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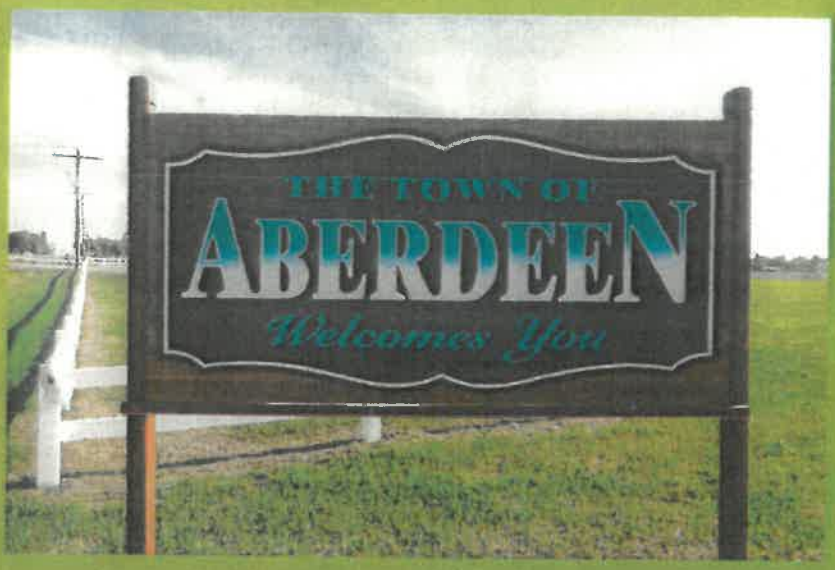

WATERWORKS SYSTEM ASSESSMENT

FINAL REPORT FOR:
TOWN OF ABERDEEN

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1.0 Background and General Overview

1.1 General

Aberdeen, Saskatchewan, has a population of 670 persons (estimated by the Town). In April of 2010, the Town began receiving potable water via the SaskWater Saskatoon Northeast Treated Pipeline (surface water from the South Saskatchewan river treated by the City of Saskatoon WTP) and abandoned their treatment system. The Town provides storage and pumping to the distribution system. The previous WSA was completed in 2011.

An addition to the water pumphouse (WPH) was completed in 2012. The addition included an upgrade of the electrical system and replacement of one of the distribution pumps. The Highway 41 Water Utility added two pumps to feed their rural distribution system from the Town reservoirs. The existing filters were removed to create space for the new pumps.

1.2 Location

The reservoirs and pump house are located on Lot 24, Blk/Par 9, Plan 101513078, in the Town of Aberdeen.

1.3 Inspection of Waterworks System

The waterworks system inspection took place on July 23, 2015. The Town foreman and primary waterworks operator, Brad Oleksyn, was interviewed.

1.4 Operators and Certification

The Town has two certified operators, Brad Oleksyn and Mural Hingston. Mr. Oleksyn holds WD2 and WT2 certifications and Mr. Hingston holds WD1 and WT1 certifications. There are no uncertified backup operators.

1.5 Previous WSA Report & Upgrades

1.5.1 Identified Issues & Risks

The previous WSA was completed in 2011. It identified the following issues and risks (paraphrased):

1. A chemical feed system is required to pump sodium hypochlorite and ammonium sulphate to allow for boosting of chloramines if required.
2. A double check valve is required on both the pailfill and the truckfill for backflow prevention.
3. A raised curb to 150 mm above the floor and a sealed cable entry are required at the access to Reservoir No. 1.

1.5.2 Recommendations

Recommendations from the previous WSA (paraphrased):

1. Upgrades to the distribution pumps are recommended to suit the projected pumping requirements.
2. Both reservoirs are recommended to be cleaned.

1.5.3 Upgrades

Since the previous WSA, the following upgrades were completed:

1. The pumphouse was expanded in 2012 to accommodate new electrical, a replacement distribution pump and distribution pumps for the Highway 41 Utility.
2. The pail fill has been removed.
3. A double check valve has been added to the truckfill to work with the existing vacuum breaker.
4. The access to Reservoir No. 1 has been upgraded to include an increased curb height to 150 mm as well as removing a control cable that used to pass through the access.
5. Approximately 600 m of distribution mains have been added.

2.0 Review of Available Information

2.1 Plans, Reports, and Manuals

Plans, reports, and manuals that were reviewed are listed in Appendix B. The records are generally complete and well kept.

Reports from the Environmental Project Officer (EPO) were reviewed from 2011-2015. The reports have generally been favourable.

2.2 Historic Problems

There are no reports of historic problems.

3.0 Water Usage Analysis

3.1 Population

Table 3.1 is a summary of population statistics for the Town based on Census data from Statistics Canada, covered population information from Saskatchewan Health (SHSP) and information provided by the Town. SHSP figures are not always an accurate representation of the actual population, but are useful for estimating growth.

The Census data shows a population increase of about 2.7% from 2006 to 2015. SHSP data fluctuates between growth and decline, however long term population changes are approximately 1.4% over the past decade. At the time of the inspection, the Town estimated a current population of 670 and that a growth rate of approximately 1.4% would be reasonable.

For analysis purposes, a reported 2015 population of 670 and a future growth of 1.4% will be used.

Table 3.1 – Population Summary

Year	Census	SHSP	Town	Forecast
2006	527	759		
2007		780		
2008		790		
2009		772		
2010		756		
2011	599	979		
2012		984		
2013		1013		
2014			670	
2015				670
2020				718
2025				770
2030				825
2035				884

3.2 Consumption and Sizing

A water usage analysis and projection was completed based on data supplied by the Town. The results of the analysis are shown in Table C.1, Appendix C. The average daily per capita water usage for the last five years was approximately 275 Lpcd (litres per capita per day). The Water Security Agency of Saskatchewan (WSASK) statistics (based on Saskatchewan Health Covered Population data) indicate an average of 325-398 Lpcd for a Saskatchewan community of this size. For future projection in this analysis, an average usage of 300 Lpcd will be used. This is consistent with other communities using SaskWater supply pipelines.

