



Annual
Water
Report

2013



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1.0 Introduction

The Town of Oliver operates an extensive Municipal and Rural water system which consists of seven ground water well sites, two surface water sources, and three reservoirs. See Appendix A.

The Town provides domestic water to approximately 2,255 residential and 247 commercial/ industrial connections and also provides irrigation water to approximately 585 connections irrigating over 3,900 acres of farmland and 175 Acres of non-farm land within the Town of Oliver and a substantial portion of Area 'C' of the Regional District of Okanagan Similkameen.

All domestic connections, other than those still receiving canal water in the summer months, are now metered. There are 46 customers in the summer of 2013 receiving canal water for domestic use.

2.0 History

The Liberal Premier of BC, "Honest" John Oliver, helped create, "The Soldiers' Settlement Plan", known as, "The Soldiers Land Act", following the First World War in 1918. This plan was implemented to provide immediate and long term economic opportunities to the soldiers by making land available to them at a reasonable cost.

The challenge for the government was to make the arid rangeland viable by constructing an irrigation system to create thousands of farmable acres. The irrigation project was named the South Okanagan Lands Irrigation Project.

The "ditch" as it is known was completed in 1923 running 40 kilometres in length to transport irrigation water from one side of the valley to the other, transforming the arid desert into blossoming orchards and farms.

In 1963 the premier, W.A.C. Bennett, passed the responsibility for the irrigation system from the province to a committee of growers called the South Okanagan Land and Irrigation District (SOLID.) The system was operated by SOLID until 1989 when the Towns of Oliver and Osoyoos assumed control of the system.

On the dissolution of SOLID, in order to give rural water customers a continued voice in the operation of the local water system, two water councillor positions were created by bylaw.

3.0 System Overview

As part of the water distribution system, the Town maintains approximately 138 kilometres of water main.

The distribution system is made up of asbestos concrete (AC), polyvinyl chloride (PVC), cast iron (CI), high density polyethylene (HDPE) pipe materials, with pipe sizes ranging from 50mm to 600mm diameter.

The age of the water mains range from new to approximately 48 years old. The age of the pipe does not necessarily reflect the need to replace it as the various material types and installation conditions make for different average life expectancies.

The majority of the Town's rural water system is twinned with the exception of part of System 1 north of Town and part of System 2/Black Sage. System 1 is discussed under 8.2.1, Phase 3 Twinning Project, but there are currently no plans to complete twinning in System 2. The water system is still referred to by system numbers one through seven, however; the domestic water system is also referred to as Rural North, Municipal, Rural South and Black Sage.

The Town uses ground water for its main source of domestic water, with the only exception being a portion of System 1 customers north of Oliver who have not been twinned yet; these customers still receive surface water in the summer months but are slated to receive domestic ground water through the last twinning project in 2014, leaving only irrigation customers on the canal water.

Normal operating pressures range from 60psi to 120psi for standard pressurized services. Our irrigation system also has a number of low pressure users who pump out of the irrigation canal with their own pump houses.

3.1 Irrigation System

Surface water, specifically Okanagan River, is still the primary source for the irrigation water system, but also includes Buchanan well, Fairview well and Black Sage oxbow. The canal system runs from McIntyre Dam (where the diversion is complete with a fish screen) north of Town to Road 18 south of Town, where it continues past Road 22 as a piped system. The irrigation system in System 2B is supplied by the Black Sage oxbow, with the remainder of System 2 not being twinned. The Town maintains a number of water licences to allow these surface water diversions.

From the canal system, Mud Lake pump house is the first of five pump houses along the canal and serves the System 1 irrigation area north of Town. Chlorination occurs at this pump station as some customers are still using this for domestic water.

The second pump station along the system is Rockcliffe Irrigation in System 4, south of the Municipal boundaries. System 4 also includes a 25,000 US gallon (94 cubic metres) irrigation water reservoir.

The third pump station along the system is Fairview irrigation pump station in System 5. System 5 includes a 50,000 US gallon (189 cubic metres) irrigation water reservoir. There is also Fairview Irrigation well in System 5 which used to be part of the domestic water system but was switched over to the irrigation system when the nitrate levels exceeded the Canadian Drinking Water Standards. Its primary use now is to supply water in the shoulder seasons or low demand portions in the irrigation year but it can also help supplement peak demands.

Hester Creek irrigation pump station is located in System 6.

Mt Kobau irrigation pump station is the most southern in the water system, in System 7.

Only part of the Black Sage area has a separate irrigation system known as System 2B, while the rest of the area, known as System 2, irrigates with domestic ground water. The area that is twinned uses Black Sage pump station supplied by Black Sage oxbow for irrigation supply.

2013 irrigation season started on April 11th and ended October 14th. Crews began filling the canal and turning on spray fillers April 8th. The canal diversion was shut down on October 31th. All Town irrigation systems were shut down and winterized in October.

3.2 Domestic System

The domestic water system storage capacity is 1,025,000 US gallons (3880 cubic metres) between four reservoirs. Existing municipal reservoirs consist of a 360,000 US gallon (1360 cubic metre) reservoir and a newer (constructed in 2010) 500,000 US gallon (2470 cubic metre) reservoir. The other two reservoirs still in use are located in System 6a; Road 13 reservoir at 150,000 US gallons (568 cubic metres) and Hester Creek reservoir at 15,000 US gallons (57 cubic metres).

The rural area north of Town (System 1) is only partly twinned. Mud Lake pump house as described in the above section is treated with chlorine because it services both domestic and irrigation customers. The twinning work in this area began in 2011 and is scheduled for completion in 2014, see 8.2.1, Phase 3 Twinning Project for more detail.

During the summer months, CPR well has previously been used to supplement the water supply but was not used this year because of the increased uranium levels. Lions well has also not been used for years because of the unacceptable uranium levels.

