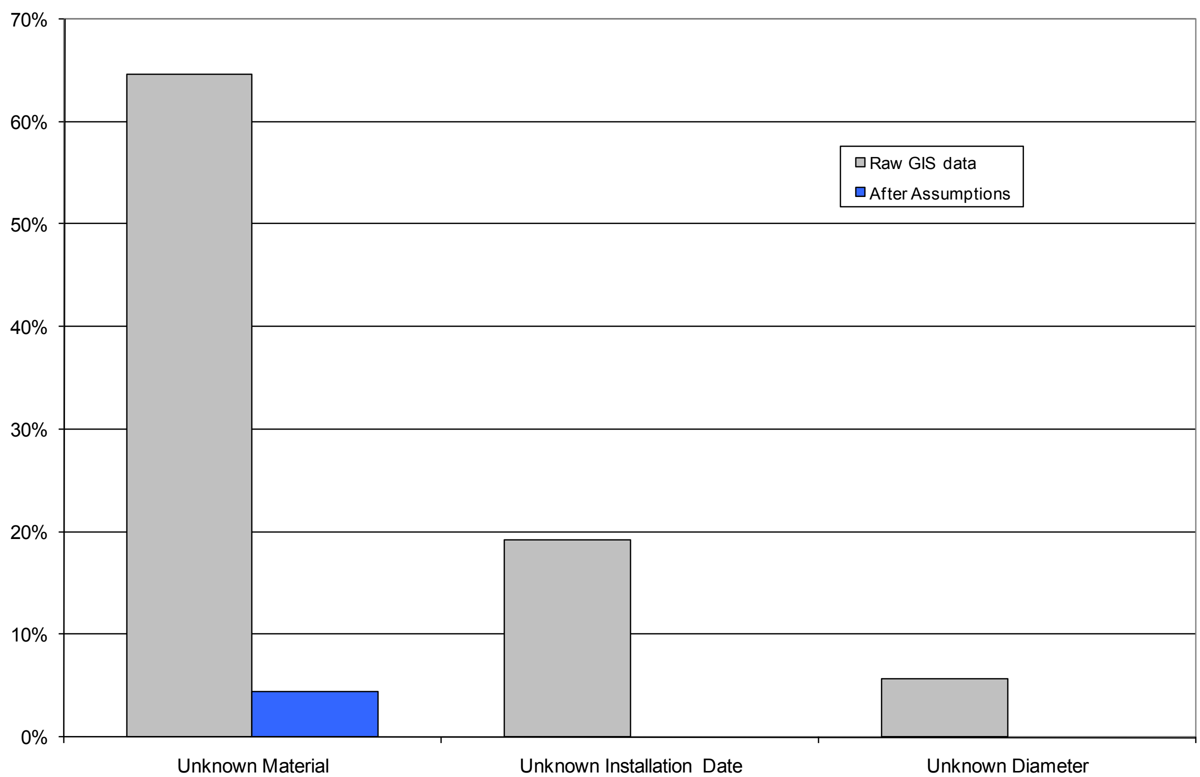
All cost estimates have been prepared using current (2009) dollars in order to facilitate year to year comparisons and to avoid the uncertainty of projecting inflation and discount rates far into the future.

2. Asset Inventory – "What Do We Own?"

2.1 Data Sources

Pipe inventories and creek lengths located within developed public right-of-ways were provided by the District of West Vancouver's GIS department in February 2009. The GIS data for storm mains is not as comprehensive as the water and sanitary sewer GIS data. With approximately 235 km of pipe, it is believed that the total length is captured. However most of the pipe material (65%) and some of the installation dates (19%) and pipe diameters (6%) are unknown (as shown in Figure 2.1).

Figure 2.1 Storm Main Unknowns



Where there were unknowns within the pipe inventory, assumptions were made as outlined in Table 2.1. In cases where the material type was unknown, the material type was assumed based on the year that the main was installed. If the installation year was also unknown, then the pipe material is labelled as "unknown' and given an average service life of 80 years.

Where the pipe diameter and installation year were unknown, a weighted average of known diameters and installation years was applied to make assumptions for the unknown parameters. For example, if 30% of the pipes with known diameters are 300 mm, then 30% of the pipes with unknown diameters were assigned a diameter of 300 mm. Using the weighted average on a significant portion of the inventory inevitably leads to a loss of accuracy. However, in the context of a high level life cycle analysis, the impact of using the weighted average, even on a large portion of the inventory, is not significant.

Table 2.1 Assumptions Made for Unknown Storm Sewer Data

If			Then Assumed		
Diameter	***Material***	***Installation***	***Diameter***	***Material***	***Installation***
any	unknown	pre 1960		concrete	
≤ 375 mm	unknown	post 1970		pvc	
>375 mm	unknown	post 1970		concrete	
unknown	unknown	2001	weighted average	weighted average	
525 mm	unknown	1995		concrete	
>375 mm	unknown	1960s		concrete	
< 450 mm	unknown	1960s		weighted average	
unknown	unknown	unknown	weighted average	Unknown (assumed average service life of 80 years)	weighted average

Within the GIS database there were a variety of abbreviations given for the same material type. Table 2.2 outlines the various abbreviations within the GIS database and the material type assumed for this study. We recommend that the District adopt standard nomenclature for data such as pipe material to facilitate the collection and analysis of asset information.

Table 2.2 Assumptions Made for Pipe Material Based on Abbreviations in GIS

Pipe Material	GIS Abbreviation
Unknown	9999, blanks, NA, Inlet, RD
Asbestos Cement	AC
Cast Iron	CI
Vitrified Clay	VC, VITCLAY
Wood	W, WD, WOOD
Concrete	conc, C, CP, RC, RCB, RCP
Ductile iron	DI
High density polyethylene	HDPE, HDPP, SC
PVC	BIGO, CPP, French Drain, Perf, PVC, PVC PERF
Steel	CMP, ST, STEEL, CSP

In 2006 West Vancouver compiled an inventory of all of its culverts and associated grates and headwalls. The information was compiled in a number of documents. A summary of the culvert inventory can be found in West Vancouver document DWV-#250343-v1-CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS.

A detention basin inventory was compiled for PSAB in December 2008. The inventory which was used for this study can be found in West Vancouver document DWV-#332589-v1-ASSET_PROJECT_-_STORM_SYSTEM.XLS.

Natural creeks and water courses are considered part of the stormwater system. These creeks occupy both private and public lands. The District is responsible for the maintenance and rehabilitation of water courses that transit public lands. It was assumed that creeks within undeveloped areas are in their natural state and can remain as they are. However, creeks within developed areas will likely be impacted by adjacent development and will require rehabilitation work at some point in the next 100 years. It was determined from GIS that there are 26 km of creeks within developed areas and on public property.

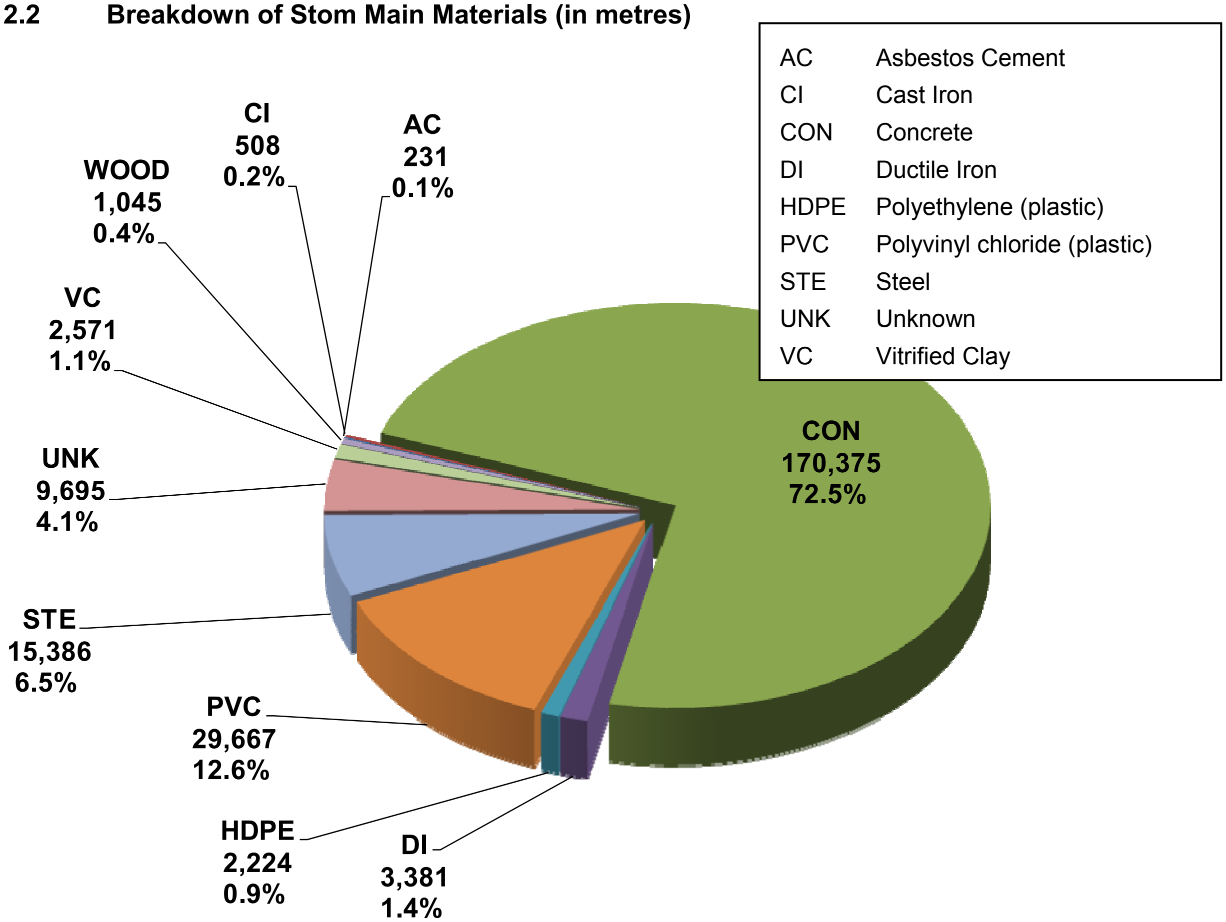
2.2 Asset Inventory Summary

West Vancouver's drainage system includes 235 km of stormwater mains and associated appurtances, 522 culverts, 26 km of streams, 19 detention basins, 136 grates, 1 oil-grit separator and 5 rain gauges. The 235 km of stormwater mains include all appurtances such as services, catch basins and storm manholes.

As described in Section 2.1, asset attributes (such as material or installation date) are often unknown. In these cases, assumptions were made based on available information. A summary of the asset inventory used for this study, which includes any assumptions, is provided in the figures below.

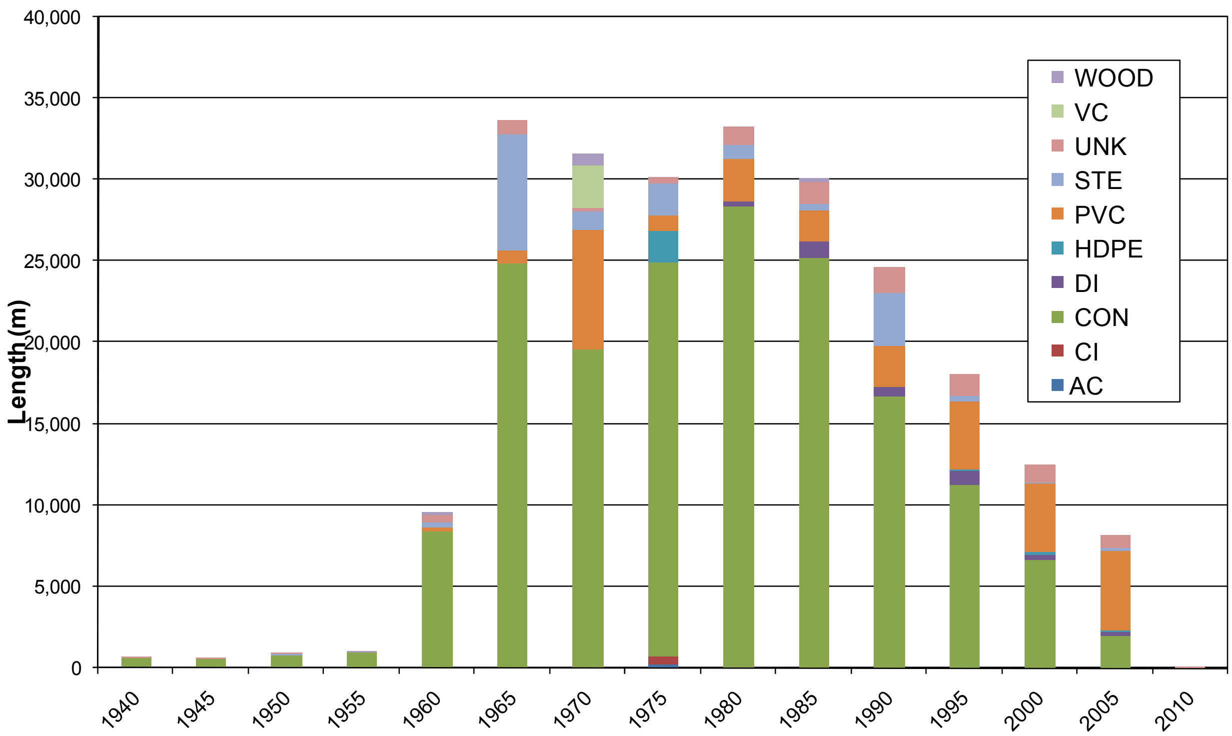
The pipe material is known for only 35% of the storm mains, which means assumptions had to be made about the majority of the inventory's material type. Figure 2.2 shows the breakdown of pipe material used for this study following the application of assumptions described in Section 2.1.

Figure 2.2 Breakdown of Stom Main Materials (in metres)



Following the application of pipe material assumptions, 80% of the mains are assumed to be made of concrete, 11% of PVC with the remaining 9% being made of a variety of pipe materials.

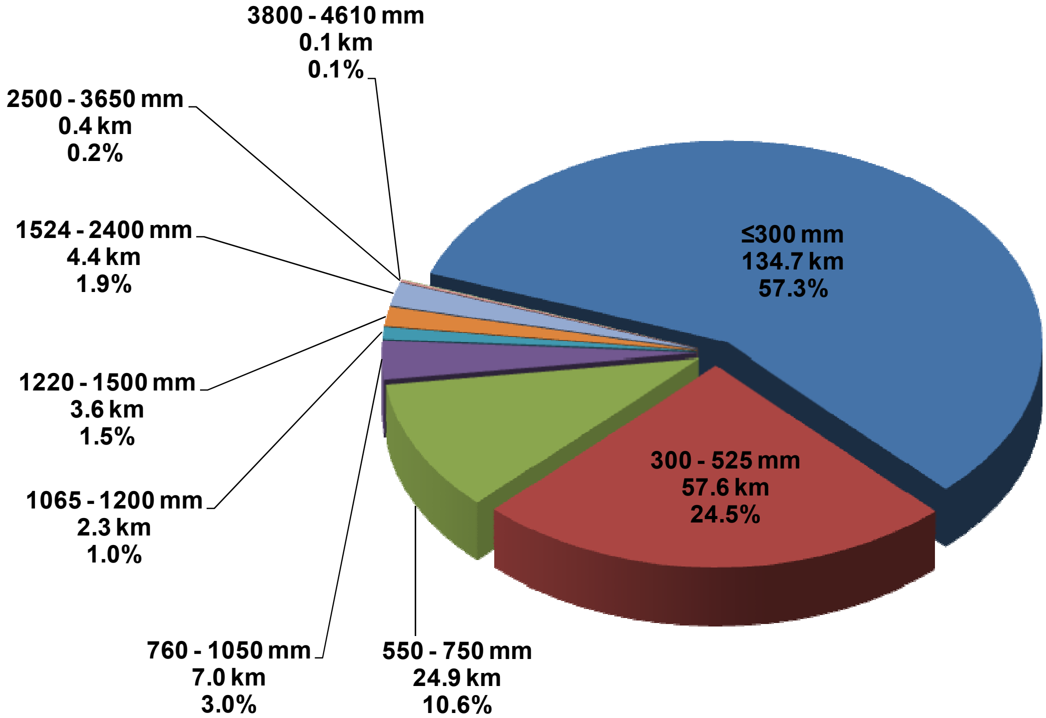
Figure 2.3 Growth of Storm Sewer System by Pipe Type



The growth of the storm sewer system by pipe type is shown in Figure 2.3. The oldest storm main in the system was installed in 1942. Some small sections of pipe were installed prior to 1963, but the majority of the system was installed after 1964.

Figure 2.4 shows that over half (57%) of West Vancouver's storm mains are 300 mm in diameter or less, approximately 25% are greater than 300 mm but less than or equal to 525 mm in diameter. The remaining 18% have a diameter greater than 525 mm.

Figure 2.4 Length of Storm Mains by Diameter (in metres)



3. Replacement Costs: "What is it worth?"

The unit replacement cost for the storm mains include manholes and service connections. The estimated unit replacement costs were developed based on recent construction costs in the District of West Vancouver. The unit replacement costs (2009 dollars) for storm mains used for this analysis are provided in Table 3.1 below.

Table 3.1 Unit Replacement Costs for Storm Mains

Size (mm)	$/m
300	$850
525	$900
750	$1,000
1050	$1,200
1200	$1,500
1500	$1,800
2400	$2,400
3650	$3,600
4610	$5,000

Most of West Vancouver's stormwater outfalls discharge directly on to the beach or rocky shoreline. As the outfalls are not submerged, the replacement costs do not include any underwater installation costs for renewing the outfalls. The unit replacement cost for the outfalls has been assumed to be the same as that for the storm mains. If future environmental or safety requirements significantly impact the design and/or construction of renewing outfalls, then the cost estimates will need to be adjusted accordingly.

In most cases existing grates at the end of their service life will need to be replaced with new custom made and structurally sound grates. The unit replacement costs used for different types of grates are as follows:

- Screens - $5,000
- Trash racks and grizzly racks - $30,000

The Manager of Sustainability, Environment & Healthy Communities for the District of West Vancouver confirmed that as culverts are replaced the District will look at installing baffles in the new culverts. In addition, new culverts should have grates and be designed for energy dissipation, as necessary. West Vancouver had already developed cost estimates for each of its culverts in 2008 for PSAB reporting, which were used for this study. The range of unit costs used ($50,000 - $160,000) were based on recent culvert replacement projects in West Vancouver. Factors considered in developing unit costs were the diameter of the culvert, the equipment required for installation (i.e. backhoe vs. excavator vs. crane) and the presence of a headwall. All culverts were assumed to have a length of 20 metres based on an average road width. The spreadsheet outlining the culvert replacement costs can be found in West Vancouver document DWV-#332589-v1-ASSET_PROJECT_-_STORM_SYSTEM.XLS.

Existing detention basins within West Vancouver use natural or recreational features. The only items that were included for future capital renewal works were inlet structures associated with these features. The following list outlines the renewal cost used in this study for each of the detention basins. The irrigation reservoir within the golf course is operated by the Parks Division and has not been included within this study.

Table 3.2 Renewal Cost for Stormwater Detention Basins

Basin	Renewal Cost
875 Fairmile	$4,000
Whitby Road cul-de-sac	$5,000
North of 3704 Southridge Place	$4,000
3714/3712 Southridge Place	$20,000
3712/3710 Southridge Place	$20,000
2795/2790 Southridge Place	$4,000
2327 Westhill Drive	$4,000
2250 Westhill Drive	$4,000
2035 Westhill Drive	$4,000
Woodburn at Westwood	$10,000
2538 Westhill Close	$3,000
2136-2108 Westhill Place	$4,000
2790 Chelsea Close	$4,000
1488 Chippendale Road	$3,000
2535/2531 Westhill Drive	$4,000
4615 Northwood	$4,000
2155 Westhill Wynd	$10,000
2775 Chelsea Close	$4,000
1556 Tyrol Place	$5,000
2550 Westhill Drive - 2155 Westhill Wynd	$4,000
3168 Deer Ridge Drive	$3,000
Total	**$205,000**

Based on West Vancouver's experience with creeks within its jurisdiction, it has been assumed that all creeks within developed areas will require bank stabilization work at least once within the next hundred years. An estimate of $2,000 per metre for creek stabilization work was used based on an average unit cost of $1,000 per square metre for retaining structures, such as mechanically stabilized earth walls.

Details regarding the condition of the creek banks on public property were not readily available for this study. Some information regarding the stream banks may be available within the Integrated Stormwater Management Plans (ISMPs) that West Vancouver has undertaken. Where there is no information regarding the stability of creeks on public property, we recommend that the District of West Vancouver undertake creek assessments to determine the rehabilitation required. The results of any creek assessments will help refine the funding forecasts developed as part of this study.

Based on the assumptions documented in this report, West Vancouver's stormwater system has an estimated replacement value of $333 million (in 2009 dollars), a breakdown of which is shown in Table 3.3. Two-thirds of the value of the system is within its storm mains, 17% is within its culverts and 15% is within its creek banks. The remaining 1% ("other") consists of the detention basins, grates, oil-grit separator and rain gauges.

Table 3.3 Replacement Value – West Vancouver's Stormwater System

Component	Replacement Value
Storm Mains	$222.3 million
Culverts	$56.9 million
Creek Banks	$51.3 million
Other	$2.5 million
Total	**$333 million**

In 2008, West Vancouver estimated that its stormwater system had a replacement cost of $272 million (reference DWV document -#332589). $272 million is lower than the estimate developed for this asset management plan ($333 million) as it doesn't consider any costs associated with rehabilitating creek banks.

In 2006 UMA prepared a "Multi-Year Storm Sewer Condition Assessment Program" for the District of West Vancouver. Within the summary report, the replacement value of the storm mains was estimated at $189 million. The 2006 estimate was a Class D estimate based on $2 per millimetre diameter per metre sewer. The estimate prepared for this plan is based on current construction costs in West Vancouver.

4. What is its Condition?

West Vancouver recently completed an inventory of its culverts and associated grates. As part of the data collection, each culvert and grate was given a rudimentary condition grade of good, fair or poor. The majority of the culverts (88%) were rated as good, 10% as fair and 2% as poor. The majority of the grates (84%) were rated as good, 12% as fair and 4% as poor. A list of the culverts and grates noted to be in poor condition has been provided in Appendix D.

Although these condition grades were based on a cursory visual inspection, they have been used for this study since West Vancouver does not have a more detailed condition assessment of these culverts and does not know the date that they were installed. We recommend that West Vancouver conduct a more thorough condition assessment of its culverts to develop a better estimate of future renewal needs.

Recently West Vancouver staff discovered several storm mains that are deteriorating despite being only 30-40 years old. The premature deterioration may be due to rocks entering the pipe system and scouring the inside of the pipe as they propel down the steep slopes at high velocities. To account for the fact that some mains are deteriorating prematurely, a Weibull probability distribution curve for predicting the timing of main replacement has been applied to this analysis. This will be discussed further in Section 6.