Peaking factors are used to determine the sizing requirements of various components. The required size is determined by multiplying the average daily consumption by the peaking factors. Peak day demand is used to determine the required supply rate based on a 24 hour day. Calculated peak day usage factors have ranged from 2.11 to 2.54. For a community of this size, the WSASK recommends a peak day factor of 2.75 which is used herein. Distribution pumps are sized to supply the estimated peak hour usage. For a community of this size, the WSASK recommends a peak hour factor of 4.13 which is used herein. Treated water storage equal to 2 times average daily use is recommended for a system with fire protection.

Based on the estimated population of 625 persons and the aforementioned factors, the 2015 water requirements are estimated and summarized in Table 3.1. Further analysis and a 20 year projection, based on the same factors are included in Table C.1.

Table 3.2 –Water Requirements (2015)

Estimated Average Day (m^3)	Estimated Peak Day (m^3)	Supply Rate (Lps)	Dist. Pumping Rate (Lps)	Storage (m^3)
201	553	6.4	9.6	402

4.0 Water Supply

4.1 SaskWater Supply

Potable water is supplied to the Town by the SaskWater Saskatoon Northeast Treated Pipeline (from the City of Saskatoon Water Treatment Plant). The supply pipeline adjacent to the building is 150 mm PVC pipeline. Inlet piping at the WPH includes a double check valve assembly, flow rate control valve, turbine water meter and solenoid fill valve (Photo 1).

There has been no change to the SaskWater supply agreement noted in the previous WSA. The details are as follows:

- Average flow rate: 5.6 Lps
- Maximum annual quantity: 176,602 m^3 (with the understanding that additional capacity will be provided, if available)

The contracted supply rate is less than the estimated 2015 peak day requirement but greater than the average.

During extended periods of high usage, it is possible that reservoir levels may be unacceptably low (i.e. less than half full). It is recommended that the Town monitor and record reservoir levels during high usage to determine reservoir levels fall unacceptably low. This can help determine if an increase in the contracted water supply rate is required.

The Highway 41 Utility is also drawing out of the Town's reservoir and their water supply allotment from SaskWater will also flow to the reservoir. The Town reports that a consistent incoming flow rate of 7.0 Lps is observed. This flow accounts for required volumes used by both the Town and the Utility. If stored water levels drop unreasonably low, the water supply agreement allows the Town to temporarily cut off water supply to the Utility. The usage and supply allotment will need to be monitored to ensure there is minimal impact to the Town's water supply.

5.0 General Water Pumphouse Facilities

The original WPH was constructed in 1964. The plant was expanded in 1984 and again in 2012. The interior is generally clean and well-kept.

The recently expanded area of the pumphouse houses upgraded electrical (Photo 8) and provides space for a future standby (fire) pump and standby power generator.

The access to the 1984 reservoir is outside and secured with a padlock.

The entrance has a storm door which is equipped with a locking handle. However, the door frame is rotted and the door can be opened without a key (Photo 15). Upgrades are required to this entrance to ensure that the building can be locked and secured.

The WTP is equipped with an autodialler to notify the operator of abnormal conditions.

6.0 Water Treatment Process

6.1 Process Description

Potable water enters the WPH building and is discharged to Reservoir No. 2 for storage. The water circulates to Reservoir No. 1 and then to the distribution pumps. Chlorine in the supplied water is manually monitored. Distribution pressure is maintained with the use of variable frequency drives (VFD's) on the pumps.

6.2 Water Treatment Chemicals

6.2.1 Chlorine and Ammonia

At the time of the inspection, the Town did not have a chemical feed system and no chemicals were being fed. Since the time of the inspection, the Town has installed a chemical feed system that allows for addition of chemicals (sodium hypochlorite and ammonium sulphate) to boost chloramines in the incoming water. The chemical drums on site are marked with gradations for the Town to record chemical usage.

In 2014, total chlorine residuals at the pumphouse ranged from 0.93 mg/L to 1.64 mg/L. The Town is consistently exceeding the minimum requirement of 0.5 mg/L.

6.3 Treated Water Quality

Extensive water quality testing is not necessary because good quality, treated potable water is received from SaskWater (which is treated by the City of Saskatoon). Typical water quality information is available from www.saskh2o.com under "City of Saskatoon".

In 2014, treated water turbidity ranged from 0.10 NTU to 0.39 NTU. The Town's permit does not have an applied limit for turbidity.

6.4 Disinfection

Primary disinfection of the water supplied to the Town is achieved at the City of Saskatoon water treatment plant. Disinfection analysis is not required for the Town. The City of Saskatoon water treatment plant uses monochloramine for secondary disinfection. Total chlorine content must be monitored at the pumphouse. Free chlorine content is very low, if any.

7.0 Treated Water Storage

There have been no changes to the treated water capacity since the previous WSA.

Treated water is stored in two below grade reinforced concrete reservoirs. Table 7.1 lists reservoir capacities.

Table 7.1 – Reservoir Characteristics

Reservoir	Year Constructed	Reservoir Capacity (m^3)
1	1964	113
2	1984	489
		Total = 602

Incoming water is discharged to the far side Reservoir No. 2 (Photo 2), flows through the reservoir to the connecting pipe to Reservoir No. 1. The water then flows across Reservoir No. 1 to the distribution pumps.

Water storage available is adequate for the projected Town requirements. This has not included any allowance for the water used by the Highway 41 Utility. As mentioned previously, the water supply agreement allows the Town to temporarily cut off water supply to the Utility if stored water levels drop unreasonably low. Regular review of the water use and storage requirements for the actual Utility use is recommended to ensure there is minimal impact on the Town system.