There are three wells at Tucelnuit, of which only #2 and #3 are used to supply the domestic system. Rockcliffe well is also a major supplier of domestic water to the Municipal System.

Airport Booster station is typically set to supply water from within the municipal boundaries to the rural area south but can also be used to bring water from the Rural Area South to the Municipal system.

There are three Black Sage domestic wells accessed from the River dyke supplying the Black Sage area or System 2. They can also be used to supplement the rest of the rural domestic system south of Town.

Miller well is used to supply the Road 13 reservoir and supplement (up to 500 gallons per minute) the Black Sage or System 2 area during peak demand.

There is also a booster pump station (for System 6A) that helps elevate domestic water to an area including Road 13 and Pallay Drive.

3.3 SCADA (Supervisory Control and Data Acquisition)

The Town utilizes a SCADA system to monitor and control many functions at a number of the pump stations and reservoirs. This system allows the Water Operators to monitor demand, reservoir levels and turn pumps on/off. The Operator can change set points and monitor some aspects of the system remotely. For more detail on the extent of the SCADA system, see Appendix K.

4.0 Routine Maintenance Program

Fire hydrants are inspected and flushed annually.

Water main flushing program is done annually. True Engineering is working on a unidirectional flushing program for the domestic system within the municipal boundaries.

The Town does not currently have a formalized valve exercising program but this would be included in the unidirectional flushing program for the domestic system within the municipal boundaries.

Annual pump testing is completed on all pumps for preventative maintenance. The tests include load testing motors, checking bearings, inspection of motor controls and auxiliary equipment such as fans, sump pumps and heaters.

Most wells and pump stations are inspected daily. The reservoirs have intrusion alarms and are inspected monthly to ensure the site and structure are secure.

5.0 Water Quality

Oliver has hard water which contains calcium and magnesium compounds. Hard water can cause pipes to fur up and scale to collect in kettles, electric irons, and washing machines, wearing them out sooner and making them less efficient. Many residents have purchased water softeners. Water softeners use either potassium chloride or sodium chloride. Potassium chloride is a naturally occurring mineral essential for human health and contributes to plant vigor and soil stability where sodium chloride is not suitable for people on sodium restricted diets, and can adversely affect plants and build up in the soil, rendering it less able to sustain plants. The Town encourages the use of Potassium chloride in home water softeners because all wastewater is reclaimed, treated and used for irrigation.

In Town the average hardness is 240 mg/L or ppm between the municipal wells but can vary depending on the source. The rural domestic water ranges from 159 at Black Sage #1 to 373 at Black Sage #3. The hardness in the water system fluctuates depending on which wells are being pumped and location.

5.1 Well Assessment/ Protection Plan

The Town received an Assessment of Groundwater Under the Direct Influence of Surface Water (GWUDI) report from Western Water Associates Ltd in 2012. The report indicates that Buchanan, Miller, Tucelnuit, and Black Sage #2 and #3 wells are low GWUDI risk while CPR, Lions and Black Sage #1 wells are moderate GWUDI risk requiring further sampling. CPR and Lions are no longer used in the domestic water system. Completion of a ground water protection plan is slated for 2014, see 8.3.1, Ground Water Protection Plan for more detail.

5.2 Disinfection

Permanent chlorination systems are set up at all domestic pump houses except for Black Sage. In 2012, Black Sage experienced intermittent coliform hits throughout the summer months, so in May 2013 the Town installed a temporary hypo-chlorination pump injection system at Black Sage. The temporary set up failed in June and could not be repaired until July. A capital project to provide a permanent solution to this is scheduled to begin in the fall of 2013, see 8.2.3, Black Sage Wells Chlorine Contact Time for more detail.

Upgrades to the chlorination and contact time were also completed at Tucelnuit and Rockcliffe pump houses. See 8.1.1, Tucelnuit Hypo-chlorination Building & Equipment and 8.1.2, Rockcliffe Domestic Chlorine Residual Improvements for more detail.

5.3 Monitoring Program

Those customers north of Town (in System 1) not yet twinned on the west side of Okanagan River were sent notices on April 15th of a boil water notice due to increased turbidity, (equal to or greater than 5 Nephelometric Turbidity Units or NTU.) Those customers remained on boil water notice for the remainder of 2013 since once turbidity subsided; there were intermittent coliform counts even after that system was switched to municipal ground water in October.

A water main break on Lakeside Drive resulted in a boil water notice being issued for all in Town customers on April 5th, removed April 11th.

System 2 customers were put on a boil water notice June 21st after the temporary hypo-chlorination injection system at Black Sage wells broke down and low coliform count resulted. The boil water notice was rescinded on July 12th once repairs had been made and backup equipment was in place. Black Sage well was shut down October 31st with System 2 being supplied from the Municipal System for the winter months.

Turbidity resulting from construction work in the Hollow area also required a boil water notice to be issued for in Town and customers to the north of Town on August 15th, terminated on August 29th.

5.3.1 Bacteriological

The Drinking Water Protection Regulation requires that water suppliers monitor for Total coliforms and Escherichia coli (E-coli) in the drinking water system. Total coliforms are a group of bacteria commonly found in soil and vegetation, as well as the intestines of mammals. Total coliform bacteria are not likely to cause illness, but their presence indicates that the water may be vulnerable to contamination by more harmful microorganisms. E-coli is also found in the intestines of mammals but it's presence in the water indicates recent fecal contamination and may indicate the possible presence of disease-causing pathogens.

There are four test stations located in the Municipal boundaries. The rural area north of Town has one test site for canal water during the summer months. There are eight testing sites south of Town. See Appendix D for details.

Municipal staff take weekly water samples for bacteriological testing of Total Coliforms and E-coli at various sites throughout the water system. See Appendix E for test results.