In 2006 UMA developed a *Multi-year Storm Sewer Condition Assessment Program* for West Vancouver, which can be found in Appendix B. Historically West Vancouver has done very little storm sewer condition assessment. We therefore recommend that West Vancouver implement the sewer condition assessment program as outlined in the 2006 report. Once West Vancouver determines the condition of its storm mains, it will be able to refine estimates of future funding requirements, prioritize mains for renewal and prolong the life of its storm mains through targeted rehabilitation work.

The District of West Vancouver has typically conducted creek bank assessments only when an issue arises. West Vancouver has also completed Integrated Stormwater Management Plans for various watersheds that identify areas where stream bank erosion is a concern. However, West Vancouver does not have a comprehensive view of where and when stream bank rehabilitation works need to be conducted. It is recommended that West Vancouver extract available condition information from its ISMP's to plan the rehabilitation of its creek banks. Where there is no information on creeks that transit public lands in developed areas, West Vancouver should consider conducting creek bank assessments to better gauge the extent of stream rehabilitation works that may be required.

It is important to note that this asset management plan addresses renewal based on asset condition. It does not address asset renewal in response to other factors such as capacity or environmental requirements.

5. What Needs to be Done?

To sustain the functionality of West Vancouver's stormwater system, numerous preventative and corrective maintenance activities must occur, and assets must be renewed as needed. In general, maintenance practices impact renewal requirements as effective preventative maintenance programs will help to extend the life of a given asset.

Grouting, spot repairs, regular root cutting, video inspections and full replacement are some of the options that should be considered to determine the most cost effective strategy for operating and maintaining the storm sewer system. The optimal strategy will have to be reviewed on a case by case basis depending upon a variety of factors such as the age, location and structural integrity of the sewer. A good reference for the review of rehabilitation strategies for sewers is the Best Practice by the National Guide to Sustainable Municipal Infrastructure titled "Selection of Technologies for Sewer Rehabilitation and Replacement". The InfraGuide Best Practice Reports can be found at
http://www.sustainablecommunities.fcm.ca/Infraguide/Best_Practice_Reports.asp

West Vancouver should inspect its storm sewer system as recommended in the *2006 Multi-year Storm Sewer Condition Assessment Program* in order to identify optimal rehabilitation strategies. Other components of the stormwater system such as creeks, ditches, headwalls, grates and oil-grit separators also require regular inspection and maintenance to ensure their functionality and to optimize the life of each asset.

As this study provides a high level view of asset renewal requirements, the maintenance and rehabilitation of specific assets – such as the replacement of rip rap around culvert headwalls - has not been identified. Instead, all assets are assumed to require replacement at the end of their predicted service life, which provides a more conservative approach to budgeting than if rehabilitation strategies were also considered. In Section 7, the potential for extending the life of assets through a targeted rehabilitation program is discussed.

6. When Do We Need to Do It?

The CAP (Capital Asset Planning) model predicts the replacement year of an asset based on its age, the expected service life for the type of asset, its condition, and the consequences associated with its failure. In some cases replacement needs may also be based on externalities such as development but as these externalities are largely unknown at this time they have not been considered in this analysis. The model also assumes that the whole asset (i.e. culvert with headwall) is replaced at the same time.

The model, which was developed for “top-down” asset renewal planning, can be used to estimate the remaining life of an asset but it is not an appropriate tool for determining short term capital programs. Identifying specific assets for replacement in the short term should be done in consultation with inspection results, maintenance records, capacity requirements and replacement programs of other utilities and roadways, and an understanding of the risk associated with a given asset failing. Short term capital planning should be done as part of a bottom-up asset renewal plan, as discussed in Section 6.4.

6.1 Risk

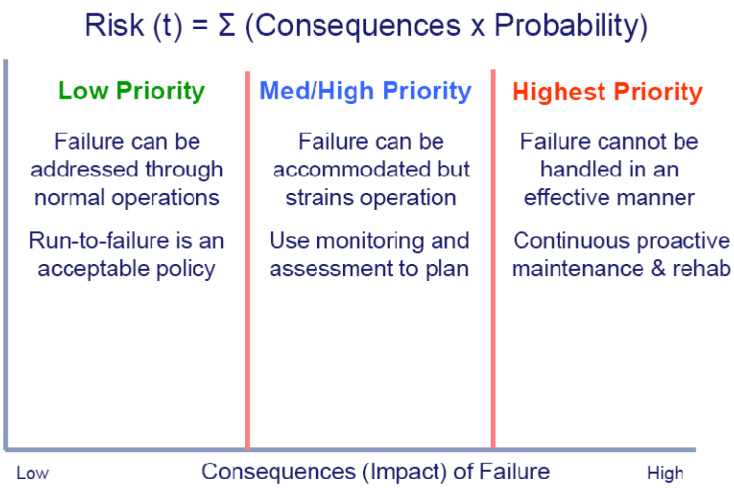
The risk associated with a given asset failing can be defined as the probability of an asset failing (based on age, material and condition) multiplied by the consequences of it failing (defined as its criticality).

Risk Exposure = (Consequences of Failure) X (Probability of Failure)

The CAP model allows users to input a criticality rating to capture the level of damage or disruption that would be caused should an asset fail. As asset criticality has not yet been formally determined for West Vancouver’s stormwater system, a criticality rating was not used for this analysis. This extra level of refinement could be done in a second more detailed renewal forecast.

Additionally, once West Vancouver determines the criticality of different assets within its stormwater system it could use a risk based approach to determine the most cost-effective strategy for maintaining an asset based on the consequences of failure as depicted in Figure 6.1.

Figure 6.1 Risk-based Approach to Asset Renewal Planning



This risk-based approach is similar to that which was developed for West Vancouver's *Storm Sewer Condition Assessment Program* by UMA in 2006. The objective of the Storm Sewer Condition Assessment Program was to prioritize storm sewers for inspection and identify condition assessment requirements. As the objective of this study is to develop long term financial forecasts for renewing West Vancouver's sanitary system and not to prioritize the replacement of specific assets, the condition assessment risk model was not adopted for this study. However, we recommend that the risk model be used for prioritizing sewers for inspection and for a bottom-up renewal plan, as discussed in Section 6.4.

6.2 Expected Service Life for Different Asset Types

A storm main's service life depends on many factors – material, quality of installation, soil conditions, impact of rocks entering the storm system and disturbances by adjacent construction. Of these factors, West Vancouver, like most municipalities, only has information on the material of a portion of its storm mains. Fortunately, various industry sources exist that estimate a storm main's typical service life based on its material type.

Table 6.1 summarises information on the estimated service life of storm mains that were collected from NASSCO (an industry organisation) and a survey from the National Water and Wastewater Benchmarking program. The table also outlines the service lives that were used for this study. The category "Future" is for any pipe that will be installed in the next 100 years.

Table 6.1 Estimated Service Lives for Storm Mains by Material Type

Material	Estimated Service Life	% of inventory	Benchmarking Survey	NASSCO
AC	85	0.10%	86	75
CI	85	0.22%	84	
STE	85	6.55%	87	
CON	80	72.47%	95	75
DI	100	1.44%	87	
HDPE	85	0.95%	86	50
PVC	85	12.62%	86	50
UNK	80	4.12%		
VC	85	1.09%	92	75
WOOD	50	0.44%		
Future	100			

As the majority of the existing pipes are concrete and PVC, the estimated service lives for these two materials will have the largest impact on the study findings. PVC pipe manufacturers claim that PVC will last 100 years, but since it has not been in the ground that long, a more conservative number of 85 years was used. This is consistent with what other cities across Canada are estimating for their PVC pipes as shown in the recent National Water and Wastewater Benchmarking Survey results.

Although it was assumed that concrete will last on average 80 years, not all pipes will fail at exactly 80 years of life. To simulate the reality that not all pipes with an expected service life of 80 years will fail at exactly 80 years, the Weibull probability distribution was used to model a replacement envelope and predict pipe failure as the network ages. This means that a portion of the pipes will fail before its expected service life and a portion will last beyond their expected service life. More information about the Weibull Distribution can be found in Appendix C.

The service lives used for assets other than storm mains are shown in Table 6.2.

Table 6.2 Estimated Service Lives for Stormwater Assets

Asset Type	Estimated Service Life (years)
Culverts	60
Oil-grit separator	50
Rain gauge	15
Screens	50
Detention Basins – inlet structures	50

As the installation dates of the existing culverts are unknown, the forecasted replacement year of the culverts was based on their condition. For this analysis, the forecasted replacement year was based on the following:

- All culverts in poor condition should be replaced within the next 5 years (i.e. 2010-2015);
- All culverts in fair condition should be replaced within the following 15 years (i.e. 2015- 2030); and
- All culverts in good condition should be replaced within the remaining 40 years (i.e. 2030-2070).

There is not sufficient information to determine when each creek on public lands will need to be rehabilitated. We therefore recommend that the District of West Vancouver complete a creek assessment program to better determine the current condition of the creeks and estimate the cost and timing of any required rehabilitation work. For the sake of this study, it was assumed that each creek within developed areas will require bank rehabilitation within the next 100 years. Therefore, the financial forecast has assumed that 1% of the creeks will require rehabilitation each year.

As the District obtains additional information on the condition of its creeks, the assumptions made in this plan should be reviewed and refined as necessary.

6.3 Sensitivity Analysis

The service life of concrete storm mains was estimated at 80 years based on industry standards and West Vancouver's limited CCTV data. Concrete pipe represents 52% of the value of West Vancouver's stormwater system. The cost of stabilising creek banks within West Vancouver had to be estimated in the absence of information on the condition of the existing creek banks. In order to test the sensitivity of the estimated service life of concrete pipe and the cost of rehabilitating creek banks worst and best case scenarios were developed in addition to the original "best estimate". The range of values used for the three scenarios is presented in Table 6.3.

Table 6.3 Range of Estimated Service Lives and Costs Used

Asset Attribute	Worst Case	Best Estimate	Best Case
Creek bank stabilisation costs	$5,000/metre	$2,000/metre	$500/metre
Concrete pipe - average service life	60 years	80 years	100 years

The impact of using a range of cost estimates and service lives can be seen in Section 7. If West Vancouver were to expand its CCTV program and creek assessment program, then it could better estimate how long its assets will last and refine the financial forecasts provided in this report.

6.4 Bottom-up Asset Renewal Planning

This asset management plan represents a "top-down" approach to renewal planning, which is appropriate for strategic long-term planning and estimating future renewal budgets. A "bottom-up" asset renewal plan identifies specific assets for replacement based on priority and is critical for optimising available renewal budgets.

The bottom-up approach, which is used for short-term capital planning of projects, outlines asset renewal priorities based on asset condition and criticality. It is therefore important that West Vancouver determine the condition and criticality of its assets in order to develop a bottom-up stormwater asset renewal plan.

7. How Much Will It Cost?

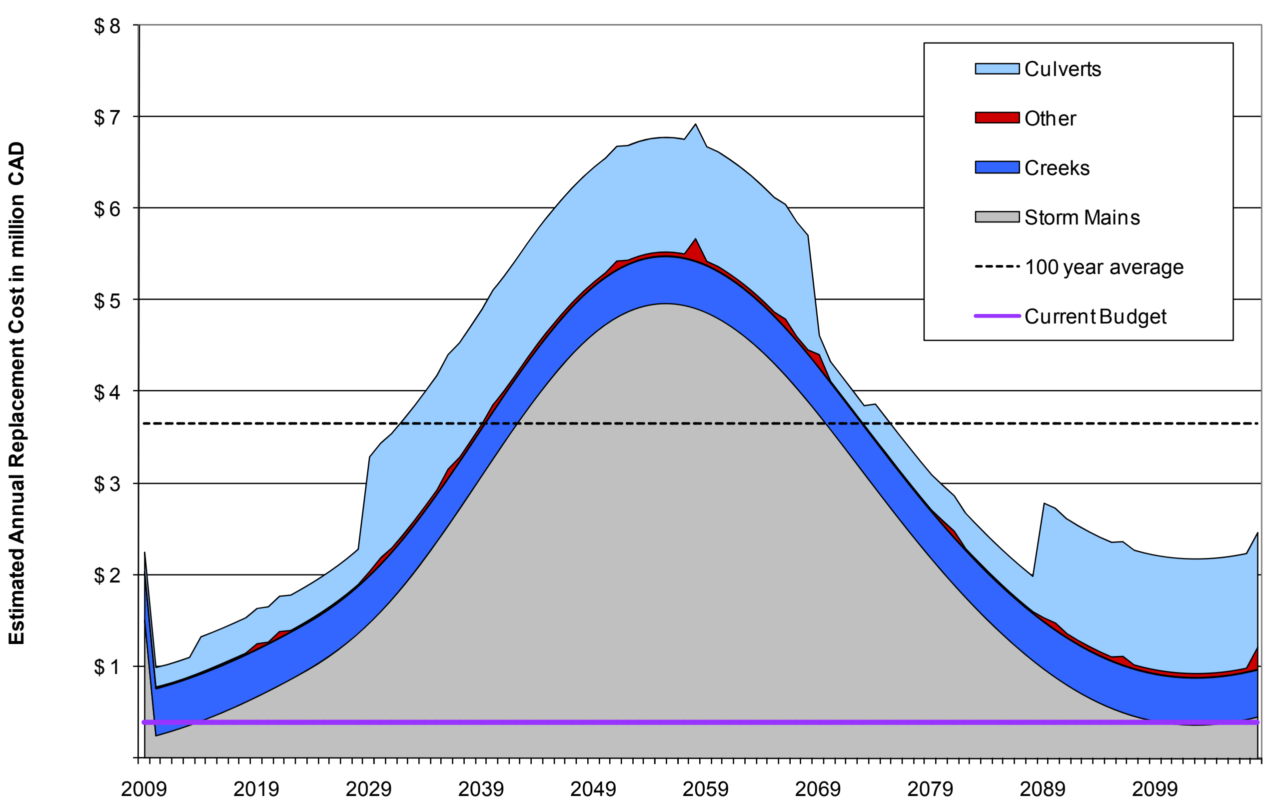
This study estimates required capital renewal budgets over the long term, which facilitates the setting of capital budgets and associated revenue requirements. The District will still need to develop a prioritized capital renewal plan that identifies exactly which assets are to be replaced over the short term.

7.1 Long Range Forecast

The main objective of this study was to provide West Vancouver with a long range forecast of future stormwater infrastructure renewal requirements. All costs presented in this report are in 2009 dollars, in order to provide a consistent view for year to year comparisons. If inflation were included, then it would be difficult to see if future cost increases were due to aging infrastructure or simply due to the selected inflation rate.

Figure 7.1 shows the total annual capital replacement costs predicted by the CAP model for the next 100 years. The average annual cost over the next 100 years is $3.7 million (which includes the backlog). Replacement of storm mains represents the largest component of the total cost.

Figure 7.1 Stormwater System Annual Replacement Requirements 100 Year Forecast

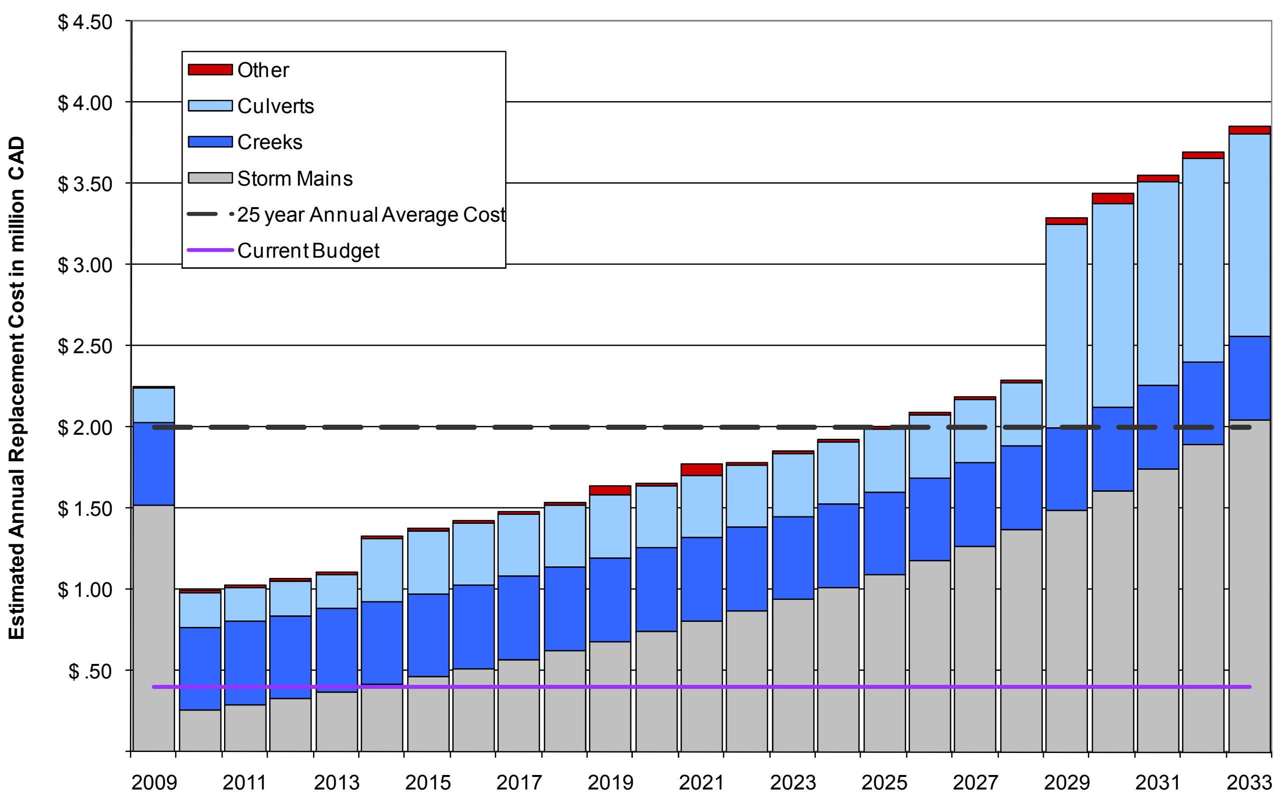


The $2.2 million cost in 2009 represents the "backlog" of assets that are statistically due for replacement but have not yet been replaced . It would appear that the "backlog" predicted by the CAP model is accurate as West Vancouver operations staff have observed culverts and storm mains that are in poor condition, and in need of immediate repair.

A large portion of the storm mains were installed in the 1960's and 1970's, probably in conjunction with the construction of the sanitary sewer system. This would explain why the stormwater replacement requirements peak to nearly $7 million around 2058.

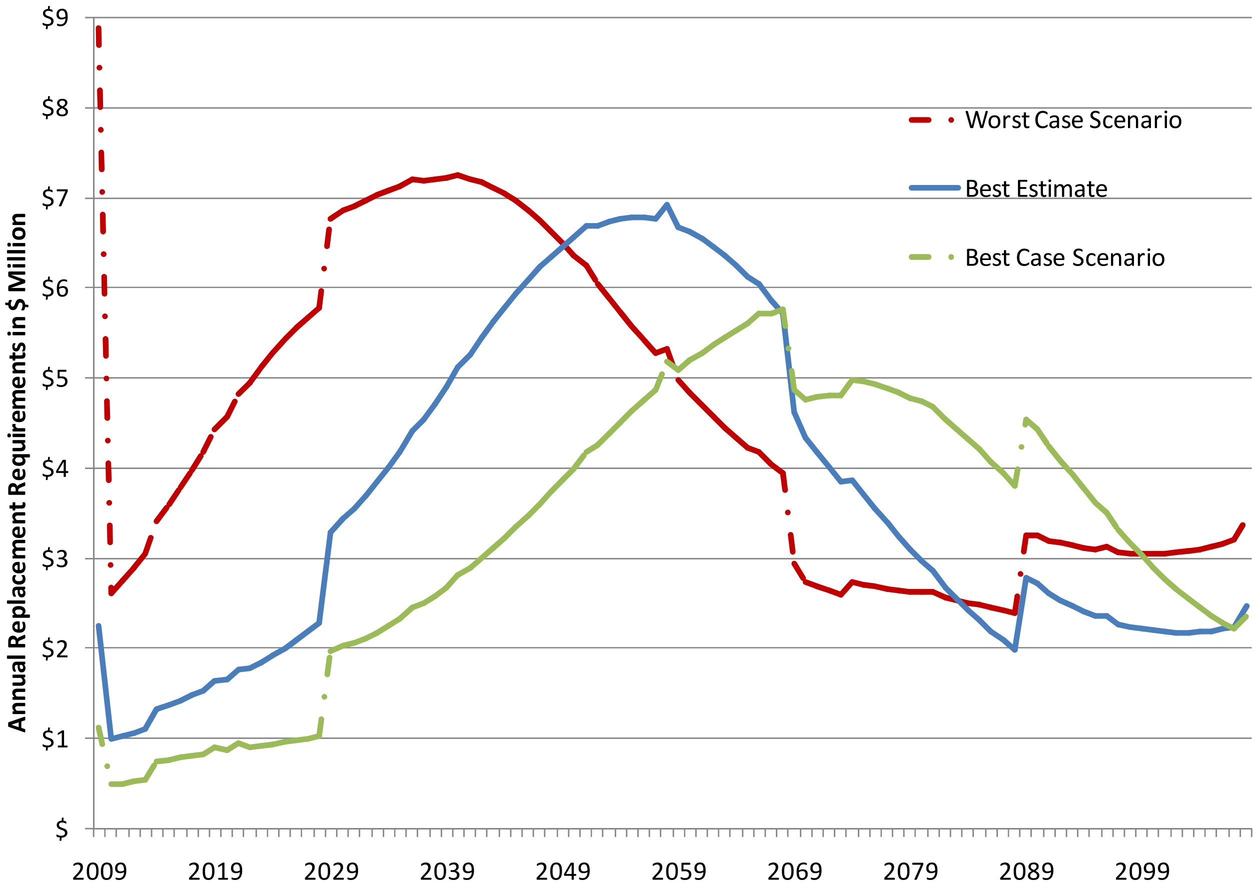
Figure 7.2 shows that the average annual estimated capital replacement cost over the next 25 years is $2 million (in 2009 dollars). The danger in taking a 25 year view is that West Vancouver won't be prepared for the signficant increase in renewal requirements in years 2035-2060.

Figure 7.2 Stormwater System Annual Replacement Requirements 25 Year Forecast



As described in Section 6.4, a range of estimated service lives for concrete pipe and a range of estimated creek rehabilitation costs were used to determine the sensitivity of key assumptions. The total capital renewal forecast using the original estimate of service lives as well as the worst and best case scenarios are presented in Figure 7.3 below.

Figure 7.3 Total Annual Replacement Requirements Using a Range of Estimated Service Lives



If the assets last longer than predicted (e.g. best case scenario) then the “hump” of renewal requirements is pushed further into the future and spread out over more years. If the assets don’t last as long as predicted (e.g. worst case scenario) then West Vancouver will start to experience an immediate dramatic increase in renewal requirements.

