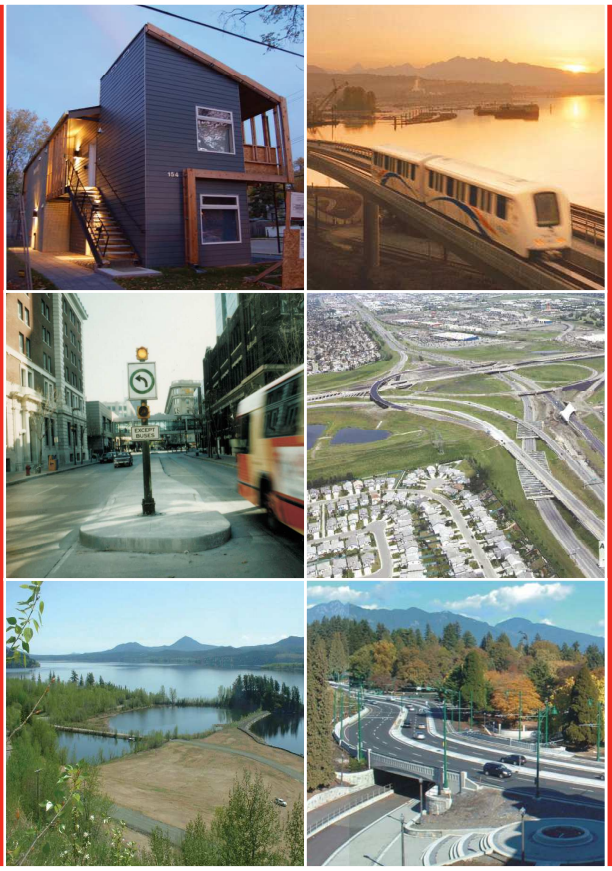
MMM Group Limited



Willowbrook Water System Assessment

Prepared for: Regional District of Okanagan-Similkameen

5114034-000

COMMUNITIES

TRANSPORTATION

BUILDINGS

INFRASTRUCTURE

MMM GROUP

March 2015

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STANDARD LIMITATIONS

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1.0 EXECUTIVE SUMMARY

1.1 Background

MMM Group Limited (MMM) has been retained by the Regional District of Okanagan-Similkameen (RDOS) to prepare an assessment of the existing potable water distribution system for the unincorporated area of Willowbrook, British Columbia. The water system is currently owned and operated by Willowbrook Utilities Limited, who has requested that the RDOS take over the utility. The first step in this process is to undertake a review of the water utility. The objective of this report is to provide a strategic short and long-term planning tool for identifying and implementing water system improvements.

The assessment analyzes the current deficiencies in the water system, and provides recommendations for infrastructure upgrades. The report also contains a financial review, which addresses the utility's ownership, revenue and expenditures, in order to ensure a financially stable utility. The financial review includes a rate structure analysis, which compares various funding scenarios and a recommended rate structure.

In this respect, the financial plan can be thought of as a phased planning approach with Phase I being the current short-term capital improvement plan (0-5 year system needs) and Phase II encompassing longer (5-20 year) planning horizons.

1.2 Existing System

The area of Willowbrook is located within Electoral Area 'C' of the RDOS between Oliver and Okanagan Falls. The Willowbrook water system provides drinking water and fire protection services to approximately 80 lots and 180 residents in the community. Water supply is provided to the system from a well in the centre of the subdivision located in an easement on a residential property. From the well, water is pumped into the distribution system and up to an underground reservoir. The reservoir then feeds water by gravity back into the distribution system. In general, it is expected that the existing system is in good condition. This is based on the age and quality of material installed and the limited number of repairs that have been require. However, certain components of the system are undersized and/or lacking. As such, it is evident that the system is in need of upgrades to bring it up to current standards.

Currently, the infrastructure of the Willowbrook water system is not owned by any level of government. The system is operated and maintained by Willowbrook Utilities Limited and funded by utility fees that are collected from the water users of Willowbrook. The intention of the proposed financial plan and ownership model is to treat the Willowbrook system as a fully independent utility, which is to be fully reliant upon generating its own revenues to offset expenditures.

1.3 Recommendations

Based upon our review and analysis of the Willowbrook Water System, MMM recommends that:

- An adequate level of asset management be employed now and in the future to ensure that the Willowbrook water system is operating in a sustainable manner;
- The RDOS take ownership of the Willowbrook water system;
- Infrastructure upgrades to the existing system be performed as outlined in this report. These upgrades include the following:
    - Installation of a second well and pump;
    - Installation of a backup generator at the pump house;
    - Implementation of wellhead protection;
    - Installation of additional isolation valves;
    - Installation of a second reservoir;
    - Watermain looping at the southwest end of the system;
    - Replacement/twinning of the 150 mm watermain on Green Lake Road; and
    - Installation of a supervisory control and data acquisition (SCADA) system

  Costs and timing of the upgrades are further discussed in the report;
- The RDOS undertake a study to assess the capacity of the source aquifer;
- The RDOS consider instituting water metering;
- The RDOS continue to closely monitor water quality and consider treatment;
- A revised rate structure be employed to ensure that the residents of Willowbrook are wholly funding the Operations and Maintenance (O&M) of the Willowbrook system and contributing to capital improvements. A recommended rate structure is included in the report; and
- The RDOS seek out senior government grant funding opportunities so that improvements can be completed with less financial impact to the Willowbrook rate payers.

2.0 INTRODUCTION

The Regional District of Okanagan-Similkameen (RDOS) retained MMM to prepare a water system assessment to analyze the operation of the Willowbrook water utility. The intention of the report is to ensure a financially sustainable water utility that provides an acceptable level of service to its customers. The subsequent sections of this report provide the following:

- A description of the existing water distribution system;
- An analysis of the system as it relates to current servicing levels;
- Recommendations for infrastructure upgrades;
- A review of historical revenue and expenditure for the water utility;
- An analysis of the ownership model for the water utility; and
- An analysis of the funding of future O&M and capital improvements.