If a water sample is found to contain the presence of coliform, standard protocol is to flush and resample the water immediately at the same

location and resubmit for testing by the lab. We also complete in house presence/absence tests.

Interior Health is consulted in deciding course of action by the purveyor any time a sample shows the presence of coliform or any other abnormality.

5.3.2 Nitrate / Nitrite Sampling

Although nitrates can occur naturally, they can also occur via leaching into groundwater from manure or fertilizer application. High levels in drinking water can have adverse health effects, particularly for infants. Health Canada's maximum acceptable concentration (MAC) for nitrate in drinking water is 45 milligrams per litre (mg/l).

On approximately February 1, April 1, June 1, October 1, and December 1 of each year, samples are to be drawn from various wells and analysed for *Nitrates / Nitrites*. (Note: the intent is to sample for Nitrate / Nitrites every second month, however, the analysis for August will be included in the annual sample.) See Appendix F for results.

The University of Saskatchewan, Department of Geological Sciences, took water samples from Fairview irrigation well and Rockcliffe domestic well in October 2013 to test for Tritium and Helium which allows them to determine the nitrate residence times in the groundwater.

5.3.3 Trihalomethane Sampling

Trihalomethanes (THMs) are chemical compounds that can be formed when water is disinfected with chlorine. THMs occur when chlorine reacts with organic matter in water. Because of this it is most common in surface water. The Canadian drinking water guideline for total THMs is 100 micrograms of THMs per litre ($\mu\text{g/L}$.)

On approximately August 1 of each year, a sample is to be drawn at the Mud Lake pump station and tested for THM's. Typically, this is to be done in the summer when the organic loading is high. See Appendix F for results.

5.3.4 Uranium

Uranium is a naturally occurring element commonly found in soil and rocks. Groundwater dissolves minerals that contain uranium. High levels of Uranium in drinking water can cause kidney damage because of the heavy metal characteristics. The Canadian drinking water guideline for uranium is 0.02 milligrams per litre (mg/l).

In previous years, CPR well was flushed into Okanagan River continuously in the spring to flush out high concentrations of uranium so that the water source could be used to supplement the Municipal System during the increased demand of summer. Over the last few years, the amount of pumping required to lower the uranium levels versus the amount of time the well could be utilized to supplement has diminished to the point where it is no longer practical.

5.3.5 Annual Full Spectrum Sampling

On approximately August 1 of each year an annual sample will be drawn from two to three well site(s) or the raw canal water. The intent is that every source will be tested in a maximum five year rotation. They are to be analysed for the following:

General Parameters:

Fluoride	Nitrite	Hardness
PH	Colour	Sulphate
Chloride	Conductivity	Total Alkalinity
Nitrate (NO2)	Turbidity	Total Dissolved Solids

Metals:

Aluminium	Cobalt	Nickel
Arsenic (low level)	Copper	Potassium
Barium	Iron	Selenium (low level)
Boron	Lead (low level)	Silver
Cadmium	Magnesium	Sodium
Calcium	Manganese	Vanadium
Chromium	Molybdenum	Zinc

All of the data from the above analysis is recorded in a spreadsheet, and includes comparisons of the results with the standards set in the Canadian Drinking Water Guidelines which is available in Appendix G.

5.3.6 Turbidity Monitoring Program

Turbidity in the surface water is continuously monitored throughout the irrigation season at Mud Lake pump station through SCADA and the results are available in Appendix H.

6.0 Water Use

The Town pumped 810,940,720 US gallons of ground water in 2013, and 2,680,614,814 US gallons of surface water. On the domestic water side, maximum daily water demand peaked at 5,508,142 US gallons on July 26th, while minimum daily demand occurred on

December 13th at 617,845 US gallons. Domestic water use averaged 2,073,405 US gallons per day or 250 US gallons (946 litres) per person based on a population of 8,297. (2011 BC Stats data of 4,824 for Oliver and 3,473 for Area C.) Average daily use per person in the Okanagan is 178 US gallons (675 litres), while in Canada it is 87 US gallons (329 litres) per the Okanagan Water Basin Board, supply and demand project.