The reservoirs can be isolated for maintenance and inspection. The reservoirs have not been cleaned since the previous WSA. Recent EPO reports have indicated that the plant was quite dirty during the recent upgrade. Given that the plant was dirty and the reservoirs have not been cleaned for a while, it is recommended that both reservoirs be cleaned. Temporary distribution pumping may be required to facilitate cleaning of Reservoir No. 1.

The previous WSA noted that the steel curb for the access to Reservoir No. 1 was only 38mm high. The access was also not properly sealed as it had a control cable passing through the opening. Since the previous WSA, the curb has been raised to 150 mm and the control cable has been removed from the access (Photo 5).

The steel cover for the access to Reservoir No. 2 is outside and set on a concrete curb, which is approximately 150 mm above the adjacent grade. The most recent EPO report indicated that the gasket at the access hatch required replacement. The Town must ensure that the access is properly sealed. The exterior reservoir access is locked, and the reservoir vent is protected with an insect screen (Photo 6).

Reservoir No. 1 has an overflow pipe to the sanitary sewer. This overflow pipe does not have backflow prevention. The discharge space does not have adequate room to install a backflow preventer. It is recommended that this overflow be removed and the wall grouted and properly sealed. An allowance for temporary pumping may be required.

8.0 Distribution System

The WPH is equipped with two distribution pumps. There are also two distribution pumps that supply the Highway 41 Utility (Photo 9) which are owned and operated by the Utility. These two pumps do not supply water to the Town. A summary of the pumps available to the Town's distribution system are shown in Table 8.1.

Table 8.1 – Pump Descriptions

Pump No.	Type	Manufacturer/ Model	Installed	hp	Flow (Lps)	Head (m)
1	Primary	Goulds VIT-CT	2012	10	12.1	42.7
2	Secondary, Electric Driven	Johnston	1964	10	6.3	31.6
	Secondary, Natural Gas Engine Driven	Johnston	1964	---	27.8	31.6

Pump No. 1 (Photo 3) was installed with the recent upgrades. Both pumps received new 10 hp motors at the same time.

Pump No. 2 (Photo 4) can be driven by either electric motor or by a natural gas engine. When needed, the engine drive is manually operated at a greater RPM than the electric motor to supply more water. SaskPower conducted a review of the natural gas engine and placed an "Unsatisfactory Condition Report" tag on the engine. It notes that the engine is not CSA approved, exhaust piping is leaking CO_2 at 32 ppm, parts are obsolete, and replacement is recommended.

The motor driven pumps are speed controlled by variable frequency drives (VFD's) to provide near constant pressure. Pumps are brought into service by a fixed roster in the VFD programming; this involves Pump No. 1 always acting as the lead pump and Pump No. 2 being added when pressure drops below 45 psi.

The Town currently does not have a backup generator to mitigate a power outage; rather, the operators start the engine driven pump as quickly as they can. This leads to distribution system pressure reductions when relying on operator response time to resume pumping. The current state of the engine driven pump indicates that an alternative backup power source is required for power outages. The Town is planning to install a backup generator and an electric standby pump (for fire flows) in the newest portion of the building. Initial generator sizing is estimated at 150 kW and would allow for operation of the electric standby pump as well as the main distribution pumps. The electric standby pump is estimated to be a 60 hp pump with a capacity of 75.7 Lps (1200 USgpm). It is possible that the generator size could be reduced if standby pump capacity is reduced or other process equipment is locked out from operation, however further consultation is required with the Town.

Additional upgrades would be required to accommodate this upgrade (e.g. building revisions for air intake, controls, etc.), however they are beyond the scope of this report.

The distribution pumping capacity is sufficient to provide the estimated distribution pumping requirements for approximately 17 years. The distribution pumps do not have 100% redundancy, however the Town's requirements can be managed with Pump No. 1 operating on its own. Pump No. 2 is recommended to be upgraded to

match the capacity of Pump No. 1 when the future generator is installed. Discharge pressure at the plant is 45 psi to 50 psi.

The distribution header has a pressure relief valve which is intended to limit the maximum pressure in the distribution system. The current pressure relief valve is insufficient to function with the current and future pumps. The pressure relief valve must be replaced when pump upgrades are completed.

The WPH has an exterior, coin operated truck fill on the east side of the building (Photos 10-12). Water is supplied to the truck fill by a dedicated pump, capable of providing 7.0 Lps at 9.8 m of TDH. The truck fill is equipped with a double check valve and a vacuum breaker. The WPH was also previously equipped with an exterior pail fill facility, however it has been removed.

New services on the distribution system are required to be provided with backflow prevention. Commercial service connections as well as some residential service connections are required to be equipped with backflow prevention.

The distribution system consists of approximately 7,800 m of A.C. and PVC pipe (primarily 150 mm) plus services. Approximately 600 m of the aforementioned total length has been added since the previous WSA.

9.0 Water System Capacities

Table 9.1 is a summary of the capacity and remaining service life of major components within the waterworks system. The table makes reference to the 20-year design population of 884.

Table 9.1 – Capacity and Remaining Service Life of Waterworks Components

	Item	Year Installed	Existing Capacity	Serviceable Population	Typical Service Life (years)	Estimated Remaining Service Life (years)
Storage	Reservoir Storage	1964-1984	602 m^3	> 884	50	10-20
Distribution	Distribution Pumps	1964 to 2012	12.1①	845	30	5-25
	Engine Driven Standby Pump	1964	27.8 Lps	---	30	5-15
	Distribution Piping	1960's-2014	---	---	50	5-50

① Distribution pumping capacity with the largest pump (Pump No. 2 out of service)

Reservoir storage volume is sufficient for the 20-year design population. Highway 41 Utility usage should be closely monitored to determine if it is negatively affecting the water supply to the Town.