2.1 Asset Management

The operation and maintenance (O&M) of infrastructure is generally the responsibility of the local government that maintains ownership. The costs associated with this are primarily funded by utility fees and/or taxes. In the case of the Willowbrook water system, the infrastructure is not owned by a local government and is operated and maintained by Willowbrook Utilities Limited and funded by utility fees from the residents of Willowbrook. The owner of Willowbrook Utilities has requested that the RDOS consider assuming ownership and operations of the water system.

The concept of asset management, as it relates to municipal infrastructure, is a balance between providing an acceptable level of service while minimizing financial implications. This involves:

- The analysis of existing infrastructure as it relates to current and future servicing demands;
- The comparison of long term maintenance costs of ageing infrastructure versus the costs for replacement. At a certain point, the cost of ongoing maintenance will out-pace the replacement costs; and
- The balancing of revenues and expenditures for the system.

Based on our review and understanding of the existing Willowbrook water system, it is evident that the majority of the infrastructure is adequately sized and generally in good condition for its age based on industry standards. However, we do expect that replacements and/or upgrades will be required in the near future. The costs, timing, and funding of this work is discussed further in this report.

3.0 EXISTING WATER SYSTEM

3.1 System Overview

The area of Willowbrook is located in Electoral Area 'C' of the RDOS between Oliver and Okanagan Falls. The existing water distribution network provides potable water to approximately 80 lots and 180 residents within the unincorporated area of Willowbrook. It also provides water service for irrigation purposes as well as fire protection for the subdivision. The system is operated by Willowbrook Utilities under the Interior Health Permit to Operate, Facility Number 13-105-00073. The system is fed by a well which pumps water through the distribution system to a storage reservoir. The reservoir then feeds water by gravity back into the distribution system. Please refer to Figure 1 for a schematic of the existing water system. The system was initiated in 1972 and based on the materials installed and minimal breaks or repairs required it is expected to generally be in good condition.

3.2 Water Supply

The water supply for Willowbrook originates from a well in the centre of the subdivision located in an easement on a residential property. The well was originally constructed and commissioned in 1972, consisting of a 15 hp pump located in an 8" (200 mm) well. At this time, a small pump house building was constructed to house the electrical, mechanical and diagnostic components. In 2005 a new 12" well was constructed and a 25 hp pump was installed to improve the capacity of the supply. The existing well was decommissioned and the pump removed. A computer system was installed but has since been removed. There is no backup power available at the pump house in the event of an emergency or outage.

There is no information regarding the capacity of the source aquifer, however the pump is reported to have a capacity of 222 US gpm (14.0 L/s). There is also no information available regarding historical water consumption as there are no meters at the point of supply or point of use. However, there is a flow meter in the pump house, which records instantaneous pump flows only. It should be noted that MOE monitoring wells in the area have identified a lowering of the water table and drying up surface water supplies.

Photos from left to right: Pumphouse building (exterior), Pumphouse building (interior)

The system currently does not have any means of water treatment in place. However, water samples are routinely taken and analysis indicates that the water is generally in conformance with the Guidelines for Canadian Drinking Water Quality (GCDWQ). Nonetheless, based on investigations by Interior Health and Summit Environmental, it is understood that the well may be considered groundwater at risk due to close proximity to agricultural lands use and lack of wellhead protection.

3.3 Water Storage

Water from the well is pumped into the distribution network and up to an underground concrete storage reservoir. There is no dedicated supply line from the well to the reservoir. The reservoir was constructed in 1972 and is estimated to have a storage capacity of 106 m^3 (28,000 US Gallons). Storage at the reservoir serves to balance the fluctuations in demands to allow for reasonable cycling of the pump, and also provides fire flow and emergency storage. Water is fed from the reservoir by gravity back into the distribution system and to the ultimate end user. Based on discussions with the system operator, the reservoir is in good shape with no known structural or leakage issues and was clean when last inspected. However, it is understood that the reservoir could benefit from improved water turnover and circulation and the existing access hatch may require improvements including an intrusion alarm.

Photo: Reservoir access hatch.

3.4 Water Distribution

The transmission and distribution system for WIllowbrook consists of approximately 4,530 m of watermains. The watermains within the system are 150-200 mm (6-8”) PVC pipes installed in 1972. From the pump house a 200 mm diameter watermain extends east along Carr Crescent and north along Johnson Crescent to the intersection at Green Lake Road. The remainders of the watermains in the system, including the feed to the reservoir, are 150 mm diameter pipes. The system is composed primarily of dead-end mains, with internal looping only in the Carr Crescent area. Table 3.1 summarizes the breakdown of pipe size throughout the system.