Figure 1 – Five Year Trend of Total Domestic Water Pumped

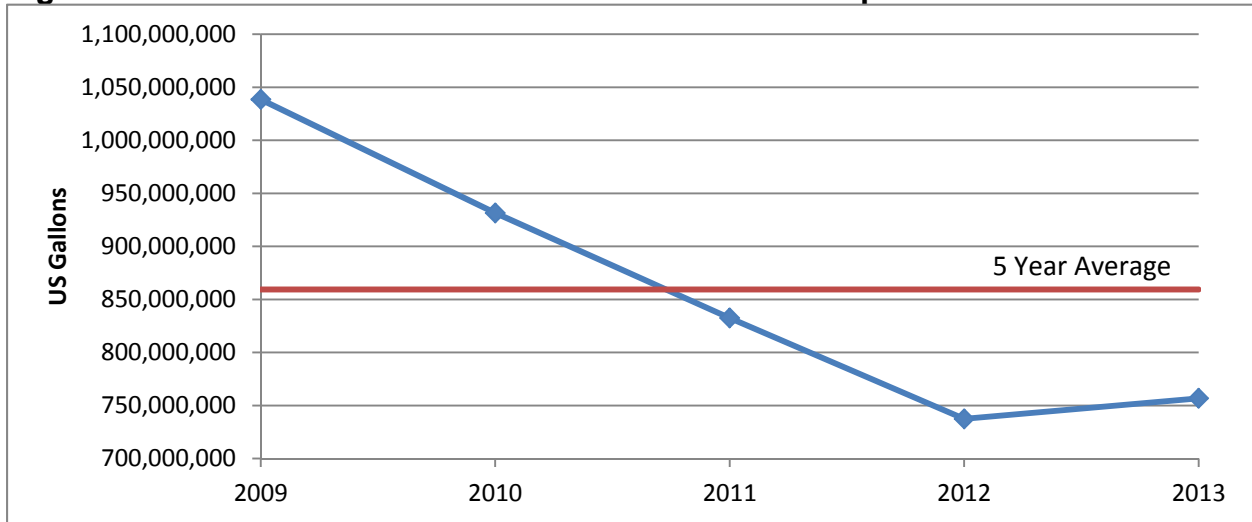
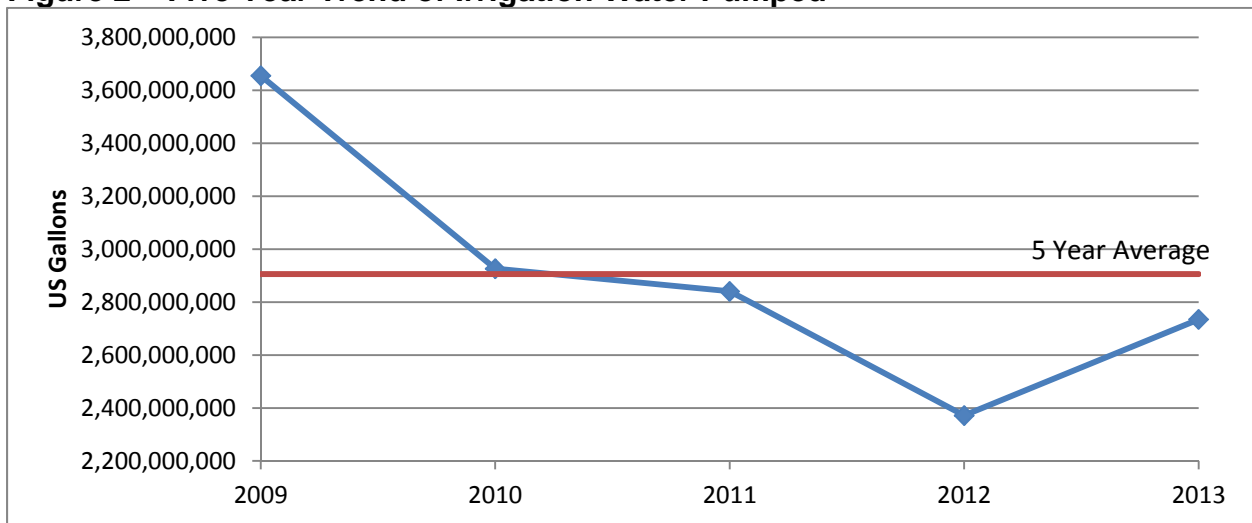


Figure 2 – Five Year Trend of Irrigation Water Pumped



7.0 Staff

According to EOCP (Environmental Operator Certification Program), Oliver’s water distribution system is a class III. Public Works has six certified Water Distribution Operators; Two level I, four level II, and one level IV. One staff member began water operator training in April 2013 at Public Works with a view to succession planning.

All Operators are required to keep up their education and to maintain 2.4 certified education units (CEU's) every two years. Various accredited courses were put on at the Town regarding safe work practices.

8.0 Capital Projects & Improvements

8.1 Completed in 2013

8.1.1 Tucelnuit Hypo-chlorination Building & Equipment

This project incorporates a new chlorination building at Tucelnuit domestic well site and is attached to the existing well #3 building. It consists of a new on-site hypo chlorination generator that converts salt into a chlorine solution which is injected into the domestic water system for basic water treatment against bacteria. The project consisted of full construction of the building extension, new equipment and electrical/control work.

8.1.2 Rockcliffe Domestic Chlorine Residual Improvements

With recent upgrades for chlorine contact time and adding a hypo chlorination pump at Rockcliffe well a couple years ago, further improvements were undertaken at the pump house in 2013. This included moving the injection pump and salt storage into a separate chlorine room, installing a ventilation system and improving alarm controls for the SCADA.

8.1.3 Manganese Pilot Project – Miller Well

This project consisted of utilizing Miller well as the primary source of drinking water from January to May, testing and placing monitoring equipment in an effort to define the level of biological removal of manganese that may be required. Manganese is a naturally occurring metal in soils and can cause a black residue/by-product when mixed with chlorine treatment; the higher levels of chlorine used, the more of the black residue materializes in the drinking water. It is currently classed as an aesthetic problem and not considered harmful to health.

8.1.4 MOTi Canal Box Culvert Upgrade – Highway 97

As part of the four laning project done North of Gallagher Lake, the Ministry of Transportation and Infrastructure (MOTi) replaced a section of the Town's irrigation canal system under the highway. The structure was replaced and widened with 160 concrete box culverts laid two wide, tied into the canal system on either side. This project was completed before the 2013 irrigation season started.

8.1.5 Repair and Restore Section of Irrigation Canal

The canal was constructed over 90 years ago, upgrades and repairs are done before the beginning of each irrigation season. Annually a section of canal is restored; in 2013 approximately 300 metres (1,000 feet) of canal, located east of Nk'Mip Canyon Desert Golf Course was rehabilitated which involved pressure washing, new rebar along the floor and walls, shot-creting the walls, pouring concrete and re-finishing the canal floor.

8.1.6 Hester Creek Pump Station Upgrades

This pump station was improved with electrical upgrades and installation of more controls for the SCADA system.

8.1.7 Hollow Street Area Upgrades

This project was a total infrastructure upgrade for the; Hollow Street, Hillside Street, Veterans Avenue area. The scope of the project included replacement of water and sewer mains, services to property line and road upgrades. This infrastructure was nearing its end life and the existing water main infrastructure was under sized in some areas for proper fire protection, which has now been upgraded.