Conducting rehabilitation work, such as spot repairs, typically extends the life of an asset. However a sewer inspection program (CCTV) is required to identify opportunities for extending the life of sewer mains through rehabilitation. Therefore, we recommend that West Vancouver implement its Storm Sewer Condition Assessment Program. The replacement costs in the 100 year forecasts above do not include CCTV or storm sewer repair costs.

8. Funding Strategies: "How Will We Pay for It?"

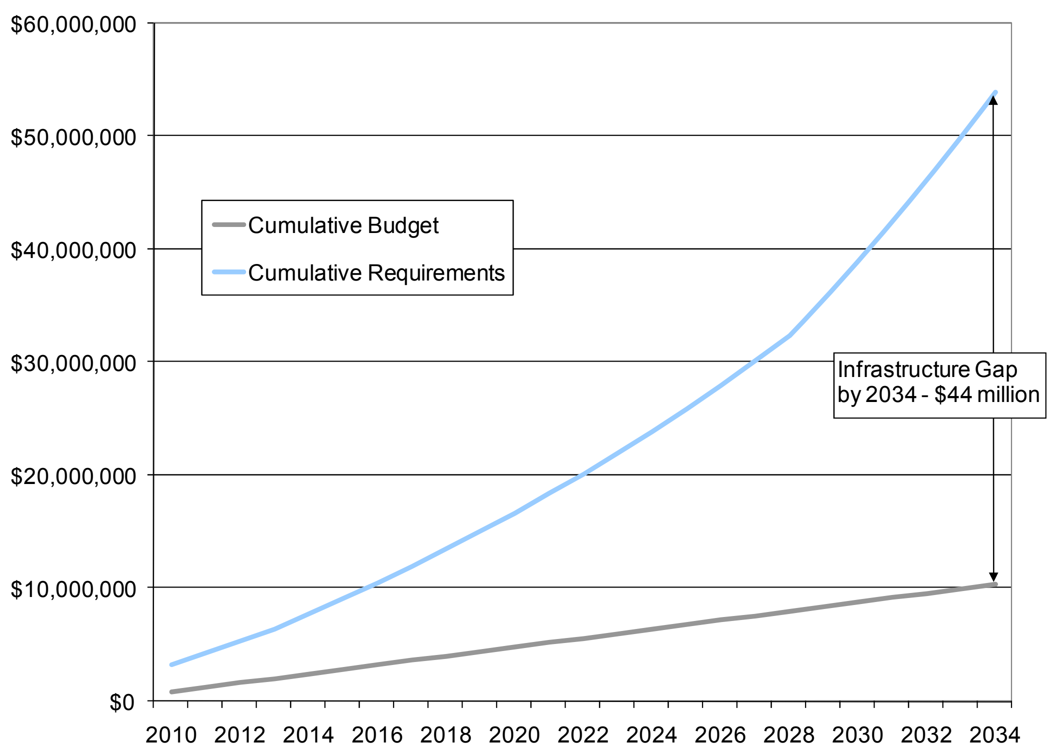
This study has estimated the total reinvestment requirements for West Vancouver's stormwater system over the next 100 years. It shows when the District can expect waves of high capital expenditures, thereby helping West Vancouver to better determine utility revenue needs and to optimise O&M practices to extend the life of existing assets.

Now that West Vancouver has identified its stormwater capital reinvestment funding requirements, it can subtract any external contributions (i.e. from development or infrastructure grants) to determine required budget levels.

8.1 Current Funding Levels

West Vancouver spends approximately $400,000 each year on the renewal of its stormwater infrastructure. Figure 8.1 shows how the anticipated renewal requirements compare with the existing renewal budget levels. The infrastructure gap measures the difference between the required capital renewal budget and the available capital renewal budget. Assuming that the stormwater capital renewal budget is only raised to keep up with inflation, the estimated infrastructure gap for the stormwater system by 2034 (i.e. in 25 years) is $44 million.

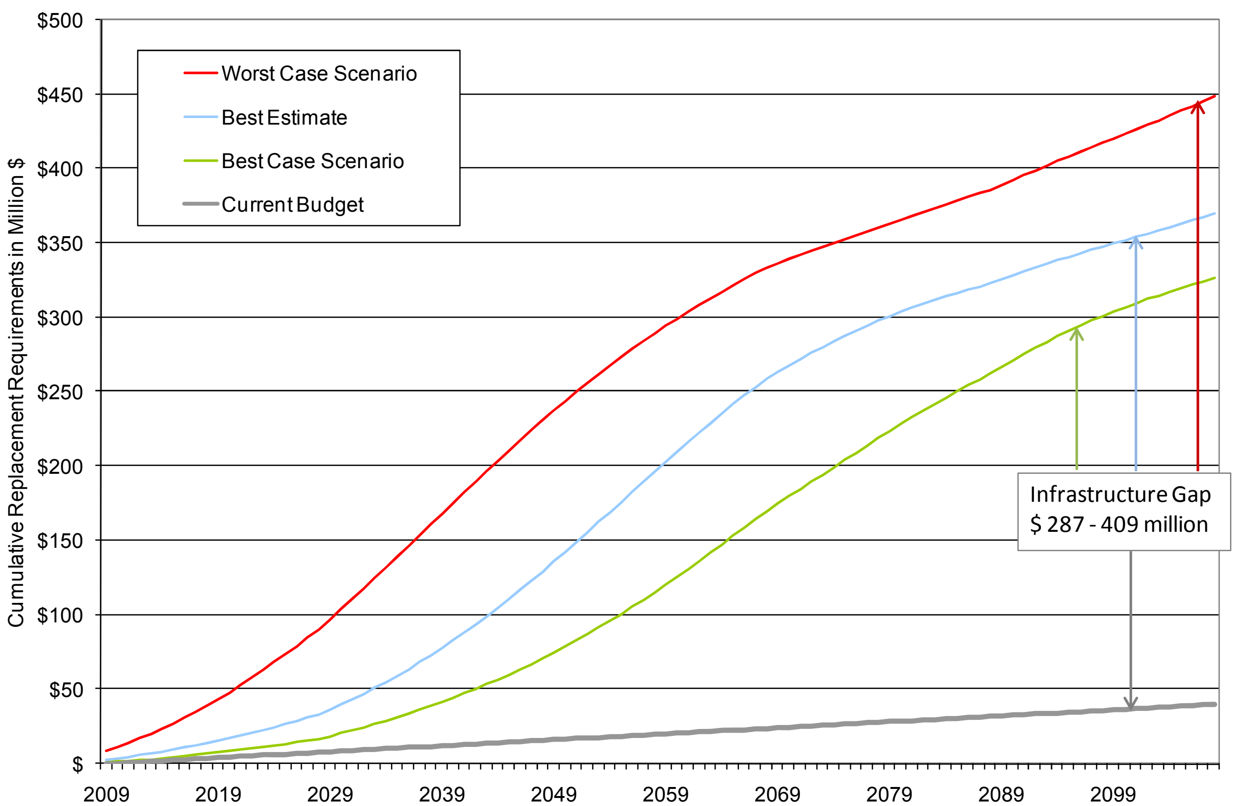
Figure 8.1 Renewal Requirements vs. Existing Budget Levels – 25 Year View



As described in Section 6.3, a range of concrete pipe service lives and creek bank rehabilitation costs was used to determine the sensitivity of key assumptions. The infrastructure gap using the original estimate of service lives as well as the worst and best case scenarios are presented in Figure 8.2.

Figure 8.2 shows that the current renewal budget is nearly sufficient for the best case scenario over the next 10 years. However, even in the best case scenario, the current renewal budget becomes significantly deficient after 20 years. Therefore it is recommended that West Vancouver take steps now, as discussed in Section 8.2, to address the pending infrastructure gap.

Figure 8.2 Best and Worst Case Estimate of 100 Year Infrastructure Gap



8.2 Future Strategies

The District needs to determine how it will address the forecasted infrastructure gap. The ultimate solution will likely come from a variety of sources:

- Extend the life of assets through a proactive inspection and rehabilitation program;
- Prioritize assets for replacement through a risk based bottom-up renewal plan (see Section 6);
- Reduce capital renewal costs through good asset management planning (see Section 9);
- Gradual but steady increase in capital renewal budgets; and
- Ensure that development driven improvements are partially or wholly funded by the development itself.

Figure 8.3 shows the impact on the infrastructure gap if West Vancouver were able to reduce the lifecycle cost of its assets and increase its renewal budget. West Vancouver would meet the anticipated renewal requirements under the best estimate scenario if it reduced the lifecycle cost of its assets by 10% and increased its stormwater renewal budget according to the following schedule:

- 2011-2015: 20% annual increase (by 2015 the annual budget will be $2 million)
- 2016-2032: 0% annual increase (maintain $2 million budget per year)
- 2033-2047: $4.5 million budget per year
- 2048-2071: $5.8 million budget per year
- 2071-2108 $2.3 million budget per year

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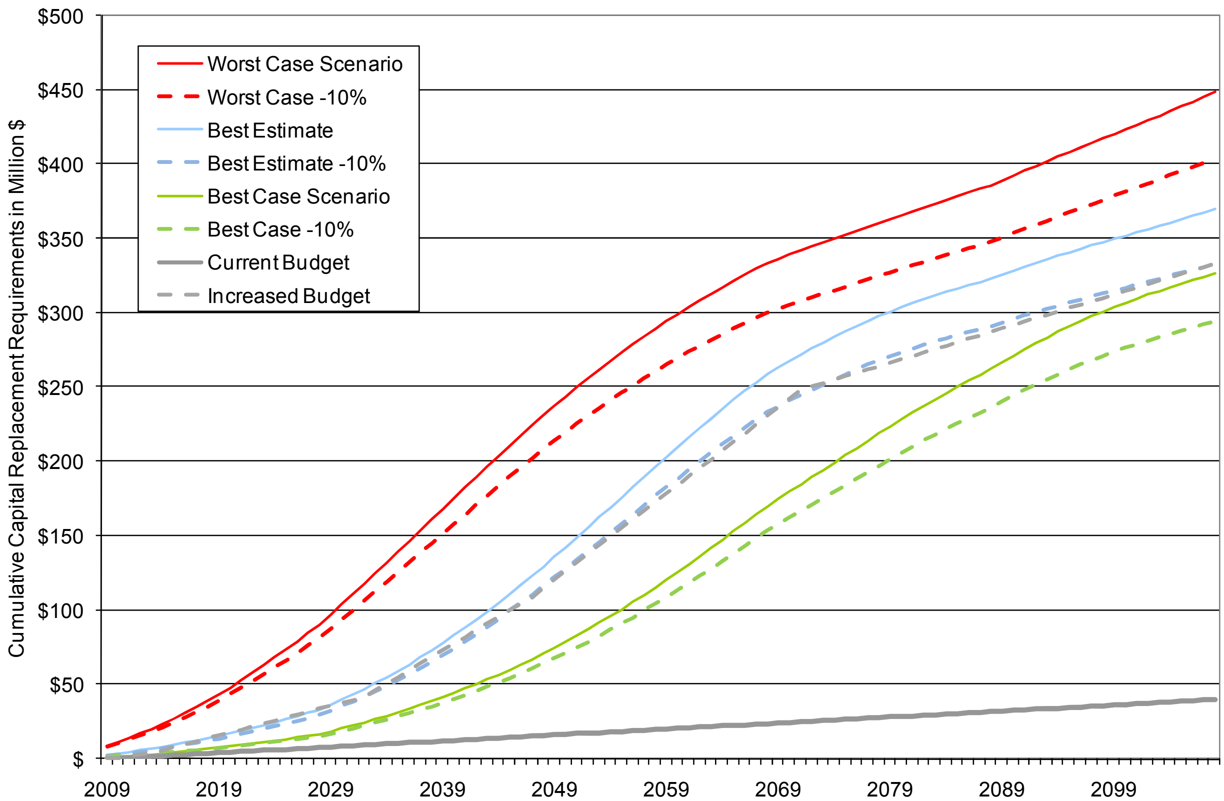
The potential spending scenario illustrated in Figure 8.3 is theoretical and assumes that all assets will be replaced on a "just in time" basis. This information provides order of magnitude costs for the theoretical replacement; however, many factors will impact the actual rate of infrastructure renewal. Examples of some of these factors include assessments of risk or criticality, resource leveling, opportunistic cost sharing, short term affordability, and future reserve policies. These factors will be as important in the development of future capital financial planning as the physical replacement requirements identified by this theoretical replacement curve.

Figure 8.3 Addressing the Infrastructure Gap



Effective communication is critical to educate and engage stakeholders to assist in meeting the upcoming challenges associated with the management of the District's infrastructure. Municipalities such as Edmonton and Hamilton have spent years quantifying their infrastructure renewal needs and communicating those needs to stakeholders. We recommend that West Vancouver use the information from this report and the National Water and Wastewater Benchmarking Initiative to inform senior management, City Council and the public on the following points:

- What assets does West Vancouver own?
- What are the assets worth?
- What is their condition?
- How much needs to be spent on infrastructure renewal?
- What is the relationship between renewal costs and maintenance costs?
- What is the level of service that West Vancouver residents receive?
- What is the relationship between infrastructure costs and levels of service?

8.3 Infrastructure Funding Mechanisms

Effective infrastructure renewal funding:

- Allocates costs to those benefiting from the service thus increasing equity in provision of services
- Supports accountability by clear allocation of funds
- Incorporates life cycle costs of infrastructure (i.e. depreciation, O&M and renewal)
- Provides reliable, predictable, dedicated funding to support multi-year infrastructure investment strategies
- Supports demand management efforts

West Vancouver budgets approximately $400,000 of its general storm water funding each year to support the capital renewal of its storm water infrastructure. It is recommended that West Vancouver increase its funding for the capital renewal of its stormwater infrastructure in anticipation of the growing infrastructure gap. The District is also recommended to use a specifically designated reserve fund to collect renewal funding (similar to a capital reserve fund) that can be managed over a multi-year horizon. The results of this study are ideally suited for estimating the requirements of future reserves. It is important to note, however, that since the estimates in this study are based on 2009 replacement costs, they need to be revised on a periodic basis to reflect actual renewal costs in future years.

Should West Vancouver want to investigate new funding mechanisms we recommend that the District refer to the *National Guide to Sustainable Municipal Infrastructure's* best practice titled *"Alternative Funding Mechanisms"*. The *National Guide to Sustainable Municipal Infrastructure: Innovations and Best Practices* is a compendium of technical best practices for addressing infrastructure issues. The best practice on alternative funding mechanisms describes eight methods for developing innovation funding sources to meet infrastructure needs, or to align costs with benefits to users. The eight alternative funding mechanisms described are Special Levies, Development Fees, Utility Models, Sponsorships, Innovative Transportation Revenues and Incentives, Government Service Partnerships, Funding Partnerships, and Strategic Funding Allocations.

8.4 Next Steps

This study provides a long term view of infrastructure renewal needs. In order to determine infrastructure renewal priorities over the next 10 years, West Vancouver needs to conduct a bottom-up assessment of the stormwater system that considers asset condition, maintenance history, criticality, and coordination with roads and other utilities. This will allow West Vancouver to better quantify short term infrastructure renewal requirements and determine the actual impact on funding requirements.

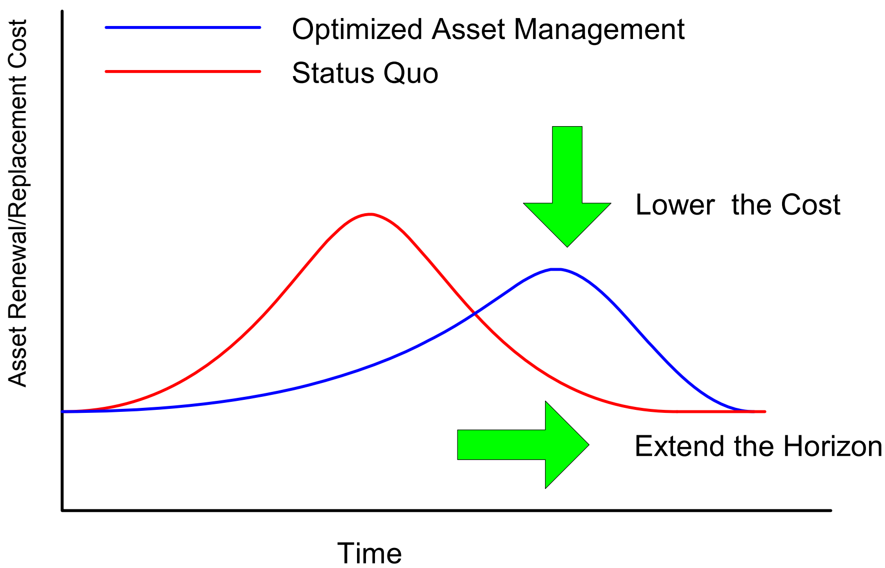
In order to conduct a bottom-up assessment, West Vancouver will need better information on the condition of its storm mains, culverts and creeks. To accomplish this, it is recommended that the District implement the program outlined in the 2006 report titled "Developing a Multi-Year Storm Sewer Condition Assessment Program" (see Appendix B). As part of this program West Vancouver should also perform a more thorough review of the criticality of its stormwater system. Determining the criticality of different assets will allow West Vancouver to identify which assets can run to failure and which assets should be renewed before failure.

This study has adhered to present day best practices for performing strategic level asset management. A "needs-based" approach has been taken that gives consideration to our current knowledge of asset life spans, and current replacement costs. Consideration has not been given to factors that might either accelerate renewal efforts (e.g. elevation of risk or criticality, resource levelling), or decelerate renewal efforts (e.g. short term affordability). These additional factors will remain for continued public debate, and provide input into the annual rate setting process. Ultimately, a "budget-based" approach to asset management will govern the extent to which West Vancouver will manage assets in a sustainable fashion over the short and long term.

9. Adopting Asset Management Practices

Good asset management planning seeks to capitalize on two means of cost savings: preventative maintenance and effective asset renewal planning. This will result in the optimization of lifecycle costs for individual assets as depicted in Figure 9.1.

Figure 9.1 Means of Achieving Savings through Asset Management



By continuing with its preventative maintenance program West Vancouver can attain, and hopefully extend, the expected service life of its infrastructure, and will benefit accordingly. We recommend that West Vancouver periodically review its preventative maintenance program to ensure that it is gaining maximum benefit from its culvert/creek inspections, its CCTV program and its storm sewer cleaning program.

A risk based approach as discussed in Section 6 will allow West Vancouver to determine the most cost-effective strategy for maintaining an asset based on the consequences of failure. By identifying the most cost effective renewal and/or replacement strategy for each asset and by integrating capital works of different utilities (water, sewer, road etc.) whenever possible, the District will optimise its capital renewal budgets. Together this will have the benefit of lowering the actual cost of the renewal program.

The efficient integration of capital works of different utilities requires coordinating the capital renewal programs for the water, sanitary, storm and road systems. Accomplishing this requires developing procedures and communication channels, which can be facilitated but not replaced by information management systems. Effectively managing and communicating asset information as outlined in the District of West Vancouver's Asset Management Information Management Strategy will help West Vancouver optimize stormwater asset maintenance and rehabilitation needs.

10. Recommendations

This section outlines the eleven (11) key recommendations that are a result of this study. The recommendations fall under two main categories:

- Sustainable funding; and
- Improving asset information to optimize renewal budgets.

10.1 Sustainable Funding

Without sustainable funding an organisation cannot maintain a given level of service from its assets. Effective communication of this study's results to Council and the general public is key to obtaining sustainable infrastructure funding.

Recommendation #1
The District of West Vancouver should plan and implement an appropriate stormwater rate structure to ensure that sufficient resources will be available to address both current and future infrastructure maintenance and replacement requirements.

Recommendation #2
The District of West Vancouver should develop a specific "Renewal Reserve Fund" for capital reinvestment in order to smooth out funding requirements, provide equitable and transparent infrastructure funding and to ensure that funds are available as infrastructure renewal requirements increase.

Recommendation #3
The District of West Vancouver should develop a communications plan to convey the current status and future requirements of the infrastructure management plan in advance of revising funding requirements.

Recommendation #4
West Vancouver should maintain and update the CAP model (or similar tool) to periodically check that its renewal funding is sufficient to meet its capital renewal needs.

10.2 Improving Asset Information and Optimizing Renewal Budgets

By identifying the most cost effective renewal and/or replacement strategy for each asset and by integrating capital works of different utilities (water, sanitary, road etc.) whenever possible, the District will optimise its capital renewal budgets. Together this will have the benefit of lowering the actual cost of the renewal program, but can only be accomplished with sufficient information about the assets. Recommendations 5 to 8 outline actions that are critical for identifying the most cost effective asset renewal strategy and reducing O&M costs. Recommendations 9 through 11 outline actions that would support West Vancouver's efforts to effectively manage its asset data.

Recommendation #5
The District of West Vancouver should dedicate funding to implement its Multi-year Storm Sewer Condition Assessment Program. This would allow West Vancouver to prioritize maintenance and rehabilitation work, to extend the life of its storm mains and to refine the financial projections presented in this report.

Recommendation #6
The District should coordinate its stormwater capital renewal program with other utilities (water, roads and sanitary) to ensure that total costs are minimized.

Recommendation #7
We recommend that West Vancouver determine the condition and estimate future rehabilitation requirements in each section of creek that is on public property. The information may already be available within existing Integrated Stormwater Management Plans (ISMP) or it may need to be gathered through on-site creek assessments. The results of this work will help refine the funding forecasts developed as part of this study.

Recommendation #8
West Vancouver should inspect its culverts, using CCTV where necessary, to prioritize culvert maintenance and rehabilitation work, to extend the life of its culverts and to refine the financial projections presented in this report.

Recommendation #9
Effectively managing and communicating asset information as outlined in the District of West Vancouver's Asset Management Information Management Strategy will help West Vancouver optimize stormwater asset maintenance and rehabilitation needs.

Recommendation #10
The District should adopt standard nomenclature for data such as pipe material to facilitate the collection and analysis of asset information. Currently, within West Vancouver's GIS there are five (5) different abbreviations for concrete (conc, C, CP, RC, RCB, RCP).

Recommendation #11
Assets that belong to Metro Vancouver should be clearly labelled as such within West Vancouver's GIS.