Table 3.1 – Water Distribution System Statistics

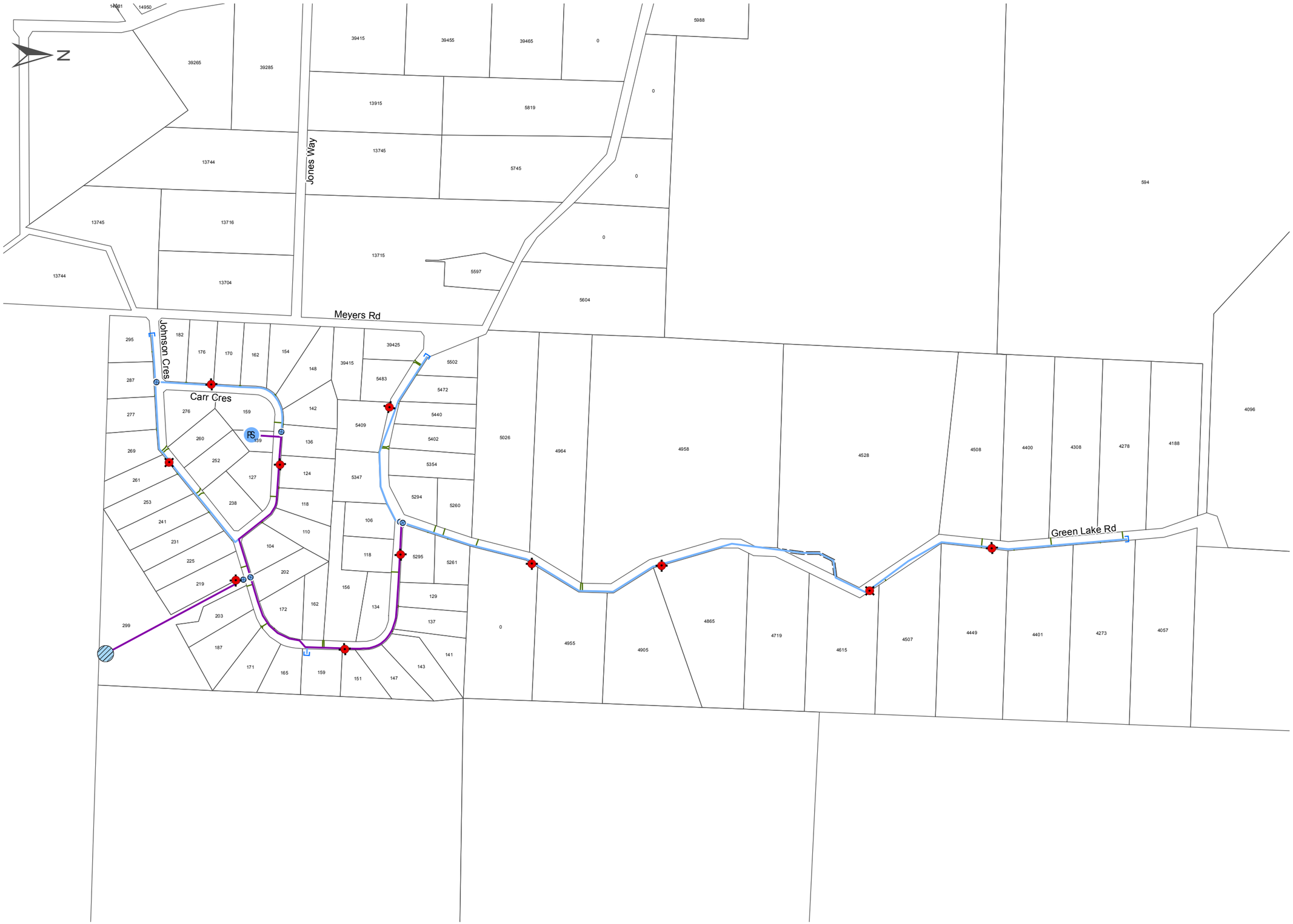
Size (mm)	Length (m)	Percent
150	3,090	68%
200	1,440	32%
Total	**4,530**	**100%**

As noted above, the existing system is comprised of 150-200 mm diameter watermains, installed in 1972 These pipes are generally large enough to supply all domestic demands and provide fire protection for residential areas. Furthermore, the generally accepted life expectancy of a water distribution system is in the range of 60 years; however, different materials and components will have varying expectancies. For the purposes of this report, it has been assumed that the PVC pipes will have a life expectancy of 75 years, based on the Water Comptrollers 'Standard Depreciation Rates for Private Water Utilities in British Columbia'. As such, the PVC watermains in the system are expected to last at least another 30 years and are not a source of concern.

3.5 System Monitoring and Communication

Based on discussions with system operator, the water system has minimal meters and alarms and no central communications system. There is a hard-wired connection between the well and the reservoir to activate the pump when the water level gets low. As noted above, there is a flow meter in the pump house, which records instantaneous pump flows only.

Photos from left to right: Pump and flow meter, System power and controls.



Legend

- Valve
- Hydrant
- End Cap
- Well and Pump House
- Reservoir

Watermain

- 150mm Dia
- 200mm Dia
- Water Service

0 75 150 300

Meters

1:8,000

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RDOS REGIONAL DISTRICT OKANAGAN-SIMILKAMEEN

Willowbrook Water System

System Assessment

EXISTING SYSTEM

project no.	figure
5114-034-000	1
date: 2014-11-14	

P:\51 - BC (Interior)\5114\034-000_Willowbrook Water System Assessment\500 - Production\520 - Drawings\522 - Base\Willowbrook_WaterSystem_Figure 1 - Existing System.mxd, 2014-11-14, 10:00:18 AM, bathi

4.0 HYDRAULIC ANALYSIS

4.1 Evaluation Criteria

In our review of the system hydraulics, we have utilized the following design criteria from the RDOS Subdivision Servicing Bylaw No. 2000, 2002:

- Domestic Design Flows
  - Maximum Daily Domestic Flow: 8,000 L/single family unit/day
  - Peak Hour Domestic Flow: 13,600 L/single family unit/day
- Fire Flow Requirements:
  - Single and Two Family Residential: 60 L/s for 1.5 hour duration
  - Multi-family Residential: 150 L/s for 2 hour duration
  - Commercial: 260 L/s for 3.5 hour duration
  - Industrial: 230 L/s for 3.0 hour duration
  - Institutional: 85 L/s for 1.8 hour duration
- Pressure Ranges:
  - Maximum Pressure: 620 kPa (90 psi)
  - Minimum Residual Pressure under peak hour demand: 265 kPa (40 psi)
  - Minimum Residual Pressure under fire flow conditions: 140 kPa (20 psi)
- Minimum Pipe Sizes:
  - Residential: 150mm (200 mm for long dead ends with multiple hydrants)
  - Commercial/Industrial/Institutional: 200 mm
- Hydrant Spacing:
  - Residential: 250 m
  - High density residential, Commercial, Industrial: 150 m
- Valving:
  - Minimum 3 valves at cross intersections
  - Minimum 2 valves at tee intersections
  - Maximum spacing of 240m for single family residential
  - Maximum of 1 hydrant isolated