8.2 Projects Started in 2013 & Completing in 2014

8.2.1 Phase 3 Twinning Project

A separate domestic water system for the Oliver Rural Area supplied from groundwater was started in 2007. This was the third and final phase of the twinning projects and comprised of approximately 5 km of water distribution main and 46 domestic services, located in System 1, north of Town. These were the last customers receiving surface water supplied by Mud Lake pump station for domestic purposes during the irrigation season. They will now receive domestic chlorinated groundwater year round. The Town received grant money to help fund this project.

8.2.2 Flume 3 Irrigation Canal Upgrade

The flume was in desperate need of repair that was put off from 2012 because the bid costs received were over budget to complete the project. It was re-tendered in 2013 and work started in November. The flume will receive upgraded carrier beams to help with the structural component of our highest flume. It will also receive a new 40 mil linear low-density polyethylene liner (LLDPE) over the existing metal that carries the water

and should help with leaks. This work will extend the life of the structure which serves as a main component on the canal system.

8.2.3 Black Sage Wells Chlorine Contact Time

Construction began in the winter of 2013 on an oversized (750mm Ductile Iron) pipe to allow adequate “chlorine contact time” for our domestic water customers in the Black Sage area, System 2 and 2B. This is to ensure that chlorine has enough time to kill bacteria before the drinking water reaches our first customers. It also includes construction of an addition to an existing pumphouse for chlorination equipment and to add controls and monitoring to the SCADA system. These wells can also serve as back-up to the rest of the domestic water system (Road 13 Reservoir). The Town has received grant money to help fund this project.

8.2.4 Buchanan Wells & Directional Drilling (Domestic & Irrigation)

This work started in the winter of 2013 and involves drilling two wells, one is a 355mm (14 inch) diameter to supplement the domestic water supply in System 1, north of Town and Municipal in-Town and the other is a 250mm (10 inch) diameter well to maintain the irrigation component of supplying irrigation water in the shoulder irrigation season and during peak demands. A hypo-chlorine generation system will be included to treat the domestic water. A 350mm 355mm (14 inch) pipe will be directionally drilled under the Okanagan River from the east side to the west to complete System 1 domestic supply to the west side of Okanagan River. The Town has received funding to help towards the development of the wells.

8.3 Proposed for 2014

8.3.1 Ground Water Protection Plan

A consultant will be contracted to prepare a report and plan as required by the Interior Health Authority (Conditions on permit). It will include risk characterization, stakeholder collaboration, establishment of achievable protection zones around each well head and screening land-use planning tools that protect groundwater water. The Town has worked with a consultant in applying for grant money to help with the project, which will carry over into 2015 before completion.

8.3.2 Rockcliffe Irrigation Pumphouse Improvements

Electrical upgrades and improvements are slated at this pumphouse which will include new ‘soft starts’ installed on the pumps to replace the old

equipment (which parts are no longer available for), instrumentation for the SCADA system and some wiring upgrades.

8.3.3 Repair and Restore Section of Irrigation Canal

Another section of the concrete canal system will be restored, located north of our Rockcliffe Irrigation pumphouse, encompassing approximately 250 metres (800 feet) of wall and a small section of floor.

8.3.4 Infrastructure Upgrade in Alley behind Firehall Bistro

The sewer requires replacement and upgrading the existing AC water main at the same time would be cost efficient. Services will also be replaced to property line.

8.4 Long-term Plans for Improvements

The Town has a 5 year budgeted capital plan for anticipated upgrades, new infrastructure and projects that may be deferred from the current budget to later years. Some of these projects would include:

- Additional domestic water treatment and water quality solutions at various sites;
- Water main and service upgrades (various areas including McGowan Subdivision);
- Kootenay Street and Main Street alley infrastructure upgrade;
- Future domestic water main looping at the head of Tucelnuit Lake;
- Irrigation canal upgrades;
- Station Street water main upgrade;
- Electrical control improvements at various sites;
- Possible reservoir expansion or control improvements for water System 4;
- Black Sage Domestic well site variable-frequency drive (VFD) motor upgrade for 100 horse power pump; and
- 6A Booster Station SCADA controls.

9.0 Emergency Response Plan

The Town has an Emergency Response Plan pertaining to the water system. The Emergency Response Plan identifies a number of potential emergencies that could occur and provides a systematic approach on how the Town will deal with the emergency; the plan was last updated May 2012.

10.0 Cross Connection Control Program

The Town's Cross Connection Control Program continues to work towards addressing the potential for the water system to be compromised by service connections which could introduce contaminated water into the Municipal water system.

The program focuses on premise isolation for commercial and industrial customers. In 2013, there are 246 testable assemblies in service (including agricultural devices) being tracked.

11.0 Water Conservation

The Town has worked towards providing public information and education for water conservation. The Town is a contributing partner in the 'Make Water Work' campaign with the Okanagan Basin Water Board (OBWB), which is a valley wide awareness campaign. The Town also participated in the 'Tap by Tap' sponsored by Fortis BC which provided free, easy to install water conserving faucet fixtures.