The distribution pumps are adequate for approximately 17 years with Pump No. 2 out of service. Pump No. 2 is recommended to be upgraded to match the capacity of Pump No. 1 when the future generator is installed.

A new generator is recommended to provide backup power and to eliminate reliance on the existing engine driven pump during power outages. A new, larger electric

standby pump is recommended to be installed at the time of the new generator installation to provide fire capacity to the Town.

Some of the older distribution piping has reached the end of its normal service life and the Town should consider a long term plan for main replacement.

10.0 Testing Procedures and Records

The Town has a Hach Pocket Colorimeter II (total and free chorine) and a Hach 2100P Turbidimeter (Photo 13). Both pieces of equipment are in good condition and calibration checks are done regularly. The Town tests regularly for both chlorine and turbidity. Work bench space within the plant is minimal (Photo 14).

The Town samples weekly for bacteriological quality and quarterly for trihalomethanes (THMs) as outlined in the Town's Permit to Operate. Bacteriological testing results have been acceptable and all repeat samples of positive samples have been negative. THM results, as shown in Appendix A, have all been well below the MAC.

The Town now has provision to boost chloramines in the incoming treated water if necessary. The Town is required to record chemical usage.

Daily testing records are maintained at the WPH. The records appear to be complete.

11.0 Operation and Maintenance

Daily plant operation includes chlorine residual testing, turbidity testing, meter readings, general plant review and maintenance as necessary.

The WPH is maintained in good condition. The maintenance performed is adequate and records are well kept and appear to be complete.

The Town reports that the distribution system hydrants and valves are exercised annually in the fall during directional flushing of the water mains.

O&M manuals were not available for review.

12.0 Metering and Water Usage Reporting

Table 12.1 lists the meters that are present in the water pumphouse:

Table 12.1 – Water Pumphouse Meters

Meter Location	Type	Registers	Reported to WSASK
Supply*	Turbine	m^3	Yes
Truckfill	Turbine	Igal	No
Hwy 41 Distribution+	Turbine	m^3	No

*Owned by SaskWater
+Owned by Hwy 41

13.0 Wastewater

This system does not generate process waste water. Wastewater (floor drainage, etc.) is directed to the sanitary sewer system.

14.0 Waterworks Cost Analysis

A waterworks cost analysis was completed to assist the Town in identifying water rates that will support the financial sustainability of the waterworks. This analysis provides a basis for full-cost pricing. Full-cost pricing is intended to generate sufficient revenue to recover all waterworks related expenses. It also heightens the value of the resource to consumers, and can affect consumers' usage habits.

The process of setting water rates can be complex with many variables. Some of these variables include the age of waterworks components (older systems tend to have a higher frequency of failure), previous debts incurred, and providing predictable rate increases for consumers. For the purposes of analysis, the following is intended to provide a screening level review to help assess the Town's ability to recoup its waterworks related expenses.

The waterworks cost analysis has been completed based on the following information supplied by the Town:

- A summary of annual operations and maintenance costs from the previous five years;
- Estimated unaccounted (non-billed) water usage; and
- The current water rate structure for the Town.

This analysis looks at operations and maintenance costs, capital replacement costs over the lifetime of the waterworks, and provides a comparison of recommended water rates with the current water rates provided by the Town.

14.1 Operations and Maintenance Costs

Waterworks operations and maintenance (O&M) costs consist of items such as chemicals, electricity, personnel, sampling/monitoring and routine maintenance. Routine maintenance consists of expected, planned or repeated maintenance items (ie: water main repair, water pumphouse maintenance and supplies, and meter replacements). O&M costs can either be fixed (ie: building heating, salaries, professional development) or variable (ie: bulk water purchase, chemical usage) with respect to water consumption.

Non-billed (non-metered) water is considered as a variable O&M cost. Non-billed water usage includes water that is unaccounted for through water main breaks, distribution system leaks, distribution system flushing and swabbing, firefighting/training, unmetered facilities and meter discrepancies. This usage is determined by comparing metered volumes of treated water leaving the water treatment plant with metered volumes from utility billings. The Town provided records of their volumes billed to consumers and bulk purchases from SaskWater for

the past three years. These records indicate that approximately 8% of incoming water is not billed to consumer. Non-billed water is typically in the range of 10-30%.

The Town provided O&M costs for the previous five years. Refer to Appendix F. Table 14.1 and Table 14.2 break these O&M costs into fixed and variable costs respectively. Variable costs have been adjusted to account for non-billed water. The Annual Operations and Maintenance Costs provided by the Town include the costs of non-routine (unplanned) maintenance over the past five years.

Table 14.1 – Fixed Operation and Maintenance Costs

Year	Fixed Annual O&M Cost
2010	$108,326.71
2011	$129,808.09
2012	$138,772.49
2013	$147,124.20
2014	$155,291.06
Fixed Average Annual O&M Costs	**$135,864.51**

Table 14.2 – Variable Operation and Maintenance Costs

Year	Annual O&M Cost	Annual Water Use (m^3)	O&M Cost Per m^3	O&M Cost Per 1000 Igal
2010	$172,010.35	37,907	$4.54	20.63
2011	$207,320.37	54,686	$3.79	17.23
2012	$173,827.52	61,119	$2.84	12.93
2013	$203,912.72	65,007	$3.14	14.26
2014	$196,165.56	67,241	$2.92	13.26
Average	$190,647.30	57,192	$3.45	$15.66
Unaccounted Water Use			8%	8%
Variable O&M Costs per Metered Volume			**$3.72**	**$16.92**

14.2 Capital Replacement Costs

Capital replacement costs are fixed costs to the Town. Although they may not be required today, a proportion of this cost must be allocated annually to ensure that waterworks infrastructure is sustainable in the long term. An estimate of capital replacement costs for major waterworks system components is shown in Table 14.3. The total estimated annual replacement cost represents the average amount that should be placed in reserves annually. The table identifies major system components, each with its associated current estimated replacement cost and estimated average service life.