4.2 Water Usage

The Willowbrook system services approximately 80 lots. Based on the domestic design flows identified above, the theoretical water demands for Willowbrook are as follows:

- Maximum Daily Flow: 640 m^3/day (7.4 L/s)
- Peak Hourly Flow: 1,088 m^3/hour (12.6 L/s)

There is currently no means of metering the amount of water that is supplied to the Willowbrook system. Metering is a good way of determining usage and leakage, as well as encouraging conservation. Population growth in the Willowbrook area is assumed to be insignificant. As such, water usage should remain relatively constant in the future.

4.3 Supply Capacity

In order to ensure redundancy of water supply, the supply system should generally be sized to be able to meet maximum day demands with the largest supply component out of commission. As noted in Section 3.2, the well pump has a capacity of 14.0 L/s which is sufficient for the estimated maximum day demand of 7.4 L/s identified in Section 4.2. However, the fact that the well has only one pump with no backup power results in a supply system that lacks redundancy.

4.4 Storage Capacity

Typically reservoirs for water distribution systems are sized to provide storage for daily use and emergency situations. The minimum storage requirement should be determined using the following formula:

Total Storage Required = A + B + C

Where: A = Fire Storage
B = Equalization Storage (25% of MDD)
C = Emergency Storage (25% of A + B)

Using this formula along with the MDD and fire flows established previously, the storage requirements for Willowbrook have been calculated and are presented in the table below.

Storage Component	Storage Requirement	Storage Volume (m^3)
A. Fire Storage	60 L/s for 1.5 hours*	324
B. Equalization Storage	25% of MDD	160
C. Emergency Storage	25% of A+B	121
	Total Storage Required:	605
	Total Storage Available:	106

*Fire Storage is for the highest land use requirement (single family residential)

As such, it is expected that the current reservoir does not have sufficient capacity for the current water demands. Effectively, the reservoir has a volume equivalent to 4 hours of the maximum day demand or 0.5 hours of fire flow. Generally, storage requirements can be reduced if the system has uninterrupted supply water provided by pump redundancy and available backup power

4.5 Distribution

As noted previously, 150-200 mm diameter watermains are typically large enough to supply all domestic demands and provide fire protection for low-density residential areas. However, there are some long 150mm dead-ends (most notably north on Green Lake Road) that may not be sufficient to supply the required flows while maintaining sufficient residual pressure. As per the RDOS Subdivision Servicing Bylaw, longer dead ends with multiple hydrants should be upsized to a minimum of 200mm diameter and looping should be considered where possible.

Another source of concern with the distribution system is the lack of isolation valves. Per the RDOS Subdivision Servicing Bylaw, a minimum of two valves are required at watermain tees and three valves at crosses. This allows for the isolation of shorter sections of watermain in the event of a shutdown for maintenance or repairs and thus disruption to fewer users. Furthermore, it is also generally required that valves are space no more than 240m apart and that no more than two hydrants are taken out of service in the event of a shutdown. In the case of WIllowbrook, there are several watermain tees that only have one valve, or no valves at all. There are also several areas where a shutdown would require several hydrants being taken out of service. As such, the operation of the system could benefit from additional valves; however the some of the issues are unavoidable due to the long dead end-mains.

4.6 Fire Protection

As discussed, it is expected that the distribution network is sufficient to provide fire flows to the majority of Willowbrook. Furthermore, the hydrant spacing is generally in accordance with the RDOS Subdivision Servicing Bylaw. However, the long dead-end main that extends north on Green Lake Road is expected to be insufficient to provide fire flows.

5.0 RECOMMENDED INFRASTRUCTURE UPGRADES

Based on our review and understanding of the Willowbrook water system, it is evident that several deficiencies exist and certain components are not up to current RDOS standards. These deficiencies generally relate to undersized or lacking infrastructure. In addition, the system consists primarily of dead-end mains and does not have watermain looping to provide robustness and redundancy. A lack of looping can also create health concerns due to stagnation of water in dead-end mains and can result in disruption of water service during repairs. As noted above, it is expected that the system is sufficient to provide both current and future domestic water demands, but not the required fire flows to certain areas. As such, it is recommended that infrastructure upgrades be undertaken within the 20 year planning horizon. Please refer to Figure 2 for a schematic of the proposed upgrades and Section 7 for proposed phasing and timing.

5.1 Supply

As noted previously, the supply system consists of a well with a single pump and no backup power. There is currently no means of treatment in place and the well is considered groundwater at risk due to its close proximity to agricultural lands. As such, the following upgrades are recommended for the supply system:

- Installation of a second well and pump: In order to provide redundancy to the water supply system, a second pump installed in a separate well is recommended. This pump would need to have a minimum capacity of the MDD (7.4 L/s) and could potentially be installed in the original 8" well. This would allow for cycling between the two pumps and ensure consistent supply of water in the event of pump repair/maintenance. The purchase and installation of the additional pump and controls has an estimated cost of $20,000 and should be completed as soon as possible.
- Installation of a backup generator at the pump house: Based on the fact that the reservoir is severely undersized, a constant and reliable supply of water to the system is critical. In the event of a power outage, the reservoir could only supply MDD for four hours. As such, the installation of a transfer switch and backup generator is recommended to ensure a constant supply of power to the pump house. This project has an estimated cost of $50,000 and should be undertaken in conjunction with the installation of the second pump. Alternatively, the transfer switch could be installed and backup power provided by a portable generator that would have to be brought to the site in the event of a power outage.
- Wellhead protection: The lack of treatment and close proximity to potential contaminates are a source of concern for water quality. As such, wellhead protection is recommended to mitigate the potential for source water contamination. This project has an estimated cost of $15,000 and should be undertaken in conjunction with the installation of the second pump and backup generator.