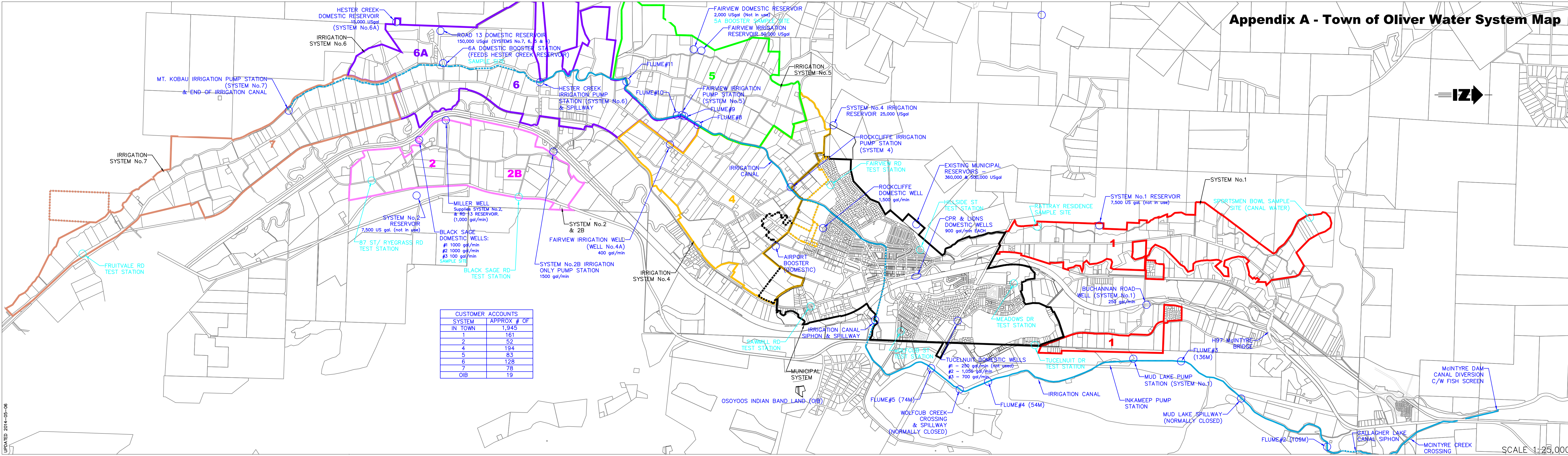
The continued twinning, phase three in System 1, is also part of the water conservation plan. All properties that are twinned then have their domestic water metered and are charged for consumption.

12.0 Conclusion

The Town of Oliver works hard to maintain water quality and quantity for their residence as well as numerous customers in Regional District Area 'C'. Efforts are made to ensure appropriate water usage and provide public education whenever possible. Without these ongoing efforts, the area would not be the robust agricultural community that it is today.

If you have any comments regarding this report or other information that you would like to see included, please email works@oliver.ca or request a customer concern form at the Town Hall.

Appendix A - Town of Oliver Water System Map



SYSTEM	APPROX # OF IN TOWN
1	161
2	52
4	194
5	83
6	128
7	78
OIB	19

SCALE 1:25,000

UPDATED 2014-05-06

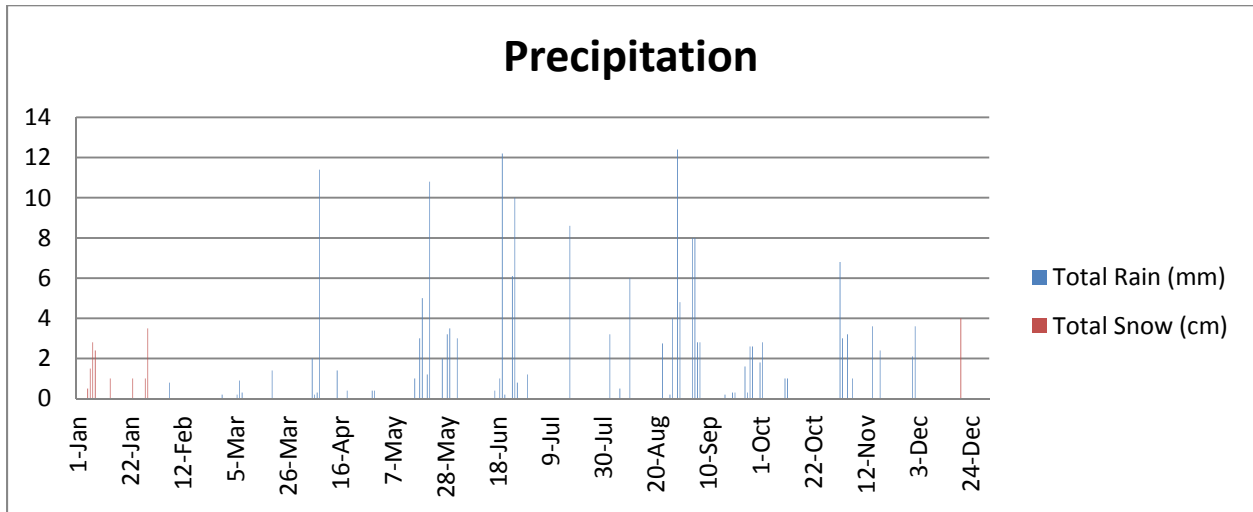
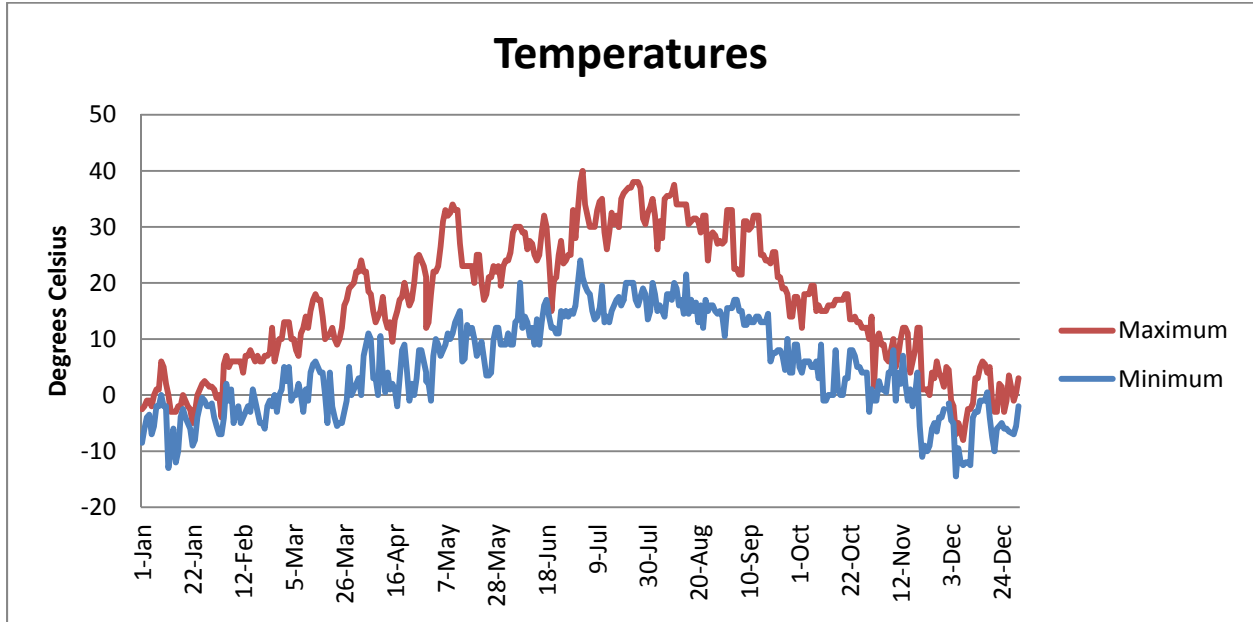
Appendix B – Water Use Data (US Gallons)