Table 14.3 – Capital Replacement Costs

	Current Estimated Replacement Cost	Estimated Average Service Life	Annualized Cost①
Water Plant Facilities			
Building	$100,000.00	30	$3,206.04
Mechanical (less distribution pumps)	$50,000.00	30	$1,603.02
Electrical (less generator)	$100,000.00	20	$4,870.11
Storage			
Reservoir Storage	$800,000.00	50	$15,003.29
Distribution			
Pumps	$100,000.00	30	$3,206.04
Distribution System③	$2,350,000.00	50	$44,072.15
Truckfill Facilities	$20,000.00	20	$974.02
Fixed Annual Capital Replacement Cost			**$72,934.68**

①Annualized Cost based on an assume interest rate of 0.25% over the estimated average service life of the waterworks component

14.3 Suggested Water Rates

Based on the foregoing cost summaries, the following water rates are provided for comparison to the current water rates. These rates are suggested to meet the waterworks costs outlined in Sections 14.1 and 14.2 to ensure a financially self-sustaining system. These rates have been generated on the basis of a fixed base cost plus an incremental cost per volume used, and then adjusted to model the current water rate structure for the purpose of comparison.

Table 14.4 – Fixed Monthly Cost per Meter

Operations and Maintenance	$135,864.51
Capital Replacement	$72,934.68
Total Average Annual Fixed Costs	**$208,799.19**
Total Average Monthly Fixed Costs	$17,399.93
Number of Meters (for billing purposes)*	273
Fixed Monthly Cost per Meter	**$63.74**

*Number of meters provided by Town

Table 14.5 – Variable Cost per Metered Volume

	Variable Cost per m^3	Variable Cost Per 1000 Igal
Variable Operations and Maintenance Costs	**$3.72**	**$16.92**

A base rate of **$63.74** plus an additional **$16.92 per 1000 Igal** ($3.72 per cubic meter) is suggested for a full-cost recovery of waterworks related expenses. The recommended water rates do not account for inflation, and an appropriate inflation rate will need to be applied.

14.4 Waterworks Sustainability

Table 14.7 compares the Town's current rate structure to the suggested water rates for full cost recovery of waterworks related expenses. Both rates are compared based on a 2014 average consumption of 20.5 m^3 (4,500 Igal) per meter per month.

Table 14.7 – Reported 2015 Water Rates vs. Suggested Water Rates

2015 Aberdeen Monthly Water Rates				
Usage Rate	$4.41	/ m^3	$20.00	/1000 Igal
Infrastructure Fee	$35.00		$35.00	
Average Monthly Usage per Meter	20.5	m^3	4500	Igal
Average Monthly Revenue per Meter			**$125.00**	
*Water rates and fees provided by Town				
Suggested Water Rates				
Base Rate (including infrastructure fee)	$63.74		$63.74	
Usage Rate (each unit of usage)	$3.72	/ m^3	$16.92	/ 1000 Igal
Average Monthly Usage per Meter	20.5	m^3	4500	Igal
Average Monthly Cost per Meter			**$139.89**	

The Town's 2015 expected water related revenue is less than the revenue expected from the recommended water rates. This analysis suggests that the Town is recouping approximately 89% of their waterworks related expenses. It is recommended that the Town review their current water rates to determine if a rate increase is required.

The Town has kept detailed, consistent records of all waterworks related cost components over the past five years. It is important for the Town to continue these good record keeping practices to help review and establish future water rates.

The foregoing analysis has been generated based on variable assumptions, and is intended to provide a limited basis to establish appropriate water rates. The Town should continue to monitor long term utility revenues, expenditures and reserve funding to see if water rates need to be revised.

15.0 Recommendations

Issues & Risks are those items which have potential to adversely affect the ability to supply safe drinking water. Recommendations are items of system improvement.

15.1 Issues & Risks

Issues & Risks are those items which have potential to adversely affect the ability to supply safe drinking water. Recommendations are items of system improvement.

15.1.1 Exterior Storm Door

Upgrades are required to the storm door and lock at the entrance to the original portion of the WPH to ensure that the building can be properly secured. The estimated cost is $3,000.

15.1.2 Reservoir No. 2 Access

EPO reports indicate that the gasket at the access to Reservoir No. 2 requires replacement. The Town must ensure that the access is properly sealed.

15.1.3 Reservoir Overflow Backflow Prevention

The overflow from Reservoir No. 1 to the sanitary sewer is required to be removed to eliminate a contamination hazard. The estimated cost is $1,000 (allowance for temporary pumping may be required). This can be coordinated with reservoir cleaning (see Section 15.2.3).

15.2 Recommended System Improvements

15.2.1 Standby Generator and Electric Standby Pump

A backup generator and a new electric standby pump are recommended to be installed in the expanded portion of the building.

The estimated cost for a 150 kW generator is $130,000. The estimated cost of a 60 hp electric standby pump (75.7 Lps, 1200 USgpm) is $50,000.

Additional upgrades would be required to accommodate this upgrade (e.g. building revisions for air intake, controls, etc.), however they are beyond the scope of this report.

15.2.2 Distribution Pump and Pressure Relief Upgrades

Pump No. 2 is recommended to be upgraded to match the capacity of Pump No. 1 when the generator is installed. The pressure relief valve must be upgraded at the same time. The estimated cost for both of these upgrades is $50,000.

15.2.3 Reservoir Cleaning

It is recommended that both reservoirs be cleaned. The estimated cost is $5,000 (allowance for temporary pumping may be required).

16.0 Conclusion

The Aberdeen WPH is generally in good condition however, there are a few upgrades/revisions required. The Town has been doing a good job of general pumphouse operation.

We trust that the foregoing report fulfills the requirements for this assessment. If you require further information, please contact our office.