Appendix A – Stormwater Inventory

DISTRICT OF WEST VANCOUVER ASSET EVALUATION STUDY - DRAINAGE ASSET INVENTORY

#	Asset Group	Asset Type	Asset ID	Class	Asset Address	Location	Quantity or Length in meters	December 2008 Replacement value (Unit Cost in CAD)	Date in Service	Expected Service Life (yrs)	Expected Replacement Year	% of Expected Service Life Used	Remaining service life (yrs)	Condition Rating (1=good, 5=poor)	Condition adjustment factor	Condition Adjusted Remaining Service Life	Condition adjusted replacement year	Risk adjustment factor	Risk & Condition Adjusted Remaining Service Life	Condition and Risk Adjusted Replacement Year	Revised Replacement Year	2009 Replacement Value	Source Data	Replacement Value Reference
1	Drainage	Creeks					25,642	$ 2,000														$ 51,284,000		
2	Drainage	Mains					235,083	$ 946														$ 222,280,259		
3	Drainage	Oil-Grit Separator			Ambleside Park		1	$ 200,000	2008	50	2058	2%	49	1	1	49					2058	$ 200,000		
4	Drainage	Rain Gauge					5	$ 10,000	2006	15	2021	20%	12		1	12					2021	$ 53,370		
5	Drainage	Culvert	SC165	2.12	1005 Highland Dr @Fairmile Rd (inlet)- crosses Highland Dr (outlet)		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HGT1	2.32	102 Deep Dene Road – East of 118 Stevens Drive @ Deep Dene Road		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC189	2.21	1025 King Georges Way		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC175	2.11	1035 King Georges Way		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BROIR24	2.11	1041 Groveland Road – 1056 Groveland Road		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC195	2.12	1051 Millstream Rd		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNWB11	2.22	1055 Crestline Road – 1060 Crestline Road		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC184	2.11	1055 Eyremount Dr		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC227	2.11	106 Deep Dene Rd		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNWB12	2.21	1063 Millstream Road – 1060 Millstream Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HGT3	2.21	107 Bonnymuir Drive – 108 Bonnymuir Drive		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BROIR25	2.22	1076 Eyremount Drive – 1071 Eyremount Drive		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC194	0	1087 Eyremount Dr		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC176	1.11	1091 Groveland Rd		1	$ 47,663		50				5	Replace Immediately						2014	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC183	2.21	1092 Eyremount Dr		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC179	3.11	1099 Hillside Rd		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC182	0	1103 Eyremount Dr		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC178	2.11	1109 Gilston Rd		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC150	3.11	1115/1125 Ottaburn Rd- 1120 Palmerston @ Lane		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNWWB14	2.12	1119 Crestline Road – 1080 Crestline Road		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC172	1.11	1122- 1117 Highland Dr		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC181	2.12	1125 Crestline Rd		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC174	2.22	1125 Groveland Court		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC147	0	1125 Mathers Ave		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC146	0	1125 Mathers Ave - HWY - 1655 11th St (inlet)		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC149	2.11	1125 Ottaburn Rd		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC269	0	1125/ 1123 Millstream Road – 1124 Millstream Road		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC162	1.11	1127 Millstream Rd		1	$ 47,663		50				5	Replace Immediately						2014	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC169	2.11	1130 Eyremount Dr		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC151	2.11	1130 Palmerston Ave		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC173	2.11	1134 Hillside Rd- 1117 Highland Dr		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC152	2.12	1135 Queens- 1125 Palmerston Ave		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC167	2.12	1137 Crestline Rd- 1138 Eyremount Dr		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC141	3.11	1143 Jefferson Ave		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC161	2.21	1143 Millstream Rd		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC168	3.11	1147 Millstream Rd		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC170	2.22	1147/1145 Eyremount Dr		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC160	3.11	1150 Millstream Rd (across Rd) to 1144 Millstream Rd		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC159	2.12	1151 Eyremount Dr		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BROEB18B	2.32	1159 Eyremount Drive – 1154 Eyremount Drive (Northern culvert)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BROEB18A	2.32	1159 Eyremount Drive – 1154 Eyremount Drive (Southern culvert)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC110	0	1165 14th St		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC111	0	1165 14th St @ Lane - 1405 Inglewood Ave		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC158	0	1167- E of 1161 Eyremount Dr		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BRO9	2.22	1171 Chartwell Drive @ Chartwell Cres - West of 1115 Chartwell Cres		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC131	2.22	1231 Sinclair Court		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC142	0	1233 11th St		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PP0	2.22	124 31st Street (outfall)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC134	2.12	1245 Esquimalt @ Lane - 1248 Fulton @ lane (inlet)		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC135	2.11	1248 Fulton @ Road		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BRO11	2.21	1251 Chartwell Pl – 1241 Chartwell Pl		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC132	2.21	1261 Esquimalt Ave		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC133	2.12	1262 Esquimalt @ Lane		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC130	2.11	1285 Keith Rd		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSNEB28	2.12	1295 Mathers Avenue - Ridgeview School @ Mathers Avenue		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSNEB30	3.11	1295 Queens Avenue @ Highway – 1328 Palmerston Avenue		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC171	2.21	1305- 1312 Crestwell Rd		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	

DISTRICT OF WEST VANCOUVER ASSET EVALUATION STUDY - DRAINAGE ASSET INVENTORY

#	Asset Group	Asset Type	Asset ID	Class	Asset Address	Location	Quantity or Length in meters	December 2008 Replacement value (Unit Cost in CAD)	Date in Service	Expected Service Life (yrs)	Expected Replacement Year	% of Expected Service Life Used	Remaining service life (yrs)	Condition Rating (1=good, 5=poor)	Condition adjustment factor	Condition Adjusted Remaining Service Life	Condition adjusted replacement year	Risk adjustment factor	Risk & Condition Adjusted Remaining Service Life	Condition and Risk Adjusted Replacement Year	Revised Replacement Year	2009 Replacement Value	Source Data	Replacement Value Reference
5	Drainage	Culvert	BRO1	2.32	1305 Taylor Way – 1308 Taylor Way		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC139	2.11	1315 Gordon Ave @ Lane- 314 Haywood Ave		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC226	2.11	132 Stevens Dr		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSNEB29	2.22	1335 Ottawa Ave - 1312 Ottawa Ave		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC137	2.12	1337 Gordon Ave- 1356 Gordon Ave		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN10	2.21	1337 Whitby Rd – 1330 Whitby Rd		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC109	2.21	1341-1340 Inglewood Ave		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC136	2.11	1356 Gordon @ lane - 1365 Fulton		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC87	3.11	136 27th St		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC263	2.11	1366 Argyle Ave - West of 13th St. @ Beach		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC121	2.21	1366 Inglewood @ Lane		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSNEB14	3.31	1367 Cammeray Road – 1372 Cammeray Road		1	$ 139,130		50				3	1.2						2029	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSNEB13	2.32	1367 Camridge Road – 1370 Camridge Road		1	$ 157,217		50				3	1.2						2029	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC156	3.12	1373 Chartwell Dr (corner @ Burnside Rd)		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC155	2.11	1379 Chartwell Dr		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BROEB16	2.32	1384 Burnside Road @ Highland Drive – 1381 Burnside Road		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC193	0	1387 Fulton Ave		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC120	2.21	1387 Haywood Ave		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSNWB8	2.22	1389 - 1390 Camridge Road		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN11	2.31	1395 Chartwell Drive – 1394 Chartwell Drive		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSNEB27	2.31	13th Street @ Ridegview School – Ambleside Park boat launch		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN8	2.11	1405 Camelot Rd – 1402 Camelot Rd		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN12	2.21	1414 Chartwell Drive – 1405 Chartwell Drive		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN13	2.21	1415 Bramwell Road – 1418 Bramwell Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSNCB24	2.11	1415 Inglewood Avenue – 1416 Inglewood Avenue		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSNCB26	2.22	1418 Gordon Ave		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSNCB25	2.12	1418 Gordon Avenue @ lane – 1443 Fulton Avenue @ lane		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSNCB16	2.21	1425 Esquimalt Avenue (inlet only – joins VSN#1A underground)		1	$ 139,130		50				3	1.2						2029	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSNCB23	2.12	1430 Inglewood Avenue @ lane – 1435 Haywood Avenue @ lane		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BRO13	2.22	1435 Sandhurst Place – 1436 Sandhurst Place		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC73	2.11	1440-1408 31st		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSNCB22	2.11	1441 Haywood Avenue – 1442 Haywood Avenue		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSNCB21	2.11	1442 Haywood Avenue @ lane – 1455 Gordon Avenue @ lane		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSNCB18A	2.22	1444 Fulton Ave - 1449 Fulton Ave		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSNCB17	2.21	1444 Fulton Avenue @ lane – 1425 Esquimalt Avenue @ lane		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSNEB15	2.32	1455 Chippendale Road – East of 1460 Chippendale Road		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN7	2.22	1455 Tyrol Road – 1450 Tyrol Road		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSNCB20	2.22	1462 Gordon Ave - 1455 Gordon Ave		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSNCB19	2.11	1462 Gordon Avenue – 1463 Fulton Avenue @ lane		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSNCB18B	2.12	1463 Fulton Avenue (inlet only – joins VSNCB#18A underground)		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC124	2.22	1488 Fulton Ave @ lane- 1495 Esquimalt Ave		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC123	2.12	1497 Fulton Ave- 1488 Fulton Ave		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSNWB9	3.22	1498 Chippendale Road - 2588 Westhill Drive @ Chippendale Road		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC125	3.11	1499 Queens Ave @ 15th St		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDN1A	2.32	1520 Taylor Way – 1340 Taylor Way (Eastern culvert)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDN1B	3.21	1520 Taylor Way – 1340 Taylor Way (Western culvert)		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BRO14	2.21	1559 Vinson Creek Road - 1435 Chartwell Drive		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN15B	2.22	1590 Chartwell Drive @ Millstream Road, trail entrance		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN2	2.21	1595 Inglewood Avenue		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN3	2.21	1595 Kings Ave		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSN7B	2.32	1598 Tyrol Place @ Highway – East of 1715 Rosebery Avenue (Eastern outlet)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSN7A	3.22	1598 Tyrol Place @ Highway – East of 1715 Rosebery Avenue (West outlet)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC126A	2.12	15th St - HWY Crossing (Inlets only)		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC126B	2.12	15th St - HWY Crossing (Inlets only)		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC126D	3.11	15th St - NW of Queens Ave		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC129	3.11	15th St to HWY off ramp East bound		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN6	2.21	15th Street HWY Entrance @ South of Tyrol Ln – 1520 Queens Ave @ 15th St		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC115	2.12	1611 Fulton Ave		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDWB23	3.31	1617 Langton Place – Langton Park		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC113	2.11	1620 Gordon Ave @ Lane - 1611 Fulton St		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC112	0	1643 Haywood Ave		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	

DISTRICT OF WEST VANCOUVER ASSET EVALUATION STUDY - DRAINAGE ASSET INVENTORY

#	Asset Group	Asset Type	Asset ID	Class	Asset Address	Location	Quantity or Length in meters	December 2008 Replacement value (Unit Cost in CAD)	Date in Service	Expected Service Life (yrs)	Expected Replacement Year	% of Expected Service Life Used	Remaining service life (yrs)	Condition Rating (1=good, 5=poor)	Condition adjustment factor	Condition Adjusted Remaining Service Life	Condition adjusted replacement year	Risk adjustment factor	Risk & Condition Adjusted Remaining Service Life	Condition and Risk Adjusted Replacement Year	Revised Replacement Year	2009 Replacement Value	Source Data	Replacement Value Reference
5	Drainage	Culvert	SC78	2.11	1650 29th St to 2870 Mathers Ave		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN5	2.22	1655 Ottawa Avenue – 1560 Ottawa Avenue (2 culverts)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN4	2.21	1685 Mathers Avenue – 1690 Mathers Avenue		1	$ 139,130		50				3	1.2						2029	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC122	3.11	1696 Lawson Ave		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC258	2.11	16th Street @ Ocean		1	$ 61,053		50				3	1.2						2029	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSN6	2.32	1725 Queens Avenue – West of 1720 Queens Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSN2	2.32	1750 Bellevue Ave - West of 1766 Duchesss Ave		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC86	3.11	1795 28th St- Rodgers Creek		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSN5	2.32	1825 Mathers Avenue - 1822 Mathers Avenue		1	$ 157,217		50				3	1.2						2029	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCD4	2.32	1885 Fulton Avenue - 1880 Fulton Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCD6	2.32	1905 Mathers Avenue - 1890 Mathers Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC265	2.11	200 Keith Road @ Klee Wyck Nursery		1	$ 61,053		50				3	1.2						2029	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDEB14	2.32	2035 Westhill Drive – 1945 Rosebery Avenue @ Highway		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC92	3.11	2050 Russet Way		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDCB11	2.32	2055 Queens Avenue – 2010 Queens Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC222	2.11	207 Rabbit Lane - End of cul-de-sac		1	$ 61,053		50				3	1.2						2029	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDWB7	2.32	2095 Queens Avenue – 2080 Queens Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC89	3.11	2097 26th St		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC104	2.11	20th St and Fulton (NE Corner)		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	RGEB5	2.21	2195 28th Street - 2765 Skilift Place		1	$ 139,130		50				3	1.2						2029	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC80	3.11	2208 Chairlift Rd		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC102	2.12	2227 Ottawa Ave		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPEB22	2.21	2261 Gisby Street – 2225 Gisby Street		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC225	0	229 Rabbit Lane		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC93	2.22	2295 Inglewood Ave to foot of 23rd		1	$ 157,217		50				3	1.2						2029	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC91	3.11	22nd St HWY Onramp Westbound to Russet Way 2050		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	RGEB6	2.32	2308 Chairlift Close		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDEB16	2.32	2327 Westhill Drive – Westhill Park		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC96	2.21	2342 Marine Dr - North of 2340 Haywood Ave		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC95	2.21	2344 Marine Dr - 2347 Bellevue Ave @ Lane		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC94	2.21	2349/2347 Bellevue Ave to Outfall		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC101	2.11	2480 Palmerston Ave		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MR5	2.32	2484 Ottawa Ave - 2508 Nelson Ave		1	$ 157,217		50				5	Replace Immediately						2014	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MR1	2.31	2505 Marine Dr - Dundarave Park		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDEB17	2.32	2505 Westhill Dr – 2426 Westhill Court		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDEB18	2.31	2508 Westhill Dr – 2505 Westhill Dr		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MR2	2.32	2512 Kings Avenue @ Haywood – 2512 Haywood Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MR4	2.32	2522 Mathers Avenue - 2511 Mathers Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MR3	2.31	2529 Lawson Avenue - 2530 Lawson Avenue		1	$ 139,130		50				3	1.2						2029	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDEB19	2.31	2536 Westhill Dr - 2535 Westhill Dr		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	RGEB8	2.22	2615 - 2620 Chelsea Court		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC84	2.22	2635 Rosebery Ave		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC224	0	265 Rabbit Lane		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSNWB11	2.32	2673 Finch Hill – 2662 Finch Hill		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	RGCB4	2.21	2678 Chairlift Road - Chelsea Close Park		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC85	2.21	2770 Palmerston Ave		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	RG1	2.32	2859 – 2842 Bellevue Ave		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	RG2B	2.32	2860 - 2833 Marine Dr (East culvert)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	RG2A	3.21	2860 - 2833 Marine Dr (West culvert)		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPEC19	3.21	2920 Deer Ridge Place - Cypress Bowl Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPEC18	3.11	2930 Deer Ridge Place @ Highway - 3049 Spencer Court @ Highway		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPWC15	3.21	2940 Deer Ridge Place @ Highway – 3053 Spencer Place @ Highway		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPWB8	3.22	2960 Deer Ridge Place @ Highway - 3071 Spencer Court @ Highway		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC76	2.11	2991- 3003 Mathers Ave @ 30th St		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC77	3.12	2994 Park Lane @ Outfall		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPEB21	2.22	3015 Spencer Drive – 2175 Gisby Street @ Spencer Drive		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPCB11	2.22	3030 Rosebery Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PP3	2.22	3033 Mathers Avenue – 3042 Mathers Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPEC17	2.11	3049 - 3052 Spencer Court		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPCB12	2.12	3054 Spencer Drive - 3053 Spencer Close		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PP2	2.22	3055 Marine Drive – 3074 Marine Drive		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	

DISTRICT OF WEST VANCOUVER ASSET EVALUATION STUDY - DRAINAGE ASSET INVENTORY

#	Asset Group	Asset Type	Asset ID	Class	Asset Address	Location	Quantity or Length in meters	December 2008 Replacement value (Unit Cost in CAD)	Date in Service	Expected Service Life (yrs)	Expected Replacement Year	% of Expected Service Life Used	Remaining service life (yrs)	Condition Rating (1=good, 5=poor)	Condition adjustment factor	Condition Adjusted Remaining Service Life	Condition adjusted replacement year	Risk adjustment factor	Risk & Condition Adjusted Remaining Service Life	Condition and Risk Adjusted Replacement Year	Revised Replacement Year	2009 Replacement Value	Source Data	Replacement Value Reference
5	Drainage	Culvert	PPWC14	2.11	3059 Spencer Court – 3056 Spencer Court		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPWC13	2.11	3061 Spencer Drive		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPWB6	2.22	3072 Spencer Court – 3094 Spencer Drive		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPWB7	2.21	3075 Spencer Court – 3072 Spencer Court		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPWB5	2.32	3086 Spencer Place		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC267	2.11	3151-3150 Benbow Road		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC69	2.11	3151-3150 Westmount Pl		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC74	2.12	3165 Dickinson Cres.		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WM6	2.21	3170 Benbow Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WM5	2.21	3180 Westmount Place		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC71	2.11	3185-3172 Mathers Ave		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC70	2.22	3187 Thompson Pl		1	$ 157,217		50				3	1.2						2029	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC221	2.11	319-334 Moyne Dr		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC75	2.12	3207 Marine Dr- 3174 Travers Ave		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WM4	2.21	3240 Thompson Crescent		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC209	2.11	325 Keith Rd east of creek - NE of Hugo Ray Park Driveway on 3rd St		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WM3	2.21	3260 Mathers		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WM1	2.22	3285 Marine Drive – 3262 Marine Drive @ Ocean (outfall)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC57	2.11	3315 Westmount Rd		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC237	3.11	3315 Westmount Rd @ HWY		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC65	2.12	3355- 3354 Mathers Ave		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC67	2.12	3361-3370 Marine Dr		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC68	2.12	3369 Radcliff Ave		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC58	2.12	3370 Thompson Crescent		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC236	3.12	3390 Westmount Rd (Westernmost Outlet)		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	CV4	2.21	3460 Mathers Avenue		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	TNR1	2.22	3521 Creery Ave - Westbay Park @ Marine Drive		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	TNR3	2.22	3570 Mathers Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC52	3.11	3601-3640 Mathers Ave		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	TNR4	3.22	3680 Cedaridge Place – 3660 Westmount Road		1	$ 157,217		50				5	Replace Immediately						2014	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC59	2.11	3704 Southridge Pl		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	TNR7	3.22	3745 Southridge Avenue – 3730 Southridge Avenue (2 culverts)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	TNR8	2.22	3760 Westridge Avenue – 3745 Southridge Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC51	2.11	3794 Southridge Ave		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC54	2.12	3797 Bayridge (South of this property, other side of road)		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC53	2.11	3801 Bayridge Ave		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC49	2.12	3846 Bayridge Ave- 3903 Bayridge Pl		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC231	0	385 Southborough Dr		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC81	3.12	3870 Westridge Ave		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC82B	2.12	3870 Westridge Ave by HWY (NE of #81)		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	GDM5	3.21	3885 Sharon Drive (@ Sharon Park)		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	GDM6	2.21	3921 Bayridge Place @ Bayridge Avenue – 3910 Bayridge Avenue		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	GDM8	2.22	3940 Westridge Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	GDM7	2.22	3950 Viewridge Place		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC48	2.11	3980 Bayridge Ave		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC47	2.12	3995 Bayridge Ave		1	$ 68,989		50				5	Replace Immediately						2014	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	GDM2	2.22	4013 Rose Crescent		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC216b	2.11	402 Hidhurst Place - additional inlet		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	GDM1	2.22	4036 Marine Drive		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC43	2.11	4050 Bayridge Ave		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC50	3.11	4077-4072 Marine Dr		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC218	2.11	410 Eastcot Rd		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC40	2.11	4105 Ripple Rd @ Ripple Pl		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC39	2.12	4115 Almondel Rd		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC41	2.11	4122 Burkehill Rd- 4060 Bayridge Ave		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC46	2.11	4125 Marine Dr - 4160 Marine Dr @ Ocean		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC212	2.21	415 Inglewood Place		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC215	2.21	415 Mathers Ave		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC233	2.11	415 Southborough Drive		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC42	3.11	4150 Burkehill Rd		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC44	2.12	4150 Rose Crescent		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	

DISTRICT OF WEST VANCOUVER ASSET EVALUATION STUDY - DRAINAGE ASSET INVENTORY

#	Asset Group	Asset Type	Asset ID	Class	Asset Address	Location	Quantity or Length in meters	December 2008 Replacement value (Unit Cost in CAD)	Date in Service	Expected Service Life (yrs)	Expected Replacement Year	% of Expected Service Life Used	Remaining service life (yrs)	Condition Rating (1=good, 5=poor)	Condition adjustment factor	Condition Adjusted Remaining Service Life	Condition adjusted replacement year	Risk adjustment factor	Risk & Condition Adjusted Remaining Service Life	Condition and Risk Adjusted Replacement Year	Revised Replacement Year	2009 Replacement Value	Source Data	Replacement Value Reference
5	Drainage	Culvert	SC45	3.11	4174 Rose Crescent		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	CV3	2.21	420 Oxley Street North @ BCR		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC251	2.11	4208 Evergreen Ave @ Fisheries		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC217	2.21	430 Mulgrave Place		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC64	2.12	430 Oxely Street North to Oxely Street North @ Railway		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNEB15	2.21	435 Southborough Dr – East of 437 Southborough @ Cap Golf Course		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC38	3.12	4401 Woodpark Rd		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC220	2.11	441 Hadden Drive		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC234	2.11	441 Southborough Drive		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNWB4	2.21	445 Southborough Drive – Capilano Golf Course		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC6	2.22	4475 - 4480 Ross Crescent		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC261	2.22	4480 Ross Crescent @ Ocean		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC4	2.22	4481 Marine Dr		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC9	3.11	4486 Piccadilly North @ Railway		1	$ 47,663		50				3	1.2						2029	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC219	2.21	450 Eastcot Rd		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC211	2.22	450 Macbeth Crescent		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC34	3.12	4508 Woodgreen Dr @ Woodcrest Rd/ HWY		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC11	2.11	4540 Clovelly Walk		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC12	2.11	4562 Piccadilly North		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WW6	2.12	4611 Woodburn Road		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WW7	2.12	4613 Woodburn Road		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WW2	2.22	4615 Willow Creek Road – 4440 Regency Place		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WW5A/B	3.12	4625 Port View Place – 4781 Estevan Place (WW#5A) & 4753 Caulfeild Dr (WW#5B)		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC10	2.11	4645 Keith Rd		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC3	2.11	4651 - 4611 Marine Dr		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	TNR2	2.12	466 Hillcrest Street		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC29	2.22	4661 Willow Creek Rd - 4190 Rockridge Rd		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC250	2.12	4711 Pilot House Road @ Beach		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WW3	2.11	4717 Caulfield Drive		1	$ 61,053		50				5	Replace Immediately						2014	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WW4	2.21	4734 Rutland Road		1	$ 139,130		50				5	Replace Immediately						2014	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC22	2.11	4787 Pilot House Rd		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC37	3.11	4799 Westwood Dr		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC20	0	4807 The Dale @ Water Lane (East)		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC21	2.11	4807 The Dale @ Water Lane (West)		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HGTEB12	3.11	486 Craigmohr Drive – 485 Craigmohr Drive		1	$ 47,663		50				3	1.2						2029	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC17	2.12	4890 The Dale		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HGTEB11	2.22	501 St. Andrews Road – 502 St. Andrews Road		1	$ 157,217		50				3	1.2						2029	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HGTWB7	2.21	526 Craigmohr Drive – 531 Craigmohr Drive		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC252	3.11	5285 Gulf Place @ Ocean		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC198	2.11	530 Thetford Place		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC15	3.12	5329 Kew Rd- 5215 Gulf Pl		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC246	3.11	5347 Kew Cliff Rd		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNEEB23	2.12	536 Ballantree Place – 520 Ballantree Place		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC16	3.12	5365 Brookside Ave - 5362 Brookside Ave @ The Terrace		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC55	2.11	5446 Meadfeild Lane from HWY		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HGTWB6	2.11	549 St. Andrews Road – 554 St. Andrews Road		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC256	0	5540 Parthenon Pl @ Ocean		1	$ 112,663		50				1	1.5						2069	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC157	3.12	5545- 5530 Greenleaf Rd		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HGTEB9	2.11	559 Glenross Road – 550 Glenross Road		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC255	3.11	5598 Gallagher Place @ Ocean		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	EGL3	3.21	5611 Daffodil Drive @ Lane		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HGTEB10	2.11	563 St. Giles Road – 564 St. Giles Road		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HGTWB8	2.21	564 Ballantree Road – 561 Ballantree Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC187	2.11	5647- 5679 Westport Rd		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNWB5	2.21	565 Robin Hood Road – 570 Robin Hood Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	EGL2	2.11	5660 Marine Drive		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HGTWB4	2.21	567 Glenross Road – 566 Glenross Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC26	2.11	5670 Daffodil Dr		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC27	2.11	5675 Daffodil Dr		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC28	2.11	5676 Marine Dr		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC145	2.11	5696 Eagle Harbour Rd		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	