GROUND WATER SOURCES													
MONTH	Scada	Scada	Scada	Scada	Scada	TOTAL	Log	Scada+Log	TOTAL	Log	GRAND TOTALS		
	CPR & LIONS PARK PS'S	ROCKCLIFFE DOMESTIC PS	TUCELNUIT PS 2	TUCELNUIT PS 3	MILLER RD RD 13		4,5,6,7	BUCHANAN ROAD PS *		BLACK SAGE DOM PS		FAIRVIEW IRR WELL	Sys 5A
	Mun	Mun	Mun	Mun	Mun		Sys 1	Sys 2		Sys 5A			
	used for DOMESTIC	used for DOMESTIC	used for DOMESTIC	used for DOMESTIC	used for DOMESTIC		used for BOTH	used for BOTH		used for BOTH		used for AGRICULTURAL	
January	0	6,801,406	6,424,208	0	13,596,866	26,822,480	0	0	0	0	26,822,480		
February	0	233,849	843,019	0	24,148,700	25,225,568	0	0	0	0	25,225,568		
March	0	678,812	7,421,953	0	24,093,700	32,194,465	0	0	0	0	32,194,465		
April	0	7,671,506	18,607,755	0	8,882,800	35,162,061	2,923,000	5,800,152	8,723,152	3,060,000	46,945,213		
May	0	21,762,980	17,785,707	10,056,311	8,016,800	57,621,798	923,000	32,709,905	33,632,905	8,105,000	99,359,703		
June	0	1,438,647	21,593,657	27,589,479	8,706,100	59,327,884	1,676,000	31,703,289	33,379,289	12,823,000	105,530,172		
July	0	9,756,714	36,381,105	29,150,965	10,839,300	86,128,085	0	60,118,267	60,118,267	7,394,000	153,640,351		
August	0	14,650,661	41,244,054	8,416,437	9,315,100	73,626,253	0	45,774,226	45,774,226	11,688,000	131,088,478		
September	0	13,796,440	22,701,650	23,083	6,116,300	42,637,473	2,539,000	20,265,396	22,804,396	6,482,000	71,923,869		
October	0	11,284,603	4,353,619	7,162,502	5,551,500	28,352,225	11,332,000	26,409,496	37,741,496	4,596,000	70,689,721		
November	0	10,130,689	1,268,010	12,228,664	0	23,627,363	0	0	0	0	23,627,363		
December	0	11,811,407	8,755,193	3,310,635	16,100	23,893,335	0	0	0	0	23,893,335		
TOTALS	0	110,017,715	187,379,931	97,938,077	119,283,266	514,618,989	19,393,000	222,780,731	242,173,731	54,148,000	810,940,720		
Max Flow	0	21,762,980	41,244,054	29,150,965	24,148,700	86,128,085	11,332,000	60,118,267	60,118,267	12,823,000	153,640,351		
Min Flow	0	233,849	843,019	0	0	23,627,363	0	0	0	0	23,627,363		
Avg Flow	0	9,168,143	15,614,994	8,161,506	9,940,272	42,884,916	1,616,083	18,565,061	20,181,144	4,512,333	67,578,393		

*Meter only read on a periodic bass

SURFACE WATER SOURCES							
MONTH	Scada	Scada	Log	Scada	Scada	Log	TOTAL
	MUD LAKE PS	ROCKCLIFFE IRR PS	FAIRVIEW IRR PS	HESTER CREEK PS	MT KOBAN PS	BLK SAGE IRR PS	
	Sys 1	Sys 4	Sys 5	Sys 6	Sys 7	Sys 2B	
	used for BOTH	used for AGRICULTURAL	used for AGRICULTURAL	used for AGRICULTURAL	used for AGRICULTURAL	used for AGRICULTURAL	
January	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0
April	18,354,122	42,476,632	17,620,000	15,690,696	13,530,650	3,841,814	93,159,793
May	65,763,636	144,284,317	68,959,000	55,666,018	62,437,012	17,488,811	348,835,158
June	74,824,730	154,666,840	67,713,000	53,492,498	54,700,869	22,412,543	352,985,750
July	146,299,143	265,589,143	124,064,000	131,310,975	121,308,425	37,748,512	680,021,054
August	100,163,679	193,507,760	93,338,000	89,633,766	80,777,558	28,027,260	485,284,345
September	30,530,178	76,621,030	27,230,000	13,943,890	31,425,672	7,913,230	157,133,822
October	22,900,020	40,489,776	31,111,000	10,944,952	18,753,643	3,060,014	104,359,385
November	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0
TOTALS	458,835,507	917,635,498	430,035,000	370,682,795	382,933,828	120,492,186	2,221,779,307
Max Flow	146,299,143	265,589,143	124,064,000	131,310,975	121,308,425	37,748,512	680,021,054
Min Flow	0	0	0	0	0	0	0
Avg Flow	38,236,292	76,469,625	35,836,250	30,890,233	31,911,152	10,041,015	185,148,276