"I, the undersigned, declare that the information contained within this submission is, to the best of my knowledge, complete and accurate, and has been prepared in accordance with the standard for this submission as published by the Saskatchewan Water Security Agency."

Respectfully submitted,

Catterall and Wright

Per:

David Fong, P.Eng.

Reviewed:

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Association of Professional Engineers & Geoscientists of Saskatchewan
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SASKATCHEWAN

Appendix A

Water Quality Data

Contents:

Table A.1 - Town of Aberdeen - Water Quality Analysis Results

	Units	Total THM	Annual Average
SDWQS MAC	mg/L		100
Date:			
	mg/L		
13-Jul-15	mg/L	48.1	
22-Apr-15	mg/L	54.3	47.3
19-Jan-15	mg/L	39.5	
15-Oct-14	mg/L	48.1	
14-Apr-14	mg/L	32.1	41.3
07-Jan-14	mg/L	43.6	
29-Oct-13	mg/L	47.7	
23-Jul-13	mg/L	59.0	47.0
22-Apr-13	mg/L	34.3	

Water quality data from www.saskh2o.ca, accessed October 23, 2015
SDWQS - Saskatchewan Drinking Water Quality Standards
MAC - Maximum Acceptable Concentration
For more detailed water quality info, refer to tests for City of Saskatoon

Appendix B

List of Plans, Reports and Manuals

Contents:

Table B.1 – List of Plans, Reports, and Manuals

Title	Consultant	Date	Comments/Description
Town of Aberdeen WTP Upgrade 1984	Catterall & Wright	1984	Reservoir expansion and plant upgrade
Town of Aberdeen Waterworks System Assessment	SAL Engineering Ltd.	2004	
WSA – Round 2	Catterall & Wright	2011	
EPO Reports		2010-2014	

Appendix C

Tables, Figures and Drawings

Contents:

Table C.1 - Town of Aberdeen - Water Usage

			Data		Calculated			Design Capacities†		
	Year	Estimated Population	Annual Water Use(m^3)	Peak Day (m^3)*	Average Day (m^3)	Peak Day Factor	Average Usage Per capita per day (Lpcd)	Supply Rate (Lps)	Distribution Pumping Rate (Lps)	Storage (m^3)
RECORDED DATA	2010	585	60,910	376	167	2.25	285	4.3	8	334
	2011	599	54,686	338	150	2.25	250	3.9	7.2	300
	2012	617	60,986	353	167	2.11	271	4.1	8	334
	2013	635	65,587	423	180	2.35	283	4.9	8.6	360
	2014	652	66,794	464	183	2.54	281	5.4	8.7	366
FORECAST/ ESTIMATE	2015	670	73,365	553	201	2.75	300	6.4	9.6	402
	2020	718	78,621	592	215	2.75	300	6.9	10.3	431
	2025	770	84,315	635	231	2.75	300	7.4	11	462
	2030	825	90,338	681	248	2.75	300	7.9	11.8	495
	2035	884	96,798	729	265	2.75	300	8.4	12.7	530
							Current	5.6	12.1	602

Estimated population based on Census Data from Statistics Canada and 1.4% future growth rate

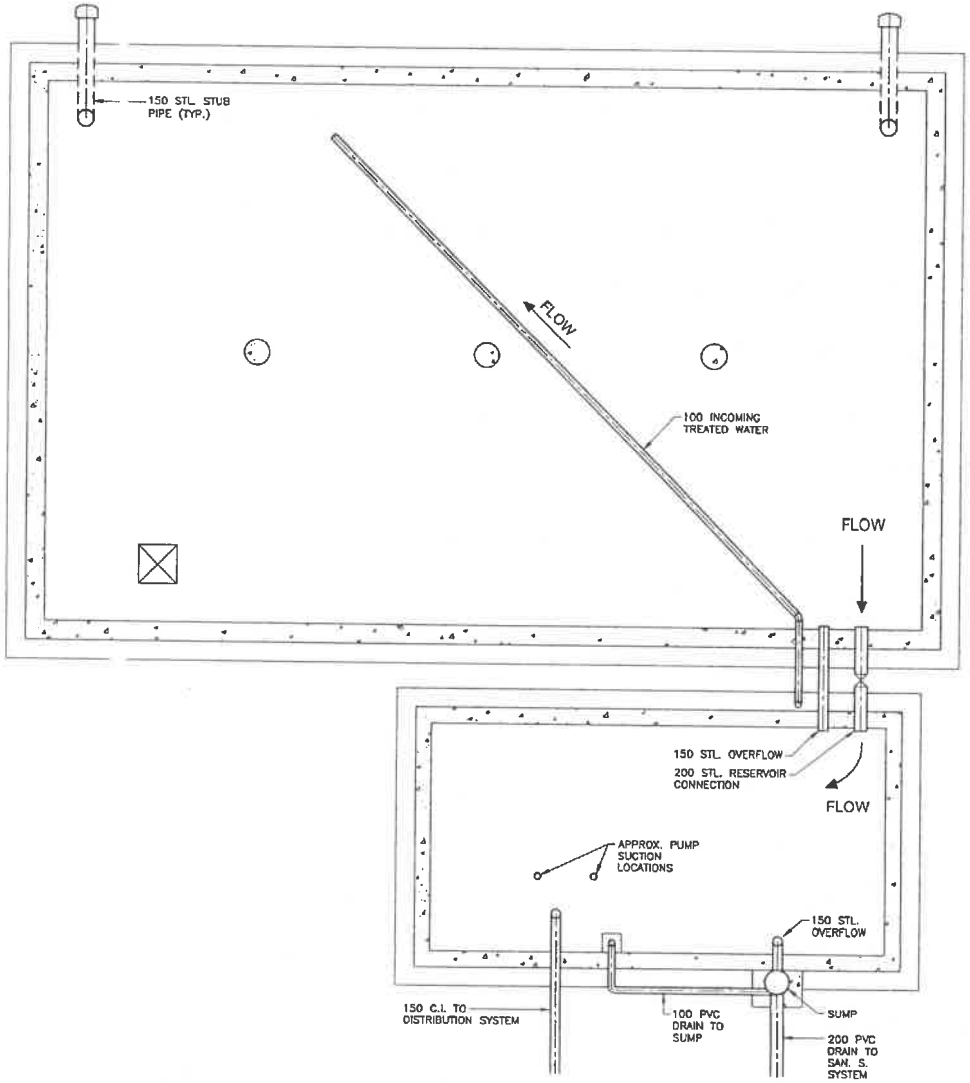
† As suggested by Saskatchewan Watershed Authority Community Water Use Records Report No. 27