There are currently no known issues with water quality and no requirement for water treatment to be implemented. As such, we have not recommended the installation of a treatment system. It should be noted that Interior Health could require treatment if deemed necessary. The supply water quality should be continually monitored and treatment considered in the future. We also recommend that a study on the capacity of the source aquifer be undertaken and water metering considered.

5.2 Storage

As noted previously, the existing reservoir is severely undersized when compared to RDOS standards and can only provide MDD for four hours or fire flow for 0.5 hours. The installation of a second pump and a backup generator would guarantee uninterrupted flow of MDD (at a minimum). Effectively MDD would be provided by the pumps and storage would only be required for fire flows. As such, the storage requirement for the reservoir could be reduced by the equalization storage component (160 m^3) plus 25% of this value for emergency storage component. This results in a total reduction of 200 m^3 for a reduced storage requirement of 405 m^3. As such, if a second pump and backup generator are installed, the system would require an additional 300 m^3 of storage. We recommend that a second reservoir be installed to supplement the storage of the existing system. The new reservoir should have a minimum storage volume of 300 m^3 which would cost approximately $200,000. This project should be undertaken following the upgrades to the supply system.

5.3 Distribution

As noted previously, the existing distribution system is likely adequately sized to provide current and future domestic demands; however the lack of looping in the system results in a lack of redundancy and possible fire flow and water quality issues. The lack of isolation valves is also a concern for system operation. As such, the following upgrades are recommended for the distribution system:

- Installation of Isolation Valves: As noted previously, dead-end mains make it impossible to isolate shorter sections of watermain for maintenance and repairs, regardless of the presence of valves. As such, there is limited opportunity to improve the system in this respect until additional looping is provided. However, the installation of valves could improve operations in the Carr Crescent area. We recommend installing 3 isolation valves; 2 valves at the northeast intersection of Carr Crescent and Johnson Crescent (northwest and southwest side of intersection) and 1 valve on Carr Crescent east of the feed from the pumphouse. This would allow for isolation of the watermain southwest of 225 Johnson Crescent and for isolation of the section of watermain on Carr Crescent east of the pumphouse. We estimate a cost of $2,500 per valve for a total project cost of $7,500.
- Watermain Looping at the southwest end of the system: With the exception of the loop formed between Carr Crescent and Johnson Crescent, the majority of the system is composed of dead-end mains. As such, it is proposed to install a new watermain along Myers Road to connect the dead-end mains on Green Lake Road and Johnson Crescent. This would greatly improve the hydraulics of the system and mitigate potential issues with water quality and service disruption. Valves should be installed at either end of the new main to allow for isolation and additional hydrants should be installed on Myers Road to provide additional fire protection. In conjunction with this upgrade, valves should also be installed on the existing main on Johnson Crescent immediately east of Green Lake Road and at approximately 143 Johnson Crescent. This would allow for isolation of the watermain on Johnson Crescent between the reservoir feed and Green Lake Road without putting both hydrants out of service. This project would require approximately 700 m of 150 mm watermain and the installation of 4 valves and 2 hydrants. It has an estimated cost of $220,000.

- Replacement of the 150 mm watermain on Green Lake Road: As noted previously, it is expected that this long dead-end (approximately 1,600 m) is insufficient with respect to providing fire flows. As such, we recommend that this watermain be replaced and upsized to a larger main. Per the RDOS Bylaw, the minimum size would be 200 mm; this should be confirmed through water modelling. Alternatively, the watermain could be twinned with a second 150 mm main to create a looped feed. Twinning is the preferred approach as it would provide a more robust supply and allow for isolation of small sections of watermain without shutting down the whole stretch. In this case, valves should be installed between each of the existing hydrants and at a minimum spacing of 240m on the second line. This project has an estimated cost of approximately $510,000.

5.4 Monitoring and Communication

An integral part of operating and maintaining a water utility is the monitoring and communication within the system. As noted previously, the existing monitoring and communications system is very minimal and basic. As such, we recommend the installation of a supervisory control and data acquisition (SCADA) system. This central system would ideally be located within/near the existing pump house and have connections to various meters, monitors and alarms throughout the system. These would include items such as flow and water level meters, quality monitors, and intrusion alarms installed at both the pump house and the reservoir. The system would require the ability for remote access to allow operators to monitor and control the system from offsite. This project has an estimated cost of $50,000 and should be installed in conjunction with, or immediately following the proposed supply upgrades.