DISTRICT OF WEST VANCOUVER ASSET EVALUATION STUDY - DRAINAGE ASSET INVENTORY

#	Asset Group	Asset Type	Asset ID	Class	Asset Address	Location	Quantity or Length in meters	December 2008 Replacement value (Unit Cost in CAD)	Date in Service	Expected Service Life (yrs)	Expected Replacement Year	% of Expected Service Life Used	Remaining service life (yrs)	Condition Rating (1=good, 5=poor)	Condition adjustment factor	Condition Adjusted Remaining Service Life	Condition adjusted replacement year	Risk adjustment factor	Risk & Condition Adjusted Remaining Service Life	Condition and Risk Adjusted Replacement Year	Revised Replacement Year	2009 Replacement Value	Source Data	Replacement Value Reference
5	Drainage	Culvert	SC204	0	570 Esquimalt Ave		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	EGL1	3.21	5718 Eagle Harbour Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC230	2.11	572 St Andrews Pl		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	NLS3	2.22	5745 Cranley Drive		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC202	2.11	575 Stevens Drive		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDN2	2.31	575 Stevens Drive – 580 Stevens Drive		1	$ 139,130		50				3	1.2						2029	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC13	2.11	5768 Cranley Dr- 5767 Cranley Dr @ Primrose Pl		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	NLS2	2.22	5770 Marine Drive		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC14	3.11	5775 Cranley Dr		1	$ 47,663		50				5	Replace Immediately						2014	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC268	3.11	5775 Marine Drive - Yacht Club @ Ocean		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WD4	2.21	5779 Westport Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HGTWB5	2.22	579 St. Giles Road – 572 St. Giles Road		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC144	2.11	5797 Westport Rd (other side of road)		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC23	3.11	5835- 5839 Marine Dr		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC200	2.12	590 Knockmaroon Road		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC32	3.11	5908 Marine Dr NE		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC31	3.11	5908 Marine Dr NW (Racerock Yacht Services)		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC24	3.12	5920 Condor Place		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNEB21	2.21	594 Craigmohr Drive – crosses road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNEEB22	2.21	595 St. Andrews Road – 615 St. Andrews Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC197	2.11	595/ 605 King Georges Way		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC201	2.11	597 Hadden Drive		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC254	3.12	6010/6014 Gleneagles Pl @ Ocean		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC1	2.12	6015 Gleneagles Dr		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC262	2.22	6030 Gleneagles Drive		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC259	2.12	6034 Gleneagles Dr. @ Ocean		1	$ 68,989		50				3	1.2						2029	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC232	2.21	607 Kenwood Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC260	3.11	6117/6121 Bonnie Bay Place		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HGTEB13	2.11	615 Ballantree Rd		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC248	3.12	6223 Imperial Ave @ Garrow Bay Park		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LRS2	2.22	6262 Marine Drive (North of Fire Hall) - 2 inlets lead to 1 outlet		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC253	3.12	6277 Taylor Drive @ Ocean		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNEB19	2.12	649 Andover Place @ Greenwood Road – NE of 620 Greenwood Road		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC196	0	650 Greenwood Rd		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC257	0	6678 Marine Dr @ Ocean		1	$ 112,663		50				1	1.5						2069	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC244	2.11	6705 Nelson Ave @ Ocean (Boathouse Pier)		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNEB17	2.21	671 Barnham Road – 680 Barnham Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNEB16	2.22	671 Kenwood Road – 680 Kenwood Road		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNEB18	2.21	675 St. Andrews Road – 680 St. Andrews Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC192	2.21	716 Parkside Rd		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC199	2.11	740 King Georges Way		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BRO4	3.22	755 Westcot Road @ Mathers Avenue – crosses Mathers Ave, South		1	$ 157,217		50				3	1.2						2029	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BROIR20	2.21	767 Eyremount Drive – 764 Eyremount Drive		1	$ 139,130		50				3	1.2						2029	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC229	0	77 Desswood Pl		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNWB7	2.22	771 Kenwood Road – 810 Kenwood Road		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC185	2.12	782 Eyremount Dr		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BROIR21	2.22	782 Eyremount Drive – 767 Eyremount Drive		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNWB8	2.22	785 St. Andrews Road – 790 St. Andrews Road		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC191	2.11	786 Southborough Dr		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNWWB13	2.21	815 Andover Crescent @ far West of driveway – 810 Andover Crescent		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNWB9	2.21	815 Greenwood Road – 810 Greenwood Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNWB10	2.21	815/ 805 Andover Crescent – 810 Andover Crescent		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNIR6	2.22	825 Kenwood Road/ Irrigation Reservoir – 830 Kenwood Road		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BRO5	3.21	837 Wildwood Pl – 327 Wildwood Pl		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC163	2.12	855 Cross Creek Rd		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC166	2.11	855 Cross Creek Rd from Pyrford Rd		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BROIR22	2.22	875 Fairmile Rd – 870 Fairmile Road		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BROIR19	2.22	875 Highland Drive – crosses road to Brothers Creek		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC164	2.11	905 Highland Dr		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BRO6	2.21	910 Wildwood Lane (North of driveway) – crosses road, East		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC103	2.22	918 20th St		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	

#	Asset Group	Asset Type	Asset ID	Class	Asset Address	Location	Quantity or Length in meters	December 2008 Replacement value (Unit Cost in CAD)	Date in Service	Expected Service Life (yrs)	Expected Replacement Year	% of Expected Service Life Used	Remaining service life (yrs)	Condition Rating (1=good, 5=poor)	Condition adjustment factor	Condition Adjusted Remaining Service Life	Condition adjusted replacement year	Risk adjustment factor	Risk & Condition Adjusted Remaining Service Life	Condition and Risk Adjusted Replacement Year	Revised Replacement Year	2009 Replacement Value	Source Data	Replacement Value Reference
5	Drainage	Culvert	BRO7	2.22	921 Wildwood Ln - 920 Wildwood Ln		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BROIR23	2.22	925 King Georges Way – 930 King Georges Way		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC228	2.11	94-108 Stevens Dr		1	$ 61,053		50				3	1.2						2029	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN1	2.21	945 15th St		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC114	2.11	951 16th St- 1620 Gordon Ave		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC154	2.11	955 Cross Creek Rd @ Chartwell Dr		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC140	2.11	965 13th St		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC153	2.11	997 Cross Creek Rd- West of Tyrol		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC177	3.11	Across from 1045 King Georges Way @ Highland Dr		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC119	2.11	Ambleside Beach in Front of Concession		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC216a	2.11	At Golf Course behind 455 Eastcot road		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC63	2.12	At Median of Westmount Entrance to Van, Exit from HSB		1	$ 68,989		50				3	1.2						2029	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LRS1	2.12	Back 9 Gleneagles Golf Course (East of 6194 Eastmont Drive)		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	5KM1	3.12	BC Rail – 8855 Lawrence Way		1	$ 53,859		50				3	1.2						2029	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LRS3	3.12	Beneath Eastbound Highway onramp from Horseshoe Bay - Marine Drive		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LRS4	3.11	Beneath Eastbound HWY onramp from Horseshoe Bay - Marine Dr (N of LRS#3)		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC213	2.11	Beneath overpass @ 498 Inglewood Ave feeding into Brothers Creek		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC266	2.11	Caulfeild Dr - SE of Meadfeild		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC208	3.11	Caulfeild HWY entrance Eastbound		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	CV1	2.22	Cave Outfall at Westbay Park		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN9	2.21	Chartwell Drive @ Cammeray Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN9.5	2.21	Chartwell Drive @ Cammeray Road - Cross Creek Park (outlet is BRO#9)		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BRO8	3.21	Cross Creek Park - Northeast of 960 Cross Creek Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BROEB15	2.32	Cross Creek Road @ Highland Drive, Northwest – Southwest corner		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC127	3.11	Crossing E onramp @ top and E of 15th St		1	$ 47,663		50				3	1.2						2029	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPEB23B	3.11	Cypress Bowl HWY Entrance, Westbound - NE of 2261 Gisby St (East)		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPEB23A	2.11	Cypress Bowl HWY Entrance, Westbound - NE of 2261 Gisby St (West)		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPWC16	3.11	Cypress Bowl Lane (1st bend) – 2940 Deer Ridge Place		1	$ 47,663		50				3	1.2						2029	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPEC20	3.11	Cypress Bowl Lane (93m from X-section with Cypress Bowl Rd) – crosses road		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPEB24	3.11	Cypress Bowl Lane, West of lower parking lot – South of Cypress Bowl Road		1	$ 47,663		50				3	1.2						2029	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC238	2.11	Cypress Bowl Rd - Westward HWY on-ramp		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WM8	3.12	Cypress Bowl Rd (first creek West of Deer Ridge Drive)		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPWB9	3.21	Cypress Bowl Road @ West of Cypress Bowl Lane – 2960 Deer Ridge		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	CV7	3.11	Cypress Bowl Road, West of Cypress Place		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC30	2.11	Cypress Park Field (Marine Dr @ Westport Rd)		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC25	2.12	Daffodil Dr @ Daffodil Lane		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDEB21	2.31	E of 2608 Finch Hill @ Chippendale Road - E of 1578 Chippendale Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPWB4	2.21	E of 3050 Rosebery - 3047 Rosebery Avenue		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	TNR6	3.22	E of 3730 Southridge Ave @ Westmount Rd – S of 3690 Westmount Rd (Chevron)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC18	2.12	E of 4890 The Dale		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC186	3.12	E of 5629 Westhaven Rd		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC203	0	E of 915 Burley Drive		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC108	3.11	E of Navvy Jack Point Park @ Ocean		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDWB9	2.32	E of Willoughby Rd @ Chippendale Rd – E of 2306 Chippendale Road		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	GDM11	3.12	Eagle Lake Road, Northwest of Works Yard		1	$ 53,859		50				3	1.2						2029	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN14	2.21	East of 1459 Chartwell Drive – 1454 Chartwell Drive		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDEB20	2.22	East of 1565 Chippendale Court - 1560 Chippendale Court		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDWB10	3.32	East of 2311 Dunlewey Place - Park		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDCB13B	2.31	East of 2537 Westhill Way - West of 2510 Westhill Way (Eastern culvert)		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDCB13A	2.31	East of 2537 Westhill Way - West of 2510 Westhill Way (Western culvert)		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WW1	2.22	East of 4418 Ross Crescent (outlet) - Keith Road @ Stone Crescent		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WD2	2.22	East of 5640 Keith Road – 5685 Keith Road		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDNEB20	2.11	East of 598 Craigmohr Drive – 1041 Millstream Road		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC243	2.12	End of Copper Cove Rd @ Ocean		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC242	2.22	End of Dufferin @ Bachelor Bay Park (left culvert)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC241	3.12	End of Dufferin @ Bachelor Bay Park (right culvert)		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC148	0	Exit 11 on HWY - 1328 Palmerston Ave (is now inlet for VSNEB#30)		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC118	2.11	Foot of 15th St, Millennium Clock @ Beach (E of SC#117)		1	$ 61,053		50				5	Replace Immediately						2014	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC117	2.11	Foot of 15th St, Millennium Clock @ Beach (W of SC#118)		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC116	2.32	Foot of 19th St @ Ocean		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC98	3.11	Foot of 22nd St @ Ocean		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	

DISTRICT OF WEST VANCOUVER ASSET EVALUATION STUDY - DRAINAGE ASSET INVENTORY

#	Asset Group	Asset Type	Asset ID	Class	Asset Address	Location	Quantity or Length in meters	December 2008 Replacement value (Unit Cost in CAD)	Date in Service	Expected Service Life (yrs)	Expected Replacement Year	% of Expected Service Life Used	Remaining service life (yrs)	Condition Rating (1=good, 5=poor)	Condition adjustment factor	Condition Adjusted Remaining Service Life	Condition adjusted replacement year	Risk adjustment factor	Risk & Condition Adjusted Remaining Service Life	Condition and Risk Adjusted Replacement Year	Revised Replacement Year	2009 Replacement Value	Source Data	Replacement Value Reference
5	Drainage	Culvert	SC99	3.11	Foot of 24th @ Ocean		1	$ 47,663		50				5	Replace Immediately						2014	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC79	3.11	Foot of 29th Ave		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC205	3.12	Foot of Hadden Dr - HWY		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC66	3.11	Gables Lane @ 3361 Marine Drive		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC206	2.12	Hadden Dr @ Mathers Ave		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCD5	2.32	Hay Park @ Inglewood Avenue – 1912 Inglewood Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	RG3B	2.31	Highway @ Cypress Exit (Westbound) - 2195 28th Street (Eastern/ central culvert)		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	RG3A	2.31	Highway @ Cypress Exit (Westbound) - 2195 28th Street (Western culvert)		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	GDM9	3.22	Highway Median – Westridge Park @ Highway (East of field)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC245	2.22	Horseshoe Bay @ Ocean (near The Lookout)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	5KM2	3.12	Hwy - Lawrence Way		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC239	2.12	HWY @ Cypress Bowl overpass		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	CV5B	2.11	HWY @ W of Westbound Westmount Exit – 3390 Westmount Rd (Eastern culvert)		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	CV5A	3.21	HWY @ W of Westbound, Westmount Exit – 3390 Westmount Rd (Central culvert)		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC240	3.11	HWY, West of Seascape Close, South of Citrus Wind		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC210	2.11	Keith Rd North of HWY overpass North of Klee Wyck		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC247	2.12	Kew Beach		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC107	2.11	Kings Ave @ Chatwin Park - (East culvert)		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC106	2.11	Kings Ave @ Chatwin Park - (West culvert)		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDEB22	2.32	Langton Park @ Finch Hill – 2608 Finch Hill		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC138	2.11	Marine Dr @ Parc Verdun to 5797 Westport Rd		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC72	3.11	Mathers Ave @ 31st St		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCD3	2.32	Memorial Park @ Marine Drive - 1944 Marine Drive		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC82B	2.12	Middle of HWY across from 3870 Westridge Ave to N of HWY		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC214	2.22	Newlands Place @ HWY		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PP1	3.21	North of 3094 Procter Avenue @ Railroad – 3094 Procter Avenue		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	EGL4	2.21	North of 5683 Westport Road – North of 5631 Daffodil Lane @ Westport Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	QM1	3.12	North of 8468 Citrus Wynd - Hwy		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	GDM10	3.22	North of Highway, West of exit 7 @ Brake-Check Sign - Highway Median		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC207	2.12	North of HWY @ Caulfeild exit, West Median		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC235	3.12	North West side of HWY - after Caulfeild overpass		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WD1	2.21	Northeast of 5692 Keith Road (outlet) East of 5640 Keith Road (inlet)		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCD2	2.32	Northwest of 19th Street @ Bellevue Avenue – 1930 Bellevue Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HDN3	2.31	Northwest of 585 Hadden Drive – Northwest of Hadden Park		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDCB12	2.32	NW of 21st Street @ Westhill Drive – 2079 Queens Avenue @ Highway		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC97	2.12	NW of Collingwood School @ Det. Bas. to 2295 Chairlift Rd @ Water Reservoir		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC62	3.11	Off ramp from HSB @ Westmount (To NW corner of Westridge Ave Park and Ride)		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC61	3.11	Off ramp from HSB, onramp to Van @ Westmount exit/ entrance		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WD3	2.22	Parc Verdun at Marine Drive		1	$ 157,217		50				3	1.2						2029	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC143	2.11	Parc Verdun by 5564 Gallagher Pl		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC249	3.11	Parthenon Pl @ Balmy Beach		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC88	3.11	Pedestrian Hwy Crossing to NE of 26th St		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC7	2.11	Piccadilly North @ Clovelly Walk		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC8	0	Piccadilly North @ Railway		1	$ 112,663		50				5	Replace Immediately						2014	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC2	2.12	Piccadilly South @ Dogwood Lane		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC223	0	Rabbit Lane @ trail entrance (Capilano Regional Park)		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC5	2.22	Ross Lane @ Ross Crescent		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDCB8	2.32	SE of 2190 Camelot Road @ 21st St - 2107 Rosebery Avenue @ 21st Street		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	RGEB7	2.31	SE of 2620 Chelsea Court – 2307 Chairlift Close		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	GDM4	3.11	Sharon Park @ BCR (West of GDM#3)		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	GDM3	2.21	Sharon Park/ BCR		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC90	2.11	Skilift Rd @ Westbound HWY Onramp		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC105	3.11	South of 2120 Argyle Ave West of Navvy Jack Park @ Ocean		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	QM2	2.21	South of 8504 Seascape Close		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC100	2.22	South of Dundarave Playground @ Ocean		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	TNR10	3.11	South of Works Yard, Cypress Bowl Road (outlet only)		1	$ 47,663		50				5	Replace Immediately						2014	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	HGT2	2.21	Southwest of 107 Glenmore Drive – Glenmore Park		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BRO12	2.21	Southwest of 1376 Burnside Road – 1379 Burnside Road		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCD1	2.32	Southwest of 19th Street @ Bellevue Avenue - Seawalk Gardens @ Ocean		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WM2	2.21	Southwest of 3285 Dickenson Crescent @ Railroad - 3299 Marine Dr @ Travers Ave		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WM7	3.22	Southwest of Deer Ridge Drive @ Highway - 3165 Benbow Road @ Highway		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	

DISTRICT OF WEST VANCOUVER ASSET EVALUATION STUDY - DRAINAGE ASSET INVENTORY

#	Asset Group	Asset Type	Asset ID	Class	Asset Address	Location	Quantity or Length in meters	December 2008 Replacement value (Unit Cost in CAD)	Date in Service	Expected Service Life (yrs)	Expected Replacement Year	% of Expected Service Life Used	Remaining service life (yrs)	Condition Rating (1=good, 5=poor)	Condition adjustment factor	Condition Adjusted Remaining Service Life	Condition adjusted replacement year	Risk adjustment factor	Risk & Condition Adjusted Remaining Service Life	Condition and Risk Adjusted Replacement Year	Revised Replacement Year	2009 Replacement Value	Source Data	Replacement Value Reference
5	Drainage	Culvert	SC264	2.11	Stevens Drive @ Southborough Drive - North East corner		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	NLS1	3.32	Telegraph Trail at Marine Drive		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC19	2.11	The Dale @ Marine Dr		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC128	3.12	Top of 15th St crosses Rd North of Overpass		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	PPWB10	0	Upper Cypress Bowl Road		1	$ 112,663		50				3	1.2						2029	$ 120,256	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	EGL5	2.22	Upper Westport Road – 5612 Westhaven Court		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC56	2.12	W of Caulfeild onramp on HWY to Meadfeild Lane		1	$ 68,989		50				1	1.5						2069	$ 73,639	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC36	3.11	W of dirt road @ back of Cypress Park (end of Woodgreen Pl)		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC180	3.11	West of 1115 Millstream Road - 1120/ 1118 Millstream Road		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BRO10	2.21	West of 1175 Chartwell Crescent - 1162 Chartwell Crescent.		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BROEB17	2.32	West of 1357 Crestwell Road – 1376 Crestwell Road		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSNWB10	2.32	West of 1533 Errigal Place - West of 1538 Errigal Place		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSNEB16B	2.32	West of 1581 Pinecrest Drive – 1588 Pinecrest Drive (Central culvert)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSNEB16C	2.32	West of 1581 Pinecrest Drive – 1588 Pinecrest Drive (Eastern culvert)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSNEB16A	2.32	West of 1581 Pinecrest Drive – 1588 Pinecrest Drive (Western culvert)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	VSN15A	2.11	West of 1582 Chartwell Drive – West of 1575 Chartwell Drive		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDEB24	3.31	West of 1633 Marlowe Place - 1636 Marlowe Place		1	$ 139,130		50				1	1.5						2069	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSN3	2.32	West of 1785 Fulton Avenue – West of 1788 Fulton Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSN4	2.32	West of 1819 Inglewood Avenue - 1792 Inglewood Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MR7	2.22	West of 2429 Skilift Road – Northwest of 2435 Russet Place (2 culverts)		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MR6	2.31	West of 2435 Queens Avenue - 2440 Queens Avenue		1	$ 139,130		50				3	1.2						2029	$ 148,508	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	CV2	2.22	West of 3397 Marine Drive @ Railroad – 3402 Marine Drive		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	WD5	3.12	West of 4799 Westwood Drive - 5377 Westhaven Wynd		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LRS5	3.11	West of Black Mountain Trail @ HWY – West of Marine Drive @ Overflow Parking		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSN1	2.32	West of John Lawson Park @ Railroad – 1768 Argyle Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	LSNWB12	3.32	West of Normanby Park @ Pinecrest Drive – 1626 Pinecrest Drive		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	TNR9	2.22	West of Westbound Westmount Highway Entrance – 3760 Westridge Ave		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BRO3	3.11	West of Wildwood Place @ Mathers Avenue – 820 Mathers Avenue		1	$ 47,663		50				1	1.5						2069	$ 50,875	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	CV6	2.22	Westbound, Westmount Exit – crosses Wentworth Avenue		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC190	3.12	Westcot Rd @ Mathers Ave		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	BRO2	2.32	Westcot Road @ Westbound Highway Entrance – 751 Burley Place		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	MCDEB15	2.22	Westhill Park - 2261 Westhill Drive		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC60	3.12	Westmount @ onramp to HSB @ Chevron		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	TNR5	3.22	Westmount Rd, Northeast of Southridge Pl - 3702 Southridge Pl @ Westmount Rd		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC188	3.12	Westport Rd @ HWY overpass- 5629 Westhaven Wynd		1	$ 53,859		50				1	1.5						2069	$ 57,489	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC83	2.22	Westridge Park, W of Godman Creek		1	$ 157,217		50				1	1.5						2069	$ 167,814	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC35	2.11	Woodgreen Dr @ Woodside Pl		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
5	Drainage	Culvert	SC33	2.11	Woodgreen Dr @ Woodview Pl		1	$ 61,053		50				1	1.5						2069	$ 65,168	LIST_OF_STREAM_CULVERTS_IN_NUMERICAL_ORDER.DOC & DWV-#269421-v1-	
7	Drainage	Detention Basin	DC3		1115 Queens Avenue- manhole access	(chamber)	1	$ 25,000		50				1	1.5						2069	$ 26,685	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DC3		1116 Queens Avenue-	manhole access (chamber)	1	$ 25,000		50				1	1.5						2069	$ 26,685	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DB11		1489 Chippendale	(behind property- access from West)	1	$ 3,000	1990	50	2040	38%	31		1						2040	$ 3,202	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DB13		1557 Tyrol Place	- access from 15th Street	1	$ 5,000	1990	50	2040	38%	31		1						2040	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DB5		2036 Westhill Drive	(East of property)	1	$ 4,000	1980	50	2030	58%	21		1						2030	$ 4,270	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DB10		2156 Westhill Wynd		1	$ 10,000	1990	50	2040	38%	31		1						2040	$ 10,674	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DB6		2251 Westhill Drive	(West of property)	1	$ 4,000	1980	50	2030	58%	21		1						2030	$ 4,270	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DB7		2328 Westhill Drive	(East of property)	1	$ 4,000	1980	50	2030	58%	21		1						2030	$ 4,270	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DB9		2536 / 2531 Westhill Drive		1	$ 4,000	1990	50	2040	38%	31		1						2040	$ 4,270	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DB8		2539 Westhill Close-	access path from driveway at end of cul-	1	$ 3,000	1980	50	2030	58%	21		1						2030	$ 3,202	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DB4		2776 Chelsea Close -tennis court surface-	CB manhole lid	1	$ 4,000	1990	50	2040	38%	31		1						2040	$ 4,270	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DB3		3169 Deeridge Drive	(back of property)	1	$ 3,000	2000	50	2050	18%	41		1						2050	$ 3,202	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DC2		3712/ 3710 Southridge Place	(back of property- chamber)	1	$ 20,000	1969	50	2019	80%	10		1						2019	$ 21,348	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DC1		3714/ 3712 Southridge Place	(back of property- chamber)	1	$ 20,000	1969	50	2019	80%	10		1						2019	$ 21,348	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DB1		4616 Northwood	(Northeast of property)	1	$ 4,000	1990	50	2040	38%	31		1						2040	$ 4,270	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	Irrigation Reservoir		521 Southborough Drive,	East of property @ Capilano Golf Course	1	$ -		50				1	1.5						2069	$ 37,359	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DB14		876 Fairmile Road		1	$ 4,000	1950	50	2000	118%	-9		1						2000	$ 4,270	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DB12		Whitby Rd cul-de-sac-	down the trail	1	$ 5,000	1960	50	2010	98%	1		1						2010	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
7	Drainage	Detention Basin	DB2		Woodburn @ Westwood	(SW of tennis court)	1	$ 10,000	1980	50	2030	58%	21		1						2030	$ 10,674	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1025/1015 King Georges Way	SC189	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1051 Millstream Road	SC195	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	106 Deep Dene Road – Houlgate Creek	SC227	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1087 Eyremount Drive – 1088 Eyremount Drive	SC194	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	