Supply rate based on peak day use and 24 hour production day

Distribution pumping rate based on 4.13 times average day use

Storage based on 2 times average day use

Peak day unavailalbe for 2010-2011. Estimated using a peak day factor of 2.25



CATTERALL & WRIGHT
CONSULTING ENGINEERS
1221 - 8th Street East
SASKATOON SK S7H 0S5
Tel (306) 343-7280, Fax (306) 956-3199

SCALE VERIFICATION
WHEN DRAWING IS PLOTTED FULL SIZE THIS LINE IS 30mm IN LENGTH

DATE	REVISION

OWNER
TOWN OF ABERDEEN

LOCATION
ABERDEEN, SK

PROJECT
WATERWORKS SYSTEM ASSESSMENT ROUND 3

SHEET TITLE
RESERVOIR PIPING PLAN

SCALE	DESIGNED
1:75	
DRAWN	CHECKED
D.F.	S.M.
DATE	SHEET
	1 of 1

DRAWING NUMBER
FIG. C.1

Appendix D

Pictures

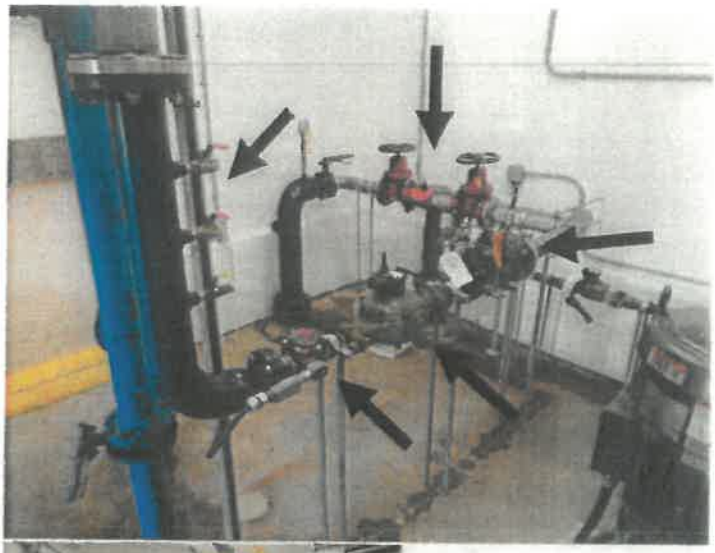


Photo 1

Water Supply Influent (Clockwise from back: backflow preventer, flow control valve, flow meter, solenoid fill valve, future chemical points of application)

Photo 2

Discharge to reservoirs

Photo 3

Distribution Pump No. 1 (left) and hydro pneumatic tank (right)

Photo 4
Pump No. 2 (electric and engine driven standby)

Photo 5
Reservoir No. 1 access – curb height extended to 150 mm

Photo 6
Reservoir No. 2 – exterior access

Photo 7
WPH exterior and
exterior Reservoir No. 2

Photo 8
Upgraded electrical

Photo 9
Highway 41 Utility
distribution pumps

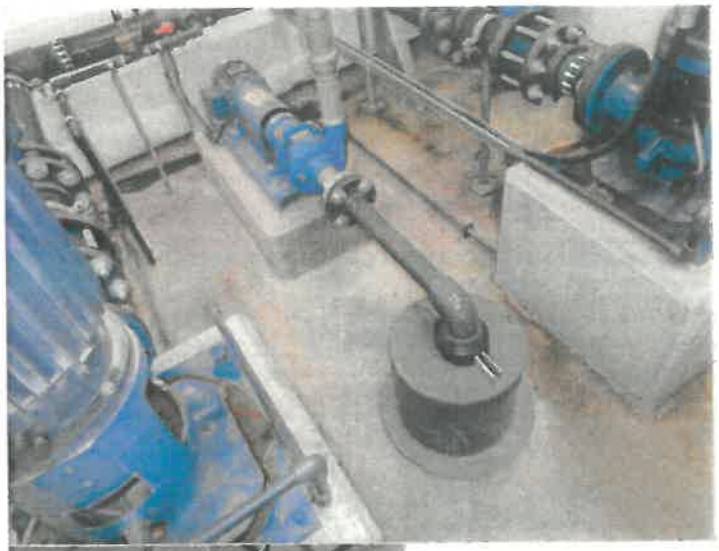


Photo 10
Truck fill pump

Photo 11
Clockwise from bottom: Truck fill backflow preventor, extension for air release (air release not shown), flow meter