N

INSTALL NEW WATERMAIN FOR LOOPING

INSTALL SECOND WELL AND PUMP
INSTALL BACKUP GENERATOR
INSTALL SCADA SYSTEM
IMPLEMENT WELLHEAD PROTECTION

INSTALL SECOND RESERVOIR

REPLACE/TWIN EXISTING 150MM DIA WATERMAIN

Jones Way
Meyers Rd
Carr Cres
Johnson Cres
Green Lake Rd

Legend

- Valve
- Hydrant
- End Cap
- Well and Pump House
- Reservoir

Watermain

- 150mm Dia
- 200mm Dia
- Water service

Upgrade Phasing

- Phase 1 - Year 1
- Phase 2 - Year 4
- Phase 3 - Year 7
- Phase 4 - Year 10

LOCATION MAP

SUMMERLAND
PENTICTON
KEREMEOS
OLIVER

0 75 150 300
Meters
1:8,000

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Willowbrook Water System

System Assessment

RECOMMENDED UPGRADES

project no. 5114-034-000
date: 2015-03-27
figure 2

P:\51 - BC Interior\5114\034-000_Willowbrook Water System Assessment\500 - Production\520 - Drawings\522 - Base\Willowbrook_WaterSystem_Figure 2 - Upgrades.mxd, 2015-03-27, 2:46:07 PM, bathi

6.0 OWNERSHIP

As noted above, Willowbrook Utilities currently owns and operates the Willowbrook water system and has requested that the RDOS consider taking it over. The intention of this report is to identify the most suitable long-term ownership model for operating and maintaining the system in the future. Below is a description of various options for ownership models:

- Status Quo: This is the current ownership model in place in which all O&M is undertaken by Willowbrook Utilities. In this model, costs for the system are funded by utility fees paid by the residents to Willowbrook Utilities. To date, these costs have been limited to operating and maintaining the system, with little set aside for capital improvements. Continuing with this model would be the simplest approach and may not require all of the upgrades noted above to bring the system up to current RDOS standards. However, there is no grant funding for capital improvements available to private utilities such as Willowbrook Utilities.
- RDOS takes ownership of the Willowbrook system: In this model; RDOS would take ownership of the system and would collect utility fees from the residents. The revenue from the utility fees would be used to pay for O&M and capital improvements for the water system. Under this approach the Willowbrook water system would be a standalone utility and any funds generated would be used to support the service. With RDOS taking ownership of the system, there would be more opportunity for grant funding from higher levels of government to help pay for the recommended upgrades identified above. This is our recommended ownership model.

7.0 FINANCIAL PLAN

The objective of the financial plan is to ensure that the fee recovery strategy (water rates, taxes, etc.) is sufficient to fund the anticipated costs for the system (O&M, required infrastructure upgrades, and associated administrative costs). The financial analysis will provide a long-term projection (20 years) to address the financial impact of maintaining the Willowbrook water system. The intention of the analysis is to treat the Willowbrook system as a fully independent utility, which is to be fully reliant upon generating its own revenue to offset expenditures. Based upon the recommended ownership model discussed in Section 6.0, RDOS would collect utility fees from the Willowbrook residents to run the system.

7.1 Annual Expenditure Forecast

Willowbrook Utilities monitors and records yearly revenues and expenditures on the water system. As noted above, the expenses to date have been limited to operating and maintaining the system, with little set aside for capital improvements. As there are no meters in the system, the existing rate structure is based on a flat fee of $25 per month for domestic services, with an additional charge of $85 per month for irrigation services. Based on review of the financial records, it appears that this rate structure is sufficient to cover annual O&M costs with a small surplus.

7.2 Capital Expenditure Forecast

In addition to the existing utility fee, the RDOS would need to collect additional fees from the Willowbrook residents to cover the costs of capital expenditures. This could be accomplished by increasing the existing fee, or establishing a separate capital charge. In order to determine a suitable amount, a proposed phasing plan (including timing) has been applied to the recommended infrastructure upgrades outlined in Section 5.0. All costs are reported in current dollars.

TOTAL CAPITAL EXPENDITURES	**$1,072,500**
Phase 1 - Year 1	$142,500
Installation of a second well and pump:	*$20,000*
Installation of a backup generator at the pump house:	*$50,000*
Implementation of wellhead protection:	*$15,000*
Installation of Isolation Valves:	*$7,500*
Installation of a SCADA System:	*$50,000*
Phase 2 - Year 4	$200,000
Installation of a second reservoir:	*$200,000*
Phase 3 - Year 7	$220,000
Watermain looping at the southwest end of the system:	*$220,000*
Phase 4 - Year 10	$510,000
Replacement/twinning of the Green Lake Road watermain:	*$510,000*

As determined above, the estimated total cost of the recommended upgrades is $1,072,500. Section 7.2.1 provides a rate structure analysis for funding the capital expenditures.

7.2.1 Capital Expenditure Rate Structure Analysis

Using the cost estimates and timing of capital improvements as established above, a financial analysis was undertaken to determine a suitable rate structure to fund capital expenditures for the Willowbrook water system. This analysis is included in Appendix A. The analysis compares the capital charge that would be required for various levels of funding from the capital program (ranging from 33% to 100%). Other sources of revenue such as grants from senior levels of government would be required to supplement the capital program in all cases other than the 100% funding scenario.

It is expected that the RDOS will fund the capital expenditures from the rates collected from the residents and supplement as required by borrowing. An annual inflation rate of 3% has been applied to the cost estimates and the same escalation rate has been assumed for the capital charge. The minimum revenue required has been determined in order to ensure that the RDOS does not have any remaining debt at the end of the 20 year period.

We understand that there are currently 80 lots serviced by the water utility that will be required to pay for capital expenditures. Dividing the total revenue required by the number of parcels results in the capital charge amount per parcel in the first year, as summarized below.

Funding Structure	2015 Capital Charge	
	Total	Per Unit
100% Funding	$57,104	$714
66% Funding	$37,668	$471
50% Funding	$28,552	$357
33% Funding	$18,844	$236

It is recommended that the capital charge amount be determined based on the 33% Funding Structure. This is based on the understanding that most grant programs are based on one third local funding and two thirds provincial/federal funding. This mitigates the financial impact to the local residents. As such, a 2015 capital charge of $236 per unit is recommended. The capital charge of $714 per unit under the 100% funding scenario represents the amount that would be required if no funding is available (i.e if the RDOS does not take over the system).