DISTRICT OF WEST VANCOUVER ASSET EVALUATION STUDY - DRAINAGE ASSET INVENTORY

#	Asset Group	Asset Type	Asset ID	Class	Asset Address	Location	Quantity or Length in meters	December 2008 Replacement value (Unit Cost in CAD)	Date in Service	Expected Service Life (yrs)	Expected Replacement Year	% of Expected Service Life Used	Remaining service life (yrs)	Condition Rating (1=good, 5=poor)	Condition adjustment factor	Condition Adjusted Remaining Service Life	Condition adjusted replacement year	Risk adjustment factor	Risk & Condition Adjusted Remaining Service Life	Condition and Risk Adjusted Replacement Year	Revised Replacement Year	2009 Replacement Value	Source Data	Replacement Value Reference
8	Drainage	Grate		screen	1119 Crestline Road – 1080 Crestline Road	HDNWWB14	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1125 Crestline Road – 1126 Crestline Road	SC181	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1125 Mathers Ave	SC147	1	$ 5,000		50				5	Replace Immediately						2014	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1143 Jefferson Ave	SC141	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1151 Eyremount Drive – Southeast of 1150 Eyremount Drive	SC159	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1295 Mathers Avenue - Ridgeview School @ Mathers Avenue	VSNEB28	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1335 Ottawa Ave - 1312 Ottawa Ave	VSNEB29	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1356 Gordon Avenue @ lane - 1365 Fulton Avenue @ lane	SC136	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1373 Chartwell Drive	SC156	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1379 Chartwell Drive	SC155	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1387 Fulton Ave	SC193	1	$ 5,000		50				5	Replace Immediately						2014	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1387 Haywood Ave	SC120	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1395 Chartwell Drive – 1394 Chartwell Drive	VSN11	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	13th St @ Ridgeview School – Ambleside Park boat launch	VSNEB27	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1425 Esquimalt Avenue (inlet only – joins VSN#1A underground)	VSNCB16	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1440 31st Street - 1408 31st Street	SC73	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1455 Tyrol Road – 1450 Tyrol Road	VSN7	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1559 Vinson Creek Road - 1435 Chartwell Dr	BRO14	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1590 Chartwell Drive @ Millstream Road, trail entrance	VSN15B	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1590 Kings Ave	VSN3	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	15th Street HWY Entrance @ South of Tyrol Ln – 1520 Queens Ave @ 15th Street	VSN6	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1650 29th Street - 2909 Mathers Avenue	SC78	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1685 Mathers Avenue – 1690 Mathers Avenue	VSN4	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1750 Bellevue Ave - West of 1766 Duchesss Ave	LSN2	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1795 28th Street - Rodgers Creek	SC86	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	1885 Fulton Avenue - 1880 Fulton Avenue	MCD4	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	2050 Russet Way	SC92	1	$ 5,000		50				3	1.2						2029	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	207 Rabbit Lane @ end of cul-de-sac	SC222	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	2097 26th Street	SC89	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	20th Street and Fulton Ave (NE Corner)	SC104	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	2208 Chairlift Rd – Highway, East of Pedestrian Crossing	SC80	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	2225 Gisby Street	PPEB22	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	2227 Ottawa Ave	SC102	1	$ 5,000		50				3	1.2						2029	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	2536 Westhill Dr - 2535 Westhill Dr	MCDEB19	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	2620 Chelsea Court	RGEB8	1	$ 5,000		50				3	1.2						2029	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	2635 Rosebery Ave	SC84	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	2678 Chairlift Rd - Chelsea Close Park	RGCB4	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	3061 Spencer Drive	PPWC13	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	3135/ 3105 Mathers Ave - 3140 Mathers Avenue @ 31st Street	SC72	1	$ 5,000		50				3	1.2						2029	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	3151-3150 Westmount Place	SC69	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	319 Moyne Drive – 334 Moyne Drive	SC221	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	3315 Westmount Road	SC57	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	3355 Mathers Avenue - 3354 Mathers Avenue	SC65	1	$ 5,000		50				3	1.2						2029	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	3521 Creery Avenue - Westbay Park @ Marine Drive	TNR1	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	3680 Cedaridge Place – 3660 Westmount Road	TNR4	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	3870 Westridge Avenue @ Highway	SC81	1	$ 5,000		50				5	Replace Immediately						2014	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	402 Hidhurst Place (same outlet as SC#216A)	SC216B	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	4045 -4050 Bayridge Avenue	SC43	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	4105 Ripple Road (A) & 4041 Ripple Place (B) (2 inlets, joins SC#43 for outlet)	SC40	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	425 Rabbit Lane – 455 Eastcot Road @ Capilano Golf Course	SC216A	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	430 Oxely Street North to Oxely Street North @ Railway	SC64	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	4651 Marine Drive - 4611 Marine Drive	SC3	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	4661 Willow Creek Road - 4190 Rockridge Road	SC29	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	501 St. Andrews Road – 502 St. Andrews Road	HGTEB11	1	$ 5,000		50				3	1.2						2029	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	530 Thetford Place	SC198	1	$ 5,000		50				3	1.2						2029	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	5446 Meadfeild Lane – 5292 Meadfeild Road	SC55	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	5545 Greenleaf Road - 5530 Greenleaf Road	SC157	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	563 St. Giles Road – 564 St. Giles Road	HGTEB10	1	$ 5,000		50				3	1.2						2029	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	5775 Marine Drive – Yacht Club @ Ocean	SC268	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	594 Craigmohr Drive – crosses road	HDNEB21	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	595 King Georges Way @ Robin Hood Road – 650 King Georges Way	SC197	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	

DISTRICT OF WEST VANCOUVER ASSET EVALUATION STUDY - DRAINAGE ASSET INVENTORY

#	Asset Group	Asset Type	Asset ID	Class	Asset Address	Location	Quantity or Length in meters	December 2008 Replacement value (Unit Cost in CAD)	Date in Service	Expected Service Life (yrs)	Expected Replacement Year	% of Expected Service Life Used	Remaining service life (yrs)	Condition Rating (1=good, 5=poor)	Condition adjustment factor	Condition Adjusted Remaining Service Life	Condition adjusted replacement year	Risk adjustment factor	Risk & Condition Adjusted Remaining Service Life	Condition and Risk Adjusted Replacement Year	Revised Replacement Year	2009 Replacement Value	Source Data	Replacement Value Reference
8	Drainage	Grate		screen	595 St. Andrews Road – 615 St. Andrews Road	HDNEEB22	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	607 Kenwood Road	SC232	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	675 St. Andrews Road – 680 St. Andrews Road	HDNEB18	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	715 Parkside Road – 716 Parkside Road	SC192	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	875 Fairmile Road – 870 Fairmile Road	BROIR22	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	925 King Georges Way – 930 King Georges Way	BROIR23	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	945 15th Street - 1488 Gordon Avenue (outlet B) & Ambleside Pier (outlet A)	VSN1	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	965 Cross Creek Road (NW of Firehall) – North of 960 Cross Creek Road	SC154	1	$ 5,000		50				3	1.2						2029	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	997 Cross Creek Road – Southwest of Tyrol Road @ Cross Creek Road	SC153	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	Chartwell Drive @ Cammeray Road	VSN9	1	$ 5,000		50				3	1.2						2029	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	East of 1459 Chartwell Dr – 1454 Chartwell Dr	VSN14	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	East of 4418 Ross Crescent (outlet) - Keith Road @ Stone Crescent	WW1	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	East of 5629 Westhaven Road	SC186	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	East of 5640 Keith Road – 5685 Keith Road	WD2	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	East of 598 Craigmohr Dr – 1041 Millstream Rd	HDNEB20	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	HWY @ West of Westbound, Westmount Exit – 3390 Westmount Road (Eastern culvert)	CV5B	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	North of 1150 Millstream Road	SC160	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	North of 2994 Park Lane @ Ocean	SC77	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	Northeast 5692 Keith Road (outlet) East of 5640 Keith Road (inlet)	WD1	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	West of 1167 Eyremount Drive – East of 1161 Eyremount Drive (no road crossing)	SC158	1	$ 5,000		50				5	Replace Immediately						2014	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	West of 1819 Inglewood Avenue - 1792 Inglewood Avenue	LSN4	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
8	Drainage	Grate		screen	West of 4799 Westwood Drive - 5377 Westhaven Wynd	WD5	1	$ 5,000		50				1	1.5						2069	$ 5,337	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	1125 Groveland Court – 1110 Groveland Court	SC174	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	1125 Palmerston Ave – 1130 Palmerston Ave	SC151	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	1405 Camelot Rd – 1402 Camelot Rd	VSN8	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	1455 Tyrol Road – 1450 Tyrol Road	VSN7	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	1590 Chartwell Drive @ Millstream Road, trail entrance	VSN15B	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	1590 Kings Ave	VSN3	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	1685 Mathers Avenue – 1690 Mathers Avenue	VSN4	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	2055 Queens Avenue – 2010 Queens Avenue	MCDCB11	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	2195 28th Street - 2765 Skilift Place	RGEB5	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	2505 Westhill Dr – 2426 Westhill Court	MCDEB17	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	2508 Westhill Dr – 2505 Westhill Dr	MCDEB18	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	2930 Deer Ridge Place @ HWY - 3049 Spencer Court @ HWY	PPEC18	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	2940 Deer Ridge Place @ HWY – 3053 Spencer Place @ HWY	PPWC15	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	2960 Deer Ridge Place @ HWY - 3071 Spencer Court @ HWY	PPWB8	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	441 Southborough Drive	SC234	1	$ 30,000		50				5	Replace Immediately						2014	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	4480 Ross Crescent @ Ocean	SC261	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	455 Eastcot Road – 450 Eastcot Road	SC219	1	$ 30,000		50				3	1.2						2029	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	4625 Port View Place – 4781 Estevan Place (WW#5A) & 4753 Caulfeild Drive (WW#5B)	WW5A & 5B	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	501 St. Andrews Road – 502 St. Andrews Road	HGTEB11	1	$ 30,000		50				3	1.2						2029	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	5329 Kew Road - 5215 Gulf Place	SC15	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	575 Stevens Drive – 580 Stevens Drive	HDN2	1	$ 30,000		50				3	1.2						2029	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	5779 Westport Road	WD4	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	921 Wildwood Lane - 920 Wildwood Lane	BRO7	1	$ 30,000		50				3	1.2						2029	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	Cypress Bowl HWY Entrance, Westbound - Northeast of 2261 Gisby Street (East)	PPEB23B	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	Cypress Bowl HWY Entrance, Westbound - Northeast of 2261 Gisby Street (West)	PPEB23A	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	Cypress Park Field/ Marine Drive @ Keith Road	SC30	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	Highway @ Cypress Exit (Westbound) - 2195 28th Street (Eastern/ central culvert)	RG3B	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	Hwy - Lawrence Way	5KM2	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	HWY, West of Seascape Close, South of Citrus Wind	SC240	1	$ 30,000		50				3	1.2						2029	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	North of 5683 Westport Road	EGL4	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	Northwest of 21st Street @ Westhill Drive – 2079 Queens Avenue @ Highway	MCDCB12	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	Southwest of Deer Ridge Drive @ Highway - 3165 Benbow Road @ Highway	WM7	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	Upper Westport Road – 5612 Westhaven Court	EGL5	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	West of 1581 Pinecrest Drive – 1588 Pinecrest Drive (Central culvert)	LSNEB16B	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	West of 2429 Skilift Road – Northwest of 2435 Russet Place (2 culverts)	MR7	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
9	Drainage	Grate		trash rack	West of 2435 Queens Avenue - 2440 Queens Avenue	MR6	1	$ 30,000		50				3	1.2						2029	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
10	Drainage	Grate		Grizzly Rack	1389 - 1390 Camridge Road	LSNWB8	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
10	Drainage	Grate		Grizzly Rack	1455 Chippendale Road – East of 1460 Chippendale Road	LSNEB15	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
10	Drainage	Grate		Grizzly Rack	1498 Chippendale Road - 2588 Westhill Drive @ Chippendale Road	LSNWB9	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	

DISTRICT OF WEST VANCOUVER ASSET EVALUATION STUDY - DRAINAGE ASSET INVENTORY

#	Asset Group	Asset Type	Asset ID	Class	Asset Address	Location	Quantity or Length in meters	December 2008 Replacement value (Unit Cost in CAD)	Date in Service	Expected Service Life (yrs)	Expected Replacement Year	% of Expected Service Life Used	Remaining service life (yrs)	Condition Rating (1=good, 5=poor)	Condition adjustment factor	Condition Adjusted Remaining Service Life	Condition adjusted replacement year	Risk adjustment factor	Risk & Condition Adjusted Remaining Service Life	Condition and Risk Adjusted Replacement Year	Revised Replacement Year	2009 Replacement Value	Source Data	Replacement Value Reference
10	Drainage	Grate		Grizzly Rack	2536 Westhill Dr - 2535 Westhill Dr	MCDEB19	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
10	Drainage	Grate		Grizzly Rack	2620 Chelsea Court	RGEB8	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
10	Drainage	Grate		Grizzly Rack	2678 Chairlift Rd - Chelsea Close Park	RGCB4	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
10	Drainage	Grate		Grizzly Rack	East of 1565 Chippendale Court - 1560 Chippendale Court	MCDEB20	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
10	Drainage	Grate		Grizzly Rack	East of 2537 Westhill Way - West of 2510 Westhill Way (Eastern culvert)	MCDCB13B	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
10	Drainage	Grate		Grizzly Rack	East of 2537 Westhill Way - West of 2510 Westhill Way (Western culvert)	MCDCB13A	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
10	Drainage	Grate		Grizzly Rack	HWY @ West of Westbound, Westmount Exit – 3390 Westmount Road (Central culvert)	CV5A	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
10	Drainage	Grate		Grizzly Rack	Northwest of 21st Street @ Westhill Drive – 2079 Queens Avenue @ Highway	MCDCB12	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
10	Drainage	Grate		Grizzly Rack	Southeast of 2190 Camelot Road @ 21st St - 2107 Rosebery Avenue @ 21st Street	MCDWB8	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
10	Drainage	Grate		Grizzly Rack	Westhill Park - 2261 Westhill Drive	MCDEB15	1	$ 30,000		50				1	1.5						2069	$ 32,022	CREEK_AND_STORM_DRAINAGE_STRUCTURES.XLS	
																					total	$ 332,957,306		

Appendix B – 2006 Multi-Year Storm Sewer Condition Assessment Program

UMA | AECOM

District of West Vancouver

Developing a Multi-Year Storm Sewer Condition Assessment Program

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F438-002-01

March 2006

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1.0 Background

1.1 This Report

This report follows the initial phase sanitary sewer condition assessment program study, completed by UMA Engineering Ltd. in November 2005. In a similar process to that undertaken for the sanitary sewers[1], a risk model has been currently developed around the District's piped storm sewer network to assist with prioritizing sewers and developing a multi-year condition assessment program. This report reviews the methodology and prioritization, and provides recommendations for taking a strategic approach to managing the storm sewer infrastructure.

1.2 Storm Sewer System

The District has recorded in its inventory, over 225 km of storm sewers which typically discharge either directly to Burrard Inlet/Howe Sound, or to one of several creeks running north-south throughout the municipality. The current study includes only District-owned storm sewer mainline pipes and culverts that are currently in the GIS inventory, and excludes any manholes, catch basins, catch basin leads, and ditches, which are all inventoried separately. Based on a Class D cost estimate of $2 per millimetre diameter per metre sewer, these storm pipes have an approximate replacement value of $189 million.

[1] Refer to "Developing a Multi-Year Sanitary Sewer Assessment Program", UMA Engineering Ltd., November 2005 report for details.

2.0 Methodology

2.1 Data Collection & Review

The District provided digital GIS data in ESRI "Shape File" format, representing the entire storm sewer inventory and associated manholes, land parcels, and topographic contour lines. A hardcopy road classification map previously provided for the sanitary sewer study was again used for this study.

2.2 Data Manipulation & Assumptions

The criteria used to develop the current risk model for the storm sewer network include:

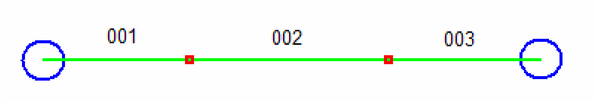
- basin;
- depth;
- size;
- material;
- age;
- soil conditions; and
- traffic volume.

2.2.1 Sewer Main Asset Delineation

The District's digital storm sewer spatial data resided in two "Shape Files": "STORM_MAINS_line" and "STORM_MAINS_arc", with attributes such as size and material, stored as a separate DBF data file: "STORM_MAINS_DATA". The spatial data and attribute table are linked by a common "GIS_ID" field. For purposes of the study, the geometry from both features were joined with the attribute table and then exported into a single GIS feature.

To be consistent with asset management best practices of evaluating linear sewer infrastructure on a manhole-to-manhole basis, each storm sewer segment should be delineated as a single entity bounded by two access points (e.g. manholes, inlet/outlet). Current segmentation resembles that for the sanitary sewers, with multiple segments between two access points.

Figure 2.1: Storm Sewer Segmentation

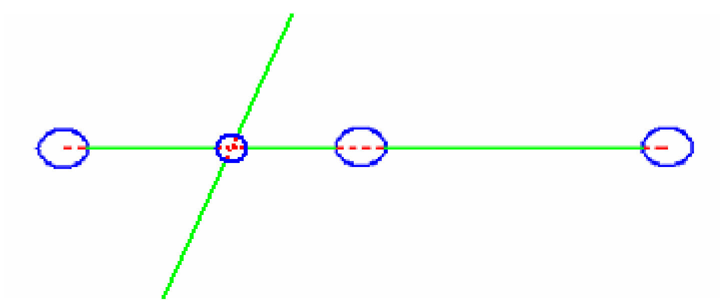


The process used to manipulate this data involved the utilization of a series of spatial analysis functions that can be performed with most GIS software without the aid of a network analysis add-in. If such network analysis tools are deployed, a different approach could be used to generate the desired sewer main asset delineation. The general concept behind this manipulation is to merge all linear geometry together into a single segment where they touch. In order to avoid merging the linear geometry into a single mass, a small section of the line is removed at asset breaking points such as at manholes and at junctions. Whenever a small line section is removed at these locations, the segments cannot be merged. A side effect of this approach is that segments that cross each other without being broken at the intersection will be merged as well. This problem was ignored within the sanitary system, but was much more pronounced within the storm system. Additional measures had to be taken such that a small line section was removed at these intersection points and thus the merge action was avoided.

The following procedure was used:

- Using the storm sewer line and arc geometries, extract all line vertices and then merge the resulting point features into a single feature where multiple points touch. The desired result is a single point feature where two or more line segments meet each other at their endpoints.
- Attach an attribute to the previous results called “NUM_SEGS” and populate with the number of unique line segments that touch each endpoint.
- Attach another attribute to the previous results called “MH_ID” and populate with the ID number of any storm sewer manhole that is located within 100mm of each endpoint.
- Filter the previous results where MH_ID is not null (manhole) or NUM_SEGS = 1 (plug) or NUM_SEGS >2 (tee or cross). This set of points will be considered the locations where the linear sewer assets will be “broken”. Create small buffer areas (e.g. 25mm) around this set of points.
- Spatially intersect the set of sewer main segments with itself. The desired result should be a series of line segments that mirrors the original line segment set, plus a series of points where the lines cross each other. Filter out these intersection points into another result set and then create a buffer zone of 10mm around this set of points.
- Create a spatial difference of sewer main segments minus the previously created buffer areas (end points and intersections). The result should consist of all the sewer segments contained within the original data set, with a small section removed near the endpoints and intersections (as shown below).