Photo 12
Truck fill exterior

Photo 13
Water testing equipment

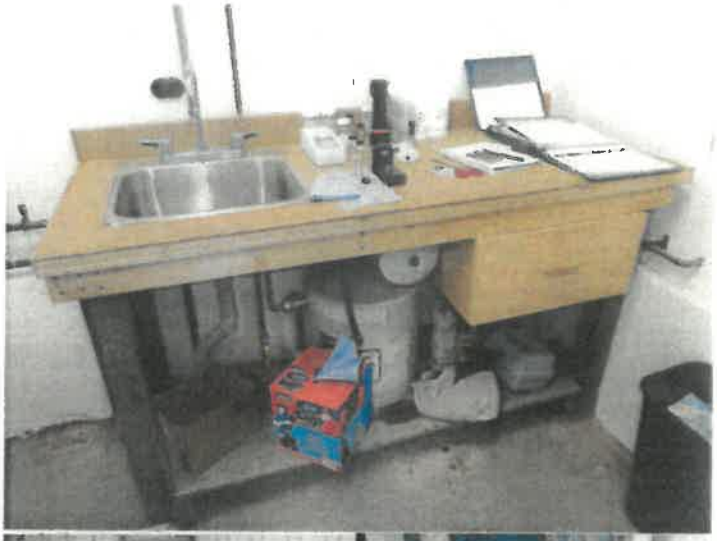


Photo 14
Work bench space

Photo 15
Building access to original portion of building

- Rotten door frame (right)

Appendix E

C*t Calculation – Not Required

Appendix F

Waterworks Cost Analysis

Contents:

Table F.1 - Operational and Maintenance Costs

	Fixed/ Variable	2010	2011	2012	2013	2014
Personnel						
Wages and Benefits	F	$95,438.62	$119,417.96	$130,659.60	$142,912.97	$149,150.02
		$95,438.62	$119,417.96	$130,659.60	$142,912.97	$149,150.02
Professional/Contractual Services						
Street Water Repairs	V	$5,710.10	$30,789.69	$4,536.35	$9,148.19	$1,495.00
Lab Testing	F	$3,063.40	$3,672.99	$2,631.25	$1,583.01	$2,241.41
		$8,773.50	$34,462.68	$7,167.60	$10,731.20	$3,736.41
Utilities						
Heat	F	$677.92	$686.73	$764.30	$733.71	$1,054.01
Power	V	$1,752.88	$6,200.00	$1,733.05	$1,199.86	$5,883.19
Telephone	F	$0.00	$0.00	$664.08	$377.50	$437.89
SaskWater Annual Connection Fee	V	$29,348.78	$40,625.00	$37,500.00	$37,500.00	$34,375.00
SaskWater Monthly Water Charges	V	$72,819.36	$105,051.80	$123,722.76	$141,127.14	$145,413.26
		$104,598.94	$152,563.53	$164,384.19	$186,938.21	$187,163.35
Maintenance, Materials and Supplies						
Repairs, Equipment and Meters	V	$28,147.86	$1,279.66	$6,154.36	$8,783.23	$8,312.01
Small Tools and Equipment	F	$327.46	$3,600.00	$90.00	$244.21	$152.38
WTP Repairs	F	$8,144.23	$459.69	$2,801.23	$325.14	$167.09
Chemicals	V	$2,129.80	$253.42	$110.00	$154.30	$687.10
		$38,749.35	$5,592.77	$9,155.59	$9,506.88	$9,318.58
Administration						
Conference Fees/Memberships	F	$675.08	$746.94	$1,162.03	$947.66	$2,088.26
Sask Water Project Costs	V	$53.78	$13,500.00	$0.00	$0.00	$0.00
Other Misc.	V	$32,002.79	$4,895.20	$71.00	$0.00	$0.00
WSA Reporting	V	$45.00	$4,725.60	$0.00	$0.00	$0.00
Utility Billing Software	F	$0.00	$1,223.78	$0.00	$0.00	$0.00
		$32,776.65	$25,091.52	$1,233.03	$947.66	$2,088.26
Total Fixed Costs		$108,326.71	$129,808.09	$138,772.49	$147,124.20	$155,291.06
Total Variable Costs		$172,010.35	$207,320.37	$173,827.52	$203,912.72	$196,165.56
Total Annual O&M Costs		$280,337.06	$337,128.46	$312,600.01	$351,036.92	$351,456.62

Appendix G

Waterworks System Assessment Checklist

Round 3 Waterworks System Assessment Summary

Waterworks: Aberdeen Waterworks | Owner(s): Town of Aberdeen

Env. Project Officer: Lee Reinhart | Summary Completion Date: 20-Apr-16

Population: Full Time: 670 | Seasonal:

Source: Groundwater: ☐ | Surface Water: ☐ | GUDI (groundwater under direct influence): ☐

Treated Groundwater: ☐ | Treated Surface Water: ☒ | Treated GUDI: ☐

Sourcewater Protection Concerns: N/A

Source/Raw Water Quality Issues that May Affect Treatment/Treated Water Quality:

Parameter:	Level:	Parameter:	Level:

Raw water capacity/allocation:

Treated/Distributed Water Quality Issues (any that exceed Standards and Objectives after treatment):

Parameter:	Level:	Parameter:	Level:

List of Chemicals Used:

Description of Treatment Processes in Place:

The Town receives treated water from SaskWater and distributes to the community.

Treatment Processes with existing issues (including capacity issues):

Other issues identified within the waterworks:

- Building exterior door and lock require upgrades to ensure that building can be adequately secured.
- Reservoir No. 2 *may* require a replacement gasket at the access. Town to confirm if completed.
- The Reservoir No. 1 overflow to the sanitary sewer requires removal.
- Pump No. 2 and pressure relief valve are recommended to be upgraded at the time of the generator installation.
- Reservoir cleaning is recommended.

Major Recommendations:

- New backup generator and standby pump are recommended.

Any Recommendations that may pose an Immediate Health Concern:

- The Reservoir No. 1 overflow to the sanitary sewer requires removal.

Total Cost of Recommended Upgrades: $240,000.00

Other Comments: - Total Cost of Recommended Upgrades does not include an allowance for temporary pumping. Generator and standby pump costs are included, however any further costs related to the proposed upgrades are not included as they are beyond the scope of this report.

*Please submit electronic copy to WSA. If more space is required, a longer summary sheet may be requested.