Appendix C – Climate Data from Oliver Sewage Treatment Plant



Appendix D – Bacteriological Sampling Sites:

Municipal System

Civic Address	Name of Site	Description of Sample Port
Across from 1080 Fairview Road	Fairview TS	Test Station
7084 Tucelnuit Drive	Tucelnuit TS	Test Station
7030 Meadows Drive	Meadows Drive TS	Test Station
6521 Hillside Street	Hillside TS	Test Station
892 McKinney Road (in back alley)	Wolfcub TS	Test Station
5829 Sawmill Rd	Sawmill TS	Test Station

Rural North

Sys. No.	Civic Address	Name of Site	Description of Sample Port
1	352 Sportsmens Bowl Road	Sportsmens	Blow-off Stand Pipe
1	497 Nettle Rd	Ratray	Residential hose bib

Rural South

Sys. No.	Civic Address	Name of Site	Description of Sample Port
2	4480 Ryegrass Road	Ryegrass TS	Test Station
2	Black Sage Rd / Orchard Grove Ln	Blacksage TS	Test Station
2	Parcel A, Plan 37485 (87th Street)	Black Sage Well #1 (125 HP)	Discharge manifold valve
2	Parcel A, Plan 37485 (87th Street)	Black Sage Well #2 (100 HP)	Discharge manifold valve
2	Parcel A, Plan 37485 (87th Street)	Black Sage Well #3 (15 HP)	Discharge manifold valve
5	Road 5 / Lot 992 Plan 22065	5A Booster Station	Suction manifold valve
6	Road 13 / Mariposa Road (Canal)	6A Booster Station	Pump bleed-off valve
7	3598 Fruitvale Way	Fruitvale TS	Test Station

Nitrate:

Sys. No.	Civic Address	Name of Site
Municipal	715 Skagit Avenue	Rockcliffe Domestic Pump Station
Municipal	Block A, Plan KAP2133 (Merlot Avenue)	Tucelnuit Pump Station – Pump #2
Municipal	Block A, Plan KAP2133 (Merlot Avenue)	Tucelnuit Pump Station – Pump #3
1	Parcel 3, Plan KAPA1432 (Buchanan Drive)	Buchanan Road Pump Station
2	202 Miller Road	Miller Road Pump Station
4	Lot 1, Plan KAP4116 (Corner of Road 5 & Highway 97)	Fairview Irrigation Pump Station
2	Parcel A, Plan 37485 (Ryegrass Road)	Black Sage Domestic Pump Station – well # 3
1	Highway 97	Canal

Appendix E – Chlorine Residual and Coliform Test Results
(Target 0.2 to 1.50 Chlorine Residual)

DATE	RURAL NORTH UN-TWINNED				BLACK SAGE				RURAL SOUTH														MUNICIPAL					
	System #1				System #2				System #4				System #5				System #6				System #7				Groundwater Source			
	Surface Water Source				Groundwater Source				Ground Water Source				Groundwater Source				Groundwater Source				Groundwater Source				Groundwater Source			
	Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli	
Jan 2nd																low	6A Booster	<1	<1					0.00	Fairview	<1	<1	
Jan 7th												0.16	5A Booster	<1	<1									0.24	Tucelnuit	<1	<1	
Jan 15th																0.17	6A Booster	<1	<1					0.03	Hillside	<1	<1	
Jan 21st					0.06	Miller Rd	<1	<1				0.25	5A Booster	<1	<1									0.04	Meadows	<1	<1	
Jan 28th																0.21	6A Booster	<1	<1					0.05	Fairview	<1	<1	
Feb 4th												0.00	5A Booster	<1	<1									0.28	Hillside	<1	<1	
Feb 12th																0.12	6A Booster	<1	<1					0.00	Tucelnuit	<1	<1	
Feb 18th																0.05	6A Booster	<1	<1					-	Fairview	<1	<1	
Feb 25th																0.17	6A Booster	<1	<1					0.20	Hillside	<1	<1	
Mar 4th												low	5A Booster	<1	<1									0.14	Meadows	<1	<1	
Mar 11th																								0.12	Tucelnuit	<1	<1	
Mar 18th																								0.06	Wolfcub	<1	<1	
Mar 25th												0.20	5A Booster	<1	<1									low	Fairview	<1	<1	
April 2nd																0.11	6A Booster	<1	<1						Hillside	<1	<1	
April 8th												0.07	5A Booster	<1	<1									0.43	Meadows	<1	<1	
																								0.14	Fairview	<1	<1	
April 9th																								0.43	Tucelnuit	<1	<1	
																								0.46	Wolfcub	<1	<1	
April 10th																								0.58	Meadows	<1	<1	
																								0.14	Fairview	<1	<1	
April 15th																0.04	6A Booster	<1	<1					0.42	Meadows	<1	<1	
April 22nd	0.20	Rattray	63	<1								0.06	5A Booster	<1	<1									0.34	Tucelnuit	<1	<1	
Apr 25th	0.29	Rattray	<1	<1																								
Apr 29th	0.50	Sportsmens	<1	<1	0.10	Black Sage TS	<1	<1																0.16	Wolfcub	<1	<1	
			BG >200																									
May 6th	1.69	Rattray	1	<1	0.10	Ryegrass TS	<1	<1																0.10	Fairview	<1	<1	
May 13th	1.69	Sportsmens	<1	<1												0.09	6A Booster	