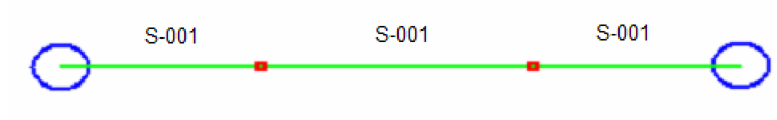
Figure 2.2: Storm Sewer Spatial Segmentation



- Create a spatial merge of all sewer main segments where they touch. Because a small linear section was removed near the endpoints during the previous step, the segments will not merge at these points. The effect of having a small line section removed at the intersection results in the retention of the original segmentation without being merged with the crossing segment. The result will be a series of sewer segments that run from manhole to manhole or manhole to tee without merging at intersections. In order to enable identification of each sewer main asset, a unique, temporary ID (“TEMP_ID”) was applied by using a random number generator.

The segment merge operation could be streamlined if an asset numbering scheme was used, such that a single ID number is applied to all segments in between two manholes, as shown below.

Figure 2.3: Storm Sewer Segment ID



This "asset number" could be used as a parameter in conjunction with the "touching" parameter during the merge operation in order to avoid using the manhole buffer/spatial difference procedure to separate other sewer mains connected to the same manhole. This asset numbering scheme would also enable external database applications such as condition assessment tools and work management systems to reference permanent ID numbers that represent actual manhole-to-manhole sewer main assets rather than arbitrary segment ID numbers that change whenever segments are split to accommodate changes in pipe characteristics.

Another issue with the storm sewer data is the lack of a sewer main "TYPE" attribute that would allow culverts, which currently reside in the same layer as the mainline storm sewers, to be differentiated. As a result, culverts are included within the results of this current study. Culverts have vastly different safety and functional requirements than closed conduit drainage infrastructure and should be classified separately and have their data managed accordingly.

2.2.2 Basin

The storm sewers are presently evaluated and prioritized according to the basin areas previously defined by Earth Tech for the sanitary sewers[2], as provided in the corresponding "Basin_Boundary" GIS feature. However, it is recommended that the District establish operational catchment areas for future data management and evaluation. This previous study identifies five basin areas with a few sub-basins. An additional sixth basin area was created to include storm mains in the Sunset Highlands region.

A few outlying storm mains exist, and are either located on Capilano Indian Reserve No. 5 or just outside of existing basin boundaries. Storm sewers on the Reserve (9 derived manhole-to-manhole segments) are excluded from the assessment, and the remainder of the outliers (54 derived segments) absorbed into the adjacent basin for the purpose of this study. Table 2.1 summarizes revisions made to the basin names from the "Basin_Boundary" feature, for clarity.

Table 2.1: Revised Basin Delineation

GIS "Basin Boundary" (from Earth Tech memo)	Revised "Basin Boundary"
Sub Basin II	Basin II
Basin III	Sub-Basin III_A
Sub Nasin IIIA	Sub-Basin III_B
Sub Basin IIIB	Sub-Basin III_C
Ambleside Basin IV	Basin IV
British	Sub-Basin V_A
Basin VA	Sub-Basin V_B
Basin VB	Sub-Basin V_C

[2] "Liquid Waste Management Plan (LWMP) Review", Earth Tech Technical Memorandum No. 1, December 2004

2.2.3 Depth

The District sewer main GIS feature has upstream and downstream invert elevation attributes included within its database structure. However sewer depths are not readily available due to the lack of surface elevation data within the storm sewer manhole and storm sewer inlet/outlet feature. The District provided a Shape File of topographic contour lines, from which approximate surface elevation polygons were derived by using a raster based terrain analysis tool.

The procedure to apply depth values to the derived manhole-to-manhole sewer segments is as follows:

- Create a 2 metre raster “grid” of the entire West Vancouver area and “rasterize” the contour polylines from the provided contour Shape File. Set the intersecting cell values to the elevation of the contour lines. Run interpolation routine that sets the value of the empty grid cells in between the contours based on the values of neighbouring cells. Output the resulting cell grid into vector polygons areas with elevation attribute.
- Using the derived manhole-to-manhole sewer segments created previously, extract all line vertices and then merge the resulting point features into a single feature where multiple points touch. The desired result is a single point feature where two or more line segments meet each other at their endpoints.
- Use spatial intersection function between previously created surface elevation polygons and the previous sewer segment endpoints in order to assign surface elevation to them.
- Create buffer areas around the points from previous results that are slightly larger than the buffer areas originally used to derive the manhole-to-manhole sewer segments (e.g. 30mm).
- Use spatial analysis functions to extract the start point geometry from the derived manhole-to-manhole sewer segments. Ensure that the “TEMP_ID” and the upstream invert elevation (“START_INVE” field) of the segment are applied to the point geometry.
- Use a spatial intersection function to join the buffer areas around the previous surface elevation points to the previous segment start point geometry.
- Use spatial analysis functions to extract the end point geometry from the derived manhole-to-manhole sewer segments. Ensure that the “TEMP_ID” and the downstream invert elevation (“END_INVERT” field) of the segment are applied to the point geometry.
- Use a spatial intersection function to join the buffer areas around the previous surface elevation points to the previous segment end point geometry.
- Join the resulting start and end point data sets based on the common “TEMP_ID” field.
- Calculate a new “START_DEPTH” attribute within the previous results by subtracting the “START_INVE” elevation of the sewer segment from the derived surface elevation.
- Calculate a new “END_DEPTH” attribute within the previous results by subtracting the “END_INVERT” elevation of the sewer segment from the derived surface elevation.
- Calculate maximum depth by determining the maximum value of the calculated “START_DEPTH” and “END_DEPTH” data fields.

It should be noted that the values of “START_INVE” and “END_INVERT” within the District Storm Sewer feature did not contain decimalized values. These values had to be divided by a ten based factor (10, 100, 1000 etc.) in order to derive the “true” invert values. The ten based factor to use had to be derived by observing the value of the associated surface elevation (see example below)

START_SURFACE_ELEV	START_INVERT	DERIVED_START_INVERT
257	25419	254.19 (divided by 100)
101	100529	100.529 (divided by 1000)

Calculated depths >15m, typically resulting from zero start or end invert elevation values, were excluded from the current analysis.

2.2.4 Size

Storm main size values were assigned to the derived manhole-to-manhole sewer segments from the “SIZE_” field in the original storm main shape file. Where multiple segments exist between manholes within the original segmentation, the maximum “SIZE_” value of all touching segments was applied in order to represent the worst case scenario. Invalid size values (e.g. 99999, 999999) were considered unknown and assigned a 0 value.

It should be noted that common practice is to assign two size fields (i.e. “HEIGHT” and “WIDTH”) and a shape field (e.g. “CIRCULAR”, “RECTANGLUR”, etc.) to storm sewers to account for noncircular pipe geometry (e.g. box culverts). It would be valuable for the District to include these fields for future data capture.

2.2.5 Material

Storm main material values were assigned to the derived manhole-to-manhole sewer segments from the “MATERIAL” field within the original storm main shape file. Where multiple segments exist between manholes within the original segmentation, the predominant material type (i.e. of longest length) of all touching segments was applied. Erroneous values (e.g. 332.916, 99999, INLET, NA) are assumed unknown and thus assigned a blank value.

Multiple denotations are sometimes used to represent the same material type. For example, concrete pipe is listed as “C”, “RC”, “RCP”, “RCB”, and “RIC”. These fields were adjusted to collate the entries. Table 2.2 summarizes the assumptions made for material type, along with the number of occurrences.

Table 2.2: Revised Material

Original GIS “MATERIAL”	Revised “MATERIAL”	Number of Occurrences
C	CONC	348
RC	CONC	628
RCP	CONC	18
RCB	CONC	2
RIC	CONC	1
STEEL	ST	1
VITCLAY	VC	1
W	WOOD	1
WD	WOOD	1
HDPP	HDPE	1
SC	HDPE	2
RD	UNKNOWN	1
PERF	UNKNOWN	20

Original GIS "MATERIAL"	Revised "MATERIAL"	Number of Occurrences
CSP	CMP/CSP	5
CMP	CMP/CSP	143
CP	UNKNOWN	8
French Drain	UNKNOWN	1

A significant portion (approximately 70%) of the manhole-to-manhole segments have an "UNKNOWN" material field. Implications of this are discussed in Section 4.2.4.

2.2.6 Age

Storm main age values were assigned to the derived manhole-to-manhole sewer segments from the "DATE_OF_IN" field within the District's storm main shape file. Where multiple segments exist between manholes within the original segmentation, the minimum "DATE_OF_IN" value of all touching segments was applied in order to represent the worst case scenario. This installation year is subtracted from the current year (2005) to obtain the age value. Erroneous values (e.g. 99999, 999999, NA) are assumed unknown and thus assigned a blank value.

2.2.7 Soil Conditions

As with the sanitary sewer study, soil condition assumptions are based on minimal geotechnical information provided in a previous Dayton & Knight Ltd. report[3]. This report indicates that soils north of the Upper Levels Highway are generally glacial deposits over bedrock, and soils below the Upper Levels Highway are generally sand and gravel. The exception is the Ambleside area with its marine sand and water table varying with tides. Based on this information the "SOIL" field for the Ambleside area (i.e. Basin IV) is assigned a "bad" value, and the remainder of the District "good". Cohesive soils are considered good ground, and cohesionless soils bad ground (see Section 2.3.1).

2.2.8 Traffic Volume

In the previous sanitary sewer assignment the District's hardcopy road classification map was manually digitized and buffer zones created for the three major road classifications as follows:

- "COLLECTOR" = 20m wide;
- "ARTERIAL" = 30m wide; and
- "FREEWAY" = 100m wide.

Road classification values were assigned to derived manhole-to-manhole sewer segments in the "ROAD_TYPE" field by using a spatial intersection operation.

Traffic volumes based on averages from the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (see Table 2.3) were subsequently applied and populated in the "TRAFFIC_FLOW" field of the resulting feature.

[3] "Preliminary Assessment of Inflow and Infiltration (I&I) into the Hollyburn Interceptor Sewer", Dayton & Knight Ltd., July 1995

Table 2.3: Assumed Traffic Volumes

Traffic Volume (veh/day) (typical)	Road Classification				
	Collectors		Arterials		Freeways
			Minor	Major	
TAC[4]	<8,000	1,000-12,000	5,000-20,000	10,000-30,000	>20,000
Assumed	7,000		16,250		>20,000

It is assumed that the sewers that do not spatially intersect any road classification buffer area are located on local or private roads and will thus carry less than 5,000 vehicles per day.

2.2.9 General Recommendations for Digital Storm Main Data Management

The recommendations for the digital storm data are summarized as follows:

- Store all storm mains and associated attribute fields within a single GIS database table or Shape File;
- Incorporate an “Asset Number” field that would allow manhole-to-manhole segments to be derived by merging based on common attribute value, rather than by “touching”;
- Incorporate a field to differentiate between culverts and mainline sewers;
- Delineate formal operational catchment areas;
- Maintain consistent units for pipe invert elevations;
- Capture depth data (or surface elevation data in addition to the existing invert elevations); and
- Provide two fields (Height and Width) to capture size dimensions and an additional field to define sewer shape or cross section type.

2.3 Risk Model Development

The storm sewer risk model is also based on the Water Research Centre (WRc) risk model[5] as detailed in our previous report[1]. In this model, sewers are categorized as A, B, or C, with Category A and B sewers forming the “critical sewer network”. Category A sewers have serious financial implications, with costs associated with failure potentially 3 to 4 times that of planned renovation. Category B sewers have less serious financial implications but unplanned sewer failure is still highly undesirable. The WRc risk model identifies strategically important sewers and facilitates planning of assessment and rehabilitation programs around these.

2.3.1 Repair Cost Factor

The WRc Repair Cost Factor (RCF) provides a preliminary category screening for each manhole-to-manhole segment. It is indicative of the direct costs of sewer failure, and is based on diameter, depth, and soil conditions. Tables 2.4 and 2.5 below are replicated for reference. The RCFs for the individual, derived segments are populated in the GIS “RCF” data field.

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[4] From Table 1.3.4.2. Characteristics of Urban Roads, Transportation Association of Canada Geometric Design Guide for Canadian Roads, September 1999

[5] Presented in the WRc Sewerage Rehabilitation Manual – Volume 1, 4^{th} Edition, 2001

Table 2.4: Repair Cost Factors (RCFs) for Pipe Sewers ≤900 mm Diameter[6]

Depth (m)	1.0-1.99	2.0-2.99	3.0-3.99	4.0-4.99	5.0-5.99	6.0+
Good Ground	1.0	2.0	3.0	4.0	5.5	7.0
Bad Ground	1.5	2.5	3.5	5.0	6.5	8.5
Category	C		B		A	

Table 2.5: Repair Cost Factors (RCFs) for Pipe Sewers >900 mm Diameter[7]

Depth (m)	1.0-1.99	2.0-2.99	3.0-3.99	4.0-4.99	5.0-5.99	6.0+
Good Ground	4.0	7.0	13.0	19.0	26.0	33.0
Bad Ground	5.5	9.0	16.0	24.0	31.0	40.0
Category	B	A				

2.3.2 Overall Cost Factor

The Overall Cost Factor (OCF) provides an indication of indirect, socio-economic costs of sewer failure, such as those that cause disruptions to public, pavement damage, and traffic rerouting. OCFs are derived from RCFs by overlaying traffic information (see Table 2.6). Roads are classified as either "highly important" or "marginally important", where highly important roads form part of a central integrated network or offer no clear detours or alternative routes that will not lead to further delays throughout the system. "Marginally important" routes carry at least 5,000 vehicles per day (veh/day) and have sufficient available alternate routes. For this study, freeways and arterials are again assumed highly important roads, collectors marginally important roads, and local and private roads as carrying less than 5,000 veh/day.

As indicated in Table 2.6, traffic volume has a significant impact on the OCF, as socio-economic risks increase greatly with traffic flow, particularly on "highly important" routes. The OCFs for individual sewer segments are provided in the "OCF" data field.

Table 2.6: Overall Cost Factors (OCFs) Including Traffic Delays[8]

Traffic Flow (veh/day)	Highly Important Roads	Marginally Important Roads
5,000-7,499	4.8 x RCF	1.6 x RCF
7,500-9,999	6.3 x RCF	1.9 x RCF
10,000-12,499	7.8 x RCF	2.1 x RCF
12,500-14,999	9.3 x RCF	2.4 x RCF
15,000-17,499	10.8 x RCF	2.6 x RCF
17,500-19,999	12.3 x RCF	2.9 x RCF
20,000+	13.8 x RCF	3.1 x RCF

The OCF also provides a quantitative value with which to evaluate sewer priorities at the segment level.

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[6] From Table D.3, WRc Sewerage Rehabilitation Manual – Volume 1, 4th Edition, 2001

[7] From Table D.4, WRc Sewerage Rehabilitation Manual – Volume 1, 4th Edition, 2001

[8] From Table D.5, WRc Sewerage Rehabilitation Manual – Volume 1, 4th Edition, 2001

2.3.3 Sewer Category

The WRc risk model sewer categories relate directly to the OCF as follows:

Table 2.7: Overall Cost Categories[9]

OCF	0-2.9	3.0-5.9	6.0+
Category	C	B	A

These broad categories provide guidelines for developing policy, as rehabilitation decisions should be structured around the following goals:

1. Eliminating unplanned failures in Category A sewers;
2. Minimizing number of unplanned failures of Category B sewers;
3. Establishing proactive cleaning programs in Category C sewers to minimize the impacts of unplanned failures; and
4. Optimizing scheduling of rehabilitation requirements.

[9] From Table D.5, WRc Sewerage Rehabilitation Manual – Volume 1, 4th Edition, 2001

3.0 Sewer Inventory Summary

3.1 Sewer Age, Size, and Depth

The storm sewer inventory was compiled and evaluated at segment level and summarized according to basin designations to allow review of basin-wide characteristics, and facilitate basin-level comparison and prioritization between basins.

The following table summarizes the length-weighted average sewer age, size, and depth where known, of derived manhole-to-manhole segments within each basin and sub-basin. Also presented are the percentages, based on length, of missing (i.e. unknown/unpopulated) data.

Table 3.1: Summary of Sewer Depth, Size, and Age

Basin	Total Length (m)	Average Age	Unknown Age	Average Size (mm)	Unknown Size	Average Depth (m)	Unknown Depth
I	10,547.1	31	26.2%	356	6.1%	4.09	44.5%
II	43,527.7	27	13.6%	377	5.5%	3.08	38.9%
III_A	19,297.6	27	20.5%	420	7.3%	3.15	47.8%
III_B	3,362.5	34	12.6%	461	7.2%	3.03	73.1%
III_C	4,154.1	27	24.5%	506	9.8%	4.54	64.5%
IV	61,892.6	36	20.4%	458	2.9%	3.03	32.8%
V_A	56,332.8	26	8.8%	426	3.1%	2.80	34.0%
V_B	10,853.8	34	13.7%	381	3.4%	3.05	52.3%
V_C	13,771.5	35	13.0%	393	4.8%	2.25	36.2%
VI	1,371.4	25	22.8%	548	8.6%	6.54	81.0%
Total	225,111.1						

3.2 Sewer Material

Table 3.2 summarizes the distribution of revised material types found within each basin/sub-basin area, expressed as a percentage length.

Table 3.2: Summary of Sewer Material

	Basin										Total
	I	II	III_A	III_B	III_C	IV	V_A	V_B	V_C	VI	
Length (m)	10,547.1	43,527.7	19,297.6	3,362.5	4,154.1	61,892.6	56,332.8	10,853.8	13,771.5	1,371.4	225,111.1
Asbestos Cement (AC)		0.12%									0.02%
Perforated HDPE (BIGO)									0.36%		0.02%
Cast Iron (CI)	0.49%	0.14%									0.05%
Corrugated Metal/Steel Pipe (CMP/ CSP)	2.42%	2.33%	4.61%	2.20%	16.23%	2.60%	2.21%		1.95%	1.12%	2.69%
Concrete (CONC)	18.74%	12.56%	33.35%	14.92%	6.39%	20.63%	30.76%	19.38%	11.77%	12.73%	21.61%
Ductile Iron (DI)	3.65%	2.18%	1.24%			0.30%			0.11%	0.72%	0.79%
High Density Polyethylene (HDPE)	1.04%	0.16%				0.05%					0.09%
Polyvinyl Chloride (PVC)	4.64%	3.39%	4.10%	3.88%	9.83%	3.54%	7.70%	0.14%	3.17%	0.17%	4.57%
Perforated PVC (PVC PERF)							0.30%				0.08%
Steel (ST)	1.02%	0.06%					0.05%		0.11%		0.08%
Vitrified Clay (VC)			0.33%				0.15%				0.07%
Wood		0.06%				0.19%			0.47%		0.09%
Unknown	67.99%	79.00%	56.38%	79.00%	67.54%	72.69%	58.82%	80.48%	82.06%	85.26%	69.85%

3.3 Sewer Category

Table 3.3 summarizes the percentage of sewers, based on length, falling within the three risk categories (A, B, and C) in each basin and sub-basin area. Unknown sewer category is a result of unknown depth.

Table 3.3: Summary of Sewer Categories

Basin	Length (m)	Category A	Category B	Category C	Unknown
I	10,547.1	19.5%	6.6%	27.6%	46.3%
II	43,527.7	11.6%	15.1%	33.7%	39.6%
III_A	19,297.6	15.1%	11.0%	25.3%	48.6%
III_B	3,362.5	14.0%	0.0%	12.8%	73.1%
III_C	4,154.1	19.3%	9.3%	6.3%	65.1%
IV	61,892.6	19.4%	12.2%	34.6%	33.8%
V_A	56,332.8	9.1%	21.6%	35.0%	34.3%
V_B	10,853.8	5.0%	20.9%	21.6%	52.6%
V_C	13,771.5	2.3%	17.6%	43.9%	36.2%
VI	1,371.4	13.3%	3.1%	1.6%	82.0%
Total Network	225,111.1	13.1%	15.2%	32.3%	39.4%

4.0 Sewer Ranking

4.1 Multi-Variate Selection Criteria

The same sewer ranking selection factors applied to the sanitary sewers can be used to determine storm sewer condition assessment priorities but with different rationale applied and correspondingly different weighting factors. The most prominent difference is that infiltration plays a less significant role in driving storm sewer inspection priorities as it is not a regulatory requirement. It should not be ignored totally, however, as it increased infiltration rates are associated with increases rates of physical deterioration.. The prioritization categories used for the storm sewer program were:

- average age;
- mean Overall Cost Factor (OCF);
- basin-wide infiltration levels; and
- inventory gaps in material type.

With the exception of infiltration, these factors were built up to the basin/sub-basin level from the derived segment level characteristics, as discussed in the following sections. This will ultimately facilitate drilling down within the basin/sub-basin areas to examine priorities more discretely over time.

If the District's data delineation differentiated between culverts and other open channel drainage infrastructure versus closed conduit storm sewers, we would also recommend the addition of public safety as a selection criterion. Culverts and open channel drainage infrastructure pose a considerably greater risk to the public from a safety perspective and warrant more rigorous inspection frequencies and clearer inventory documentation. As the data set does not currently support this level of delineation at this time, safety could not reasonably be added to the prioritization criteria.

4.2 Scoring Factors

4.2.1 Average Age

Age is a key driving criterion as previous study has indicated that sewer deterioration is ultimately impacted by age. For each basin/sub-basin, the average length-weighted age is calculated from all manhole-to-manhole segments of known age within each area (see Table 3.1). A baseline age of 100 years (typical design life) is used to compare relative ages.

4.2.2 Mean Overall Cost Factor

The OCF is also a key driving criterion as it provides an indication of socio-economic and financial risk. The mean OCF for each basin/sub-basin is a length-weighted OCF calculated from all sewer segments of known depth within each area. For scoring purposes these are indexed against a value of 6, which marks the transition from Category B to Category A sewers, where Category A represents the highest socio-economic risk.

4.2.3 Basin-Wide Infiltration

Although infiltration is not the primary driving factor in storm sewers, it cannot be completely disregarded as excessive infiltration accelerates the sewer deterioration process. Previous sanitary sewer inflow and infiltration (I&I) studies have identified high infiltration levels in the Ambleside (Basin IV) and British

Properties (Sub-Basin V_A) areas. With no available quantitative flow values, three general infiltration levels were established in the previous sanitary sewer study based on assumed degree of sanitary sewer regulatory[10] compliance:

Table 4.1: Basin-wide Infiltration Levels

Level	Significance	Value
low	general regulatory compliance	1
medium	1 – 2x regulatory requirement	2
high	> 2x regulatory requirement	3

These same levels are used for this current assessment, though values could be refined as more information is collected for the sanitary sewers, and indexed to the regulatory baseline value. Presently, a baseline value of 2, marking the transition between regulatory compliance and non-compliance, is used for scoring.