7.3 Rate Structure Summary

As discussed above, it is expected that the current rate structure is sufficient to cover O&M costs going forward. However, an increase to the existing fee or a separate charge of $236 per unit per year is required to fund capital expenses.

8.0 CONCLUSIONS

Proper Asset Management and a well-guided Financial Plan are essential to providing sustainable operation and maintenance of a municipal infrastructure system. Currently, the Willowbrook water system is owned and operated by a private utility (Willowbrook Utilities), utilizing revenues collected the residents. The current fee structure is sufficient to cover annual O&M, but does not generate reserves for capital improvements. As such, a new model for ownership, operation, maintenance and funding of the Willowbrook system is required.

In general, it is expected that the existing system is in good condition; however, certain components of the system are undersized and/or lacking. This can be summarized as follows:

- The source well has only one pump, no emergency power and is considered groundwater at risk.
- The existing reservoir does not have sufficient storage for domestic demands or fire flows.
- The distribution network has consists of several dead-end mains with minimal internal looping and a lack of isolation valves.
- The system has minimal monitoring and communication in place.

All of these factors result in a system that lacks redundancy, cannot provide sufficient fire flow and is susceptible to issues with water quality. As such, it is expected that infrastructure upgrades will be required over the next 20 years. This can be done in phases, based on urgency and available funding.

9.0 RECOMMENDATIONS

Based upon our review and analysis of the existing Willowbrook water system with respect to O&M, capital replacement, funding and ownership, we recommend that:

- An adequate level of asset management be employed now and in the future to ensure that the Willowbrook water system is operating in a sustainable manner;
- The RDOS take ownership of the Willowbrook water system;
- Infrastructure upgrades to the existing system be performed as outlined in Section 5.0 and Section 7.0 (or as urgency and funding dictate);
- The RDOS undertake a study to assess the capacity of the source aquifer;
- The RDOS consider instituting water metering;
- The RDOS continue to closely monitor water quality and consider treatment;
- The rate structure outlined in Section 7.0 be employed to ensure that the residents of Willowbrook are wholly funding the O&M of the Willowbrook system and contributing to capital improvements; and
- The RDOS seek out senior government grant funding opportunities so that improvements can be completed with less financial impact to the Willowbrook rate payers.

APPENDIX A – RATE STRUCTURE ANALYSIS

Project: **Willowbrook Water System Assessment**
Project No: **5114-034-000**

Rate Structure Analysis

100% Funding Rate Structure Analysis

Amount Borrowed (Year 1): $0.00

	Year																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Opening Reserve Balance	$0.00	-$85,396.27	-$30,849.24	$28,189.64	-$127,675.07	-$69,788.07	-$7,078.60	-$201,939.20	-$141,805.77	-$76,558.76	-$671,313.61	-$628,136.65	-$580,498.57	-$528,107.23	-$470,653.84	-$407,812.01	-$339,236.86	-$264,563.98	-$183,408.42	-$95,363.56
Less Loan Repayment	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Less Capital Expenditures	-$142,500.00	$0.00	$0.00	-$218,545.40	$0.00	$0.00	-$262,691.51	$0.00	$0.00	-$665,434.32	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Plus Interest Earned	$0.00	-$4,269.81	-$1,542.46	$281.90	-$6,383.75	-$3,489.40	-$353.93	-$10,096.96	-$7,090.29	-$3,827.94	-$33,565.68	-$31,406.83	-$29,024.93	-$26,405.36	-$23,532.69	-$20,390.60	-$16,961.84	-$13,228.20	-$9,170.42	-$4,768.18
Plus Rates Collected	$57,103.73	$58,816.84	$60,581.35	$62,398.79	$64,270.75	$66,198.87	$68,184.84	$70,230.39	$72,337.30	$74,507.42	$76,742.64	$79,044.92	$81,416.27	$83,858.75	$86,374.52	$88,965.75	$91,634.72	$94,383.77	$97,215.28	$100,131.74
Closing Reserve Balance	-$85,396.27	-$30,849.24	$28,189.64	-$127,675.07	-$69,788.07	-$7,078.60	-$201,939.20	-$141,805.77	-$76,558.76	-$671,313.61	-$628,136.65	-$580,498.57	-$528,107.23	-$470,653.84	-$407,812.01	-$339,236.86	-$264,563.98	-$183,408.42	-$95,363.56	$0.00

Number of Parcels: 80
Charge per Parcel (2015): **$713.80**

66% Funding Rate Structure Analysis

Amount Borrowed (Year 1): $0.00

	Year																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Opening Reserve Balance	$0.00	-$56,361.54	-$20,360.50	$18,605.17	-$84,265.55	-$46,060.13	-$4,671.88	-$133,279.87	-$93,591.81	-$50,528.78	-$443,066.98	-$414,570.19	-$383,129.05	-$348,550.77	-$310,631.53	-$269,155.93	-$223,896.33	-$174,612.23	-$121,049.55	-$62,939.95
Less Loan Repayment	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Less Capital Expenditures	-$94,050.00	$0.00	$0.00	-$144,239.96	$0.00	$0.00	-$173,376.39	$0.00	$0.00	-$439,186.65	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Plus Interest Earned	$0.00	-$2,818.08	-$1,018.02	$186.05	-$4,213.28	-$2,303.01	-$233.59	-$6,663.99	-$4,679.59	-$2,526.44	-$22,153.35	-$20,728.51	-$19,156.45	-$17,427.54	-$15,531.58	-$13,457.80	-$11,194.82	-$8,730.61	-$6,052.48	-$3,147.00
Plus Rates Collected	$37,688.46	$38,819.12	$39,983.69	$41,183.20	$42,418.70	$43,691.26	$45,001.99	$46,352.05	$47,742.62	$49,174.89	$50,650.14	$52,169.65	$53,734.74	$55,346.78	$57,007.18	$58,717.40	$60,478.92	$62,293.29	$64,162.08	$66,086.95
Closing Reserve Balance	-$56,361.54	-$20,360.50	$18,605.17	-$84,265.55	-$46,060.13	-$4,671.88	-$133,279.87	-$93,591.81	-$50,528.78	-$443,066.98	-$414,570.19	-$383,129.05	-$348,550.77	-$310,631.53	-$269,155.93	-$223,896.33	-$174,612.23	-$121,049.55	-$62,939.95	$0.00