4.2.4 Inventory Gaps – Unknown Material

As previously noted, a significant portion of material information is missing. Unknown material type impairs the District's ability to extrapolate condition information from known inventory to the remaining inventory. Given the large inventory gaps, this factor is included as a criterion as it is also a by-product of CCTV inspection programs. For scoring purposes the percentage of unknown material within each basin/sub-basin area is indexed against the optimum value of 100% known material type.

4.3 Basin/Sub-basin Prioritization

The four criteria driving District storm sewer program priorities are benchmarked against the baseline values discussed in the previous sections to provide a means of comparing these factors on a common level. With the exception of the infiltration requirement, the GVRD's LWMP asset management objectives still apply to storm sewer infrastructure:

- ongoing evaluation programs to assess condition (over a 20 year cycle); and
- maintenance and repair to avoid deferring rehabilitation costs.

The multi-variate proportional weight model differs for the storm sewers in a proportionate weighting shift away from the infiltration selection criterion. The significance of material inventory gaps in the overall priority remains unchanged and carries a smaller proportional weight to the other three criteria given that other means of acquiring this data exist. Where equal proportional weights were previously assigned to average age, mean OCF, and basin-wide infiltration characteristics for the sanitary sewer risk model, the remaining weighting is currently distributed between deterioration-related criteria (average age and basin-wide infiltration characteristics) and risk (mean OCF), with the infiltration weight significantly reduced.

Table 4.2 presents the four selection criteria, their proportionate weight in the ranking score, the baseline values, and the final ranking score and priority for each basin and sub-basin. The ranking score is derived from the sum product of the proportionate weight, and each selection criteria value divided by the respective baseline value. It also provides associated sewer inspection costs per basin/sub-basin, based on an estimate of $5/m for contracted sewer cleaning and CCTV inspection in accordance with WRc methodology.

[10] Based on the Greater Vancouver Regional District's (GVRD) Liquid Waste Management Plan requirement of 11,200 lphpd.

Table 4.2: Overall Cost Factors (OCFs) Including Traffic Delays

Basin	Average Age	Mean OCF	Basin-Wide Infiltration	Inventory Gaps (unknown material)	Ranking Score	Basin Priority	Total Length (m)	Inspection Costs ($5/m)
Proportionate Weight	**40%**	**45%**	**5%**	**10%**				
Baseline Value	**100**	**6**	**2**	**100%**				
I	30.6	7.77	1	68.0%	79.8	6	10,547.1	$52,700
II	27.1	6.77	1	79.0%	72.0	8	43,527.7	$217,600
III_A	26.8	14.69	1	56.4%	129.0	2	19,297.6	$96,500
III_B	33.8	7.07	1	79.0%	77.0	7	3,362.5	$16,800
III_C	27.2	52.83	1	67.5%	416.4	1	4,154.1	$20,800
IV	35.9	13.15	2	72.7%	125.3	3	61,892.6	$309,500
V_A	26.1	8.22	2	58.8%	83.0	5	56,332.8	$281,700
V_B	34.3	3.22	2	80.5%	50.9	9	10,853.8	$54,300
V_C	34.5	2.74	2	82.1%	47.6	10	13,771.5	$68,900
VI	24.8	12.37	1	85.3%	113.7	4	1,371.4	$6,900
Total							**225,111.1**	**$1,125,600**

The highest level priority is Sub-Basin III_C, followed by Sub-Basin III_A, and Basin IV. The risk criterion (mean OCF) is driving priorities in these areas. In Sub-Basins III_C and III_A, segment level depth and traffic factors are primarily responsible for high mean OCF values, while Basin IV is influenced by "bad" soils.

By investing this $1.1 million in storm sewer condition assessment, a potential savings in replacement costs of approximately $94.5 million can be achieved by intervening at the appropriate time in the sewer's deterioration cycle. Assuming a 4% discount rate, this represents a net present value (NPV) of potential savings that can be attributed to the inspection program that ranges from approximately $43 million to $78 million (see Table 4.3 below) dependent on the actual rate of deterioration and the time frame that rehabilitation is actually scheduled over.

Table 4.3: NPV of Potential Savings

Total Savings	Discount Rate	Time Period (yrs)	Discounted Savings
$94,561,155	4.00%	5	$77,722,376
	4.00%	10	$63,882,128
	4.00%	15	$52,506,453
	4.00%	20	$43,156,477

5.0 Multi-Year Condition Assessment Program Requirements

The following sections discuss the rationale for establishing the magnitude of an annual storm sewer condition assessment program.

5.1 Condition Assessment Program Requirements

While the LWMP does not apply to storm sewers, as previously noted the asset management principles of cyclical condition assessment programs and planned maintenance and rehabilitation do. For sanitary sewers the LWMP recommends a 20-year program, which for the District's storm sewer network equates to annual inspection and condition assessment costs of approximately $56,500 (discounting inflation).

Given that virtually no storm sewer condition data currently exists, this timeframe is not ideal for addressing the short-term requirement of establishing baseline condition, which in turn will dictate the pace of the future program. A 20 year program may also lead to a serious backlog of rehabilitation work if structural and service-related defects are not identified and addressed at an opportune time in the sewer deterioration cycle. Establishing baseline condition enables:

- systematic identification of required rehabilitation requirements to meet structural and service condition performance objectives;
- implementation of other infrastructure programs affected by sewer condition such as future street maintenance and rehabilitation programs; and
- establishment of the sustainable funding level required to meet structural and service condition performance objectives through the development of preliminary deterioration curves and a sustainable funding framework.

In the short-term, sewer inspection will likely have to be integrated with sewer cleaning in order to obtain reliable physical condition data. In the longer term sewer cleaning and sewer inspection typically evolve into two distinctly unique programs with different frequencies and focussing on different aspects of the sewer infrastructure, as outlined below.

1. Sewer cleaning is a required maintenance function for all sewer infrastructure. The frequency of sewer cleaning will largely be determined by experience and in storm sewer infrastructure be driven by other maintenance programs such as street cleaning frequency and catch basin cleaning. The required frequency will be somewhat independent of sewer condition and typically is required over a much shorter cycle than sewer inspection, if sewers are in good structural condition. Best practices to establish sewer cleaning frequencies typically range from 5 to 8 year cleaning cycles.

2. Sewer inspection in the long-term is a program that will be most focussed on the critical sewer network, but at lower frequencies, also directed at the lower risk areas of the sewer network as there are considerable benefits that can be achieved by proactively addressing sewer deterioration in these areas as well.

The long-term inspection requirements for the storm sewer system will be based on a balance of the concept of *collapse risk management* in the critical sewer network and optimizing reduced rehabilitation costs associated with early lifecycle repairs in the entire sewer network. The required frequency for re-inspection of individual sewer reaches will be a function of observed sewer condition during initial screening (both structural and service-related condition), the probability of collapse, and the ramifications of failure should a collapse occur.

5.2 Monitoring of Sewer Condition

Although some inspection programs focus entirely on the critical sewer network with minimal monitoring of Category C sewers via routine sewer cleaning, maintenance history, and limited inspections, studies[11] on rehabilitation cost versus condition state in Winnipeg, MB and Hamilton, ON suggest there is considerable merit in carrying out systematic physical condition assessment of the entire inventory based on the reduced cost of rehabilitation at earlier stages in the deterioration cycle.

Long-term monitoring of sewer condition in critical sewers is necessary to ensure that unanticipated failure does not occur in areas that would compromise public safety, that level of service objectives are maintained, and that future repairs can be scheduled at the most cost effective point in the sewer's deterioration cycle. Determining the re-inspection frequency required to meet these objectives allows the determination of the necessary annual funding level for inspection of the sewer network. We call this funding level the *sustainable annual inspection cost.*

The *sustainable annual inspection cost* for the system can be defined as the level of annual inspection work that must be carried out to meet the stated performance objectives for structural condition. Based on deterioration and risk models in the U.K.[12], the structural performance objective for sewer infrastructure is to rehabilitate all critical sewers with SPG's of 3 or higher (i.e. maintain the critical sewer network condition at SPG 2). The following criteria are commonly applied to determine when sewer infrastructure is considered for rehabilitation, based purely on structural deterioration and risk considerations:

- Category A sewers at SPG 3;
- Category B sewers in transition from 3 to 4; and
- Category C sewer at SPG 5.

This ensures that no unanticipated failure occurs in critical areas of the District and that rehabilitation can be continuously scheduled at the optimum point in the deterioration cycle. As a starting point this will be used as a basis for determining the optimum mode of managing the storm sewer infrastructure asset.

This *sustainable annual inspection cost* will be of function of:

- the characteristics of the overall sewer network in terms of the split between Category A, B, and C sewers; and
- the average condition of the sewer infrastructure at any point in time.

The optimum value for the *sustainable annual inspection* funding level will only be able to be determined based on considerable experience. Initially, however, reasonable assumptions can be made for balancing re-inspection frequencies versus risk based on the experience of others.

The recommended re-inspection frequencies provided for the previous sanitary sewer study are also applicable to the storm sewer infrastructure (see Table 5.1). These are based on WRc recommendations

[11] Macey, Bainbridge, et al "The Development of Advanced Asset Deterioration Models and Their Role in Making Better Rehabilitation Decisions", No-Dig 2005, Orlando, Florida, April 2005

[12] Water Research Centre (WRc), "Sewerage Rehabilitation Manual, Second Edition", January, 1990.

for Category A and B sewers at various condition states (Structural Performance Grade values), and best practices aimed at minimizing both risk and rehabilitation cost for the entire inventory.

Table 5.1: Recommended Re-inspection Frequencies for West Vancouver

Final Structural Performance Grade	Category A Sewers	Category B Sewers	Category C Sewers
5	N/A	N/A	1 year
4	-*	5 years	7 years
3	3 years	15 years	20 years
2	5 years	20 years	25 years
1	10 years	20 years	30 years

**Where rehabilitation is not planned in the immediate future sewer condition should be monitored frequently to prevent unanticipated failure.*

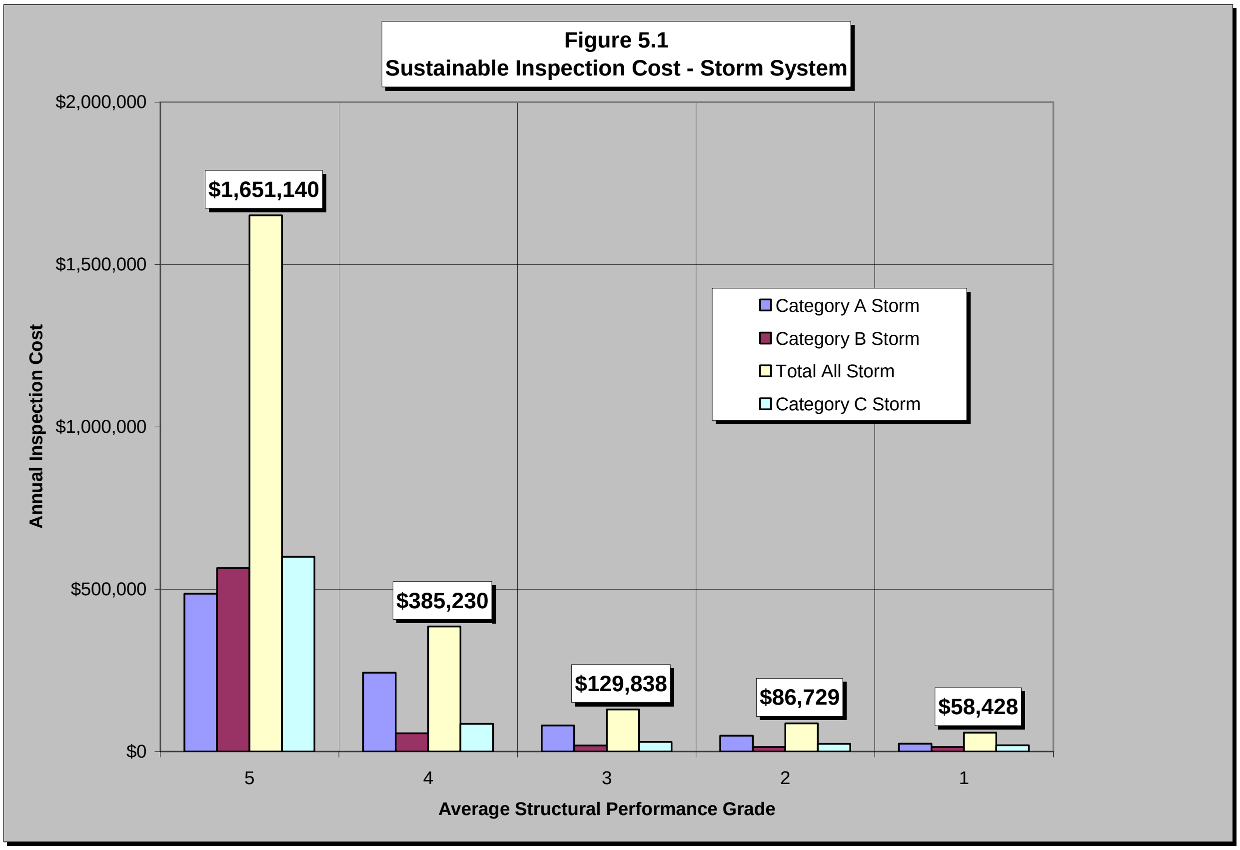
5.3 Cost of Monitoring Required to Meet Performance Objectives

The annual sustainable sewer inspection funding level at each condition state can be determined directly from the above recommended re-inspection frequencies. To represent the entire network, all sewers must first be assigned a risk category. The percentages by length of known Category A, B, and C sewers were applied to the total inventory length to assign categories to sewers with currently unknown classification. Thus, the entire inventory falls within one of three categories as follows:

Table 5.2: Estimated Inventory of Sewer by Flow Type
Based on Redistributed Length of Unknown Sewer Classification

	Length (m) and Category of Sewer		
Flow Type	**A**	**B**	**C**
Stormwater	48,601	56,516	119,994
% of o/all Total	21.59%	25.11%	53.30%

The sustainable annual cost was then calculated by multiplying the sewer length in each category by the average inspection cost ($5/m), and dividing by the corresponding re-inspection frequency. For illustrative purposes, sewers with a SPG of 5 are assumed to have a required re-inspection frequency of 0.5 years. Figure 5.1 summarizes the calculated sustainable cost for annual sewer inspection as a function of average SPG for all storm sewer inventory.



Using this model the rate of inspection priorities in the long-term would largely be driven by the observed physical condition of the inspected sewer network. While it does provide a reasonable framework for rationalizing the annual program size based on the inspected physical condition and observed deterioration patterns, it would be prudent to rationalize what level of deterioration may be present based upon the lack of an annual capital upgrading program to date and the rates of deterioration observed by others.

5.4 Estimate of Condition State of the Current Inventory

UMA has developed deterioration rate models for both Winnipeg, MB and Hamilton, ON based upon the inspection of over 1500 km of sewer infrastructure. These observations have been analysed and developed into a series of simple Markov chain deterioration models that are reflective of the average rate of condition state change that the inventory is likely to experience on an annual basis. Refer to our previous report[1] for details on the theory of the Markov model.

For sewer infrastructure, the Markov model is used to simulate the change in condition state over time for an initial distribution of sewers in various condition states. The advantage of the Markov system is that a very simple model can represent the complex behaviour of a system without the need to understand what's driving the system, only the need to see if the system is behaving in a statistically relevant manner. The Markov matrix used to represent sewer deterioration is straightforward; after any given time step, a sewer can either remain in its current state, or degrade to the next lower state.

By definition, a sewer cannot miss a step in the degradation process, so a sewer could never degrade from SPG 1 to SPG 3 without going through SPG 2. In reality, catastrophic failure such as an earthquake or soil collapse can occur that would change condition state instantaneously. These sudden, random failures cannot be simulated by the Markov model, which assumes that the system changes over time based according to fixed probabilities. Fortunately, in real life these failures represent a very small portion of a much larger data set.

While UMA has developed discrete Markov models around a number of sewer parameters (e.g. pipe material, pipe size, etc.) it is not known how relevant these matrices are to the local data set. For simplicity, therefore, the best fit average condition state transition matrix was used based on the City of Winnipeg data set, which includes observations from over 1000 km of sewer infrastructure. This matrix, depicted in Table 5.3 below, was also applied to the sanitary sewers.

Table 5.3 - Best-Fit Markov Model for Sewer Deterioration (City of Winnipeg data set)

		To				
		SPG 1	SPG2	SPG 3	SPG 4	SPG 5
From	SPG 1	96.3%	3.7%	0.0%	0.0%	0.0%
	SPG 2	0.0%	96.1%	3.9%	0.0%	0.0%
	SPG 3	0.0%	0.0%	97.5%	2.5%	0.0%
	SPG 4	0.0%	0.0%	0.0%	97.0%	3.0%
	SPG 5	0.0%	0.0%	0.0%	0.0%	100.0%

The two percentages in each condition state above represent the percentage of inventory that would be expected to remain in its current condition state and the percentage that would be expected to transition to the next condition state.

Utilizing the above deterioration rates, the current average condition of existing storm sewers within each basin/sub-basin was estimated based on its average age and the assumption that 80% of the new inventory was at SPG 1 when constructed and 20% was at SPG 2. This split is typical of infrastructure that is brought into inventory with CCTV inspection at Final Acceptance (e.g. an inspection carried out 1-2 years after installation).

The results of the analysis for each basin/sub-basin are summarized in Table 5.4 below.

Table 5.4 Estimate of Current Average Condition State for Each Basin

Basin	Assumed Initial condition	Estimated Average Condition	% Change
I	1.20	2.30	-91.60%
II	1.20	2.17	-80.57%
III_A	1.20	2.17	-80.57%
III_B	1.20	2.40	-99.69%
III_C	1.20	2.17	-80.57%
IV	1.20	2.46	-105.00%
V_A	1.20	2.13	-77.77%
V_B	1.20	2.40	-99.69%
V_C	1.20	2.43	-102.35%
VI	1.20	2.10	-74.95%
Length-Weighted Average		**2.28**	

These results indicate that current average condition states range from a low of 2.10 in Basin VI to a high of 2.46 in Basin IV, with a length-weighted average of 2.28. An interpolation between condition states 2 and 3 on Figure 5.1 gives a sustainable annual inspection cost of approximately $89,000 for the overall system.

While this amount represents a reasonable estimate of what level of annual investment in inspection should initially be made, it should be used with a great deal of caution, as ultimately these requirements should be refined based on the initial results of inspection.

It should also be noted that there is likely a substantial backlog of repairs that would benefit the development of optimum rehabilitation scheduling. These repairs cannot currently be scheduled or prioritized due to a lack of current condition assessment data. It would be prudent, therefore, to ensure that condition assessment data is accumulated more aggressively as opposed to less aggressively over the short-term until a realistic assessment can be made of the current backlog, and the financial ramifications associated with leaving it unaddressed can be reasonably quantified.

The increased exposure of the public to culverts and open channel drainage infrastructure means that public safety should also be ultimately considered in rationalizing overall priorities. The condition assessment program should ultimately recognize this and ensure that safety considerations as well as economic considerations play a role in determining priorities. To facilitate this it is recommended that the District address this subtle delineation of drainage inventory within its data set so that overall priorities can be rationally assessed with due consideration to safety.

Appendix C – Weibull Distribution

To simulate the reality that not all pipes with an expected service life of 90 years will fail at exactly 90 years, the Weibull Distribution was used to model a replacement envelope and predict pipe failure as the network ages. The Weibull Distribution, which has a broad range of applications, is used in this case to distribute the probability of assets to fail over time and associates this probability with a cost. This statistical tool does not predict when each individual asset will fail but it accurately describes how a large inventory of similar assets (e.g. pipes) actually behaves in real life.

Another advantage of Weibull Distribution is that it provides a simple and informative graphical plot. X axis is a measure of time in calendar years and Y axis is either the annual length to be replaced or the annual cost of replacement anticipated for each year.

It is important to note that Weibull Distribution's reliability depends entirely on the accuracy of parameters used in the calculation. In this analysis, these parameters are:

- installation year;
- expected service life; and
- shape parameter.

While the installation year is defined (or estimated), both the expected service life and the shape parameter are estimated. Pipe materials' expected service lives are described in Section 6. The shape parameter, or β, which is unitless and dimensionless, is also known as the slope. This is because the value of β is equal to the slope of the regressed line in a probability plot. In other words, it indicates whether the failure rate is increasing, constant or decreasing. A $\beta < 1.0$ indicates that the asset has a decreasing failure rate. A $\beta = 1.0$ indicates a constant failure rate and a $\beta > 1.0$ indicates an increasing failure rate which is typical of assets that are wearing out like pipes. Based on research papers and actual field observations, it is generally agreed that for a pipe inventory, an accurate value for β is between 7.0 and 8.0.

Please note that all Weibull calculation sheets and charts produced with MS Excel for the purpose of this study are dynamic. This allows users to change most variables, including the shape parameter and expected service lives, and see in real-time the effects of these changes on the charts. With time, as more failure data becomes available, the shape parameter can be refined to fit the District's own failure rate. Eventually this will lead to more accurate results.

Appendix D – Culverts and Grates in Poor Condition

CULVERTS

	Culvert #	Class	Location	Catchment Area	2009 replacement value
1	SC8*	3.11	136 27th St	Caulfeild / Cypress Park	$50,875
2	SC14	3.11	5775 Cranley Dr	Ambleside	$50,875
3	SC47	2.12	3995 Bayridge Ave	Bayridge	$73,639
4	SC99	3.11	Foot of 24th @ Ocean	Dundarave	$50,875
5	SC118	2.11	Foot of 15th St, Millennium Clock @ Beach (E of SC#117)	Ambleside	$65,168
6	SC162	1.11	1127 Millstream Rd	Upper BP's / Glenmore	$50,875
7	SC176	1.11	1091 Groveland Rd	Upper BP's / Glenmore	$50,875
8	WW3	2.11	4717 Caulfield Drive	Willow Creek	$65,168
9	WW4	2.21	4734 Rutland Road	Willow Creek	$148,508
10	TNR4	3.22	3680 Cedaridge Place – 3660 Westmount Road	Turner Creek	$167,814
11	TNR10	3.11	South of Works Yard, Cypress Bowl Road (outlet only)	Turner Creek	$50,875
12	MR5	2.32	2484 Ottawa Ave - 2508 Nelson Ave	Marr Creek	$167,814

* culvert with unknown class (unit replacement cost assumed to be $120,256)

$993,363

GRATES

	Culvert #	Class	Location	Catchment Area	2009 replacement value
1	SC81	screen	3870 Westridge Ave	Bayridge	$5,000
2	SC193	screen	1387 Fulton Ave	Ambleside	$5,000
3	SC147	screen	1125 Mathers Ave	Ambleside	$5,000
4	SC158	screen	1167- E of 1161 Eyremount Dr	Panorama / Canterbury	$5,000
5	SC234	trash rack	441 Southborough Drive	Upper BP's / Glenmore	$30,000

$50,000