Number of Parcels: 80
Charge per Parcel (2015): **$471.11**

50% Funding Rate Structure Analysis

Amount Borrowed (Year 1): $0.00

	Year																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Opening Reserve Balance	$0.00	-$42,698.13	-$15,424.62	$14,094.82	-$63,837.54	-$34,894.04	-$3,539.30	-$100,969.60	-$70,902.89	-$38,279.38	-$335,656.80	-$314,068.33	-$290,249.28	-$264,053.61	-$235,326.92	-$203,906.01	-$169,618.43	-$132,281.99	-$91,704.21	-$47,681.78
Less Loan Repayment	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Less Capital Expenditures	-$71,250.00	$0.00	$0.00	-$109,272.70	$0.00	$0.00	-$131,345.75	$0.00	$0.00	-$332,717.16	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Plus Interest Earned	$0.00	-$2,134.91	-$771.23	$140.95	-$3,191.88	-$1,744.70	-$176.97	-$5,048.48	-$3,545.14	-$1,913.97	-$16,782.84	-$15,703.42	-$14,512.46	-$13,202.68	-$11,766.35	-$10,195.30	-$8,480.92	-$6,614.10	-$4,585.21	-$2,384.09
Plus Rates Collected	$28,551.87	$29,408.42	$30,290.67	$31,199.39	$32,135.38	$33,099.44	$34,092.42	$35,115.19	$36,168.65	$37,253.71	$38,371.32	$39,522.46	$40,708.13	$41,929.38	$43,187.26	$44,482.88	$45,817.36	$47,191.88	$48,607.64	$50,065.87
Closing Reserve Balance	-$42,698.13	-$15,424.62	$14,094.82	-$63,837.54	-$34,894.04	-$3,539.30	-$100,969.60	-$70,902.89	-$38,279.38	-$335,656.80	-$314,068.33	-$290,249.28	-$264,053.61	-$235,326.92	-$203,906.01	-$169,618.43	-$132,281.99	-$91,704.21	-$47,681.78	$0.00

Number of Parcels: 80
Charge per Parcel (2015): **$356.90**

33% Funding Rate Structure Analysis

Amount Borrowed (Year 1): $0.00

	Year																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Opening Reserve Balance	$0.00	-$28,180.77	-$10,180.25	$9,302.58	-$42,132.77	-$23,030.06	-$2,335.94	-$66,639.94	-$46,795.90	-$25,264.39	-$221,533.49	-$207,285.09	-$191,564.53	-$174,275.39	-$155,315.77	-$134,577.96	-$111,948.16	-$87,306.11	-$60,524.78	-$31,469.97
Less Loan Repayment	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Less Capital Expenditures	-$47,025.00	$0.00	$0.00	-$72,119.98	$0.00	$0.00	-$86,688.20	$0.00	$0.00	-$219,593.33	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Plus Interest Earned	$0.00	-$1,409.04	-$509.01	$93.03	-$2,106.64	-$1,151.50	-$116.80	-$3,332.00	-$2,339.80	-$1,263.22	-$11,076.67	-$10,364.25	-$9,578.23	-$8,713.77	-$7,765.79	-$6,728.90	-$5,597.41	-$4,365.31	-$3,026.24	-$1,573.50
Plus Rates Collected	$18,844.23	$19,409.56	$19,991.84	$20,591.60	$21,209.35	$21,845.63	$22,501.00	$23,176.03	$23,871.31	$24,587.45	$25,325.07	$26,084.82	$26,867.37	$27,673.39	$28,503.59	$29,358.70	$30,239.46	$31,146.64	$32,081.04	$33,043.47
Closing Reserve Balance	-$28,180.77	-$10,180.25	$9,302.58	-$42,132.77	-$23,030.06	-$2,335.94	-$66,639.94	-$46,795.90	-$25,264.39	-$221,533.49	-$207,285.09	-$191,564.53	-$174,275.39	-$155,315.77	-$134,577.96	-$111,948.16	-$87,306.11	-$60,524.78	-$31,469.97	$0.00

Number of Parcels: 80
Charge per Parcel (2015): **$235.55**

Project: Willowbrook Water System Assessment
Project No: 5114-034-000

Rate Structure Analysis - Parameters and Assumptions

Capital Improvements

Year	Cost Current	Cost Inflated
1	$ 142,500	$ 142,500
2	$ -	$ -
3	$ -	$ -
4	$ 200,000	$ 218,545
5	$ -	$ -
6	$ -	$ -
7	$ 220,000	$ 262,692
8	$ -	$ -
9	$ -	$ -
10	$ 510,000	$ 665,434
11	$ -	$ -
12	$ -	$ -
13	$ -	$ -
14	$ -	$ -
15	$ -	$ -
16	$ -	$ -
17	$ -	$ -
18	$ -	$ -
19	$ -	$ -
20	$ -	$ -
Total:	**$ 1,072,500**	**$ 1,289,171**

Inflation Rate for Improvements: 3.0%

Interest Rates

Interest Rate on Loans: 5.0%
Interest Earned on Reserve Funds: 1.0%

Capital Charge

Annual Rate Increase: 3.0%

Number of Parcels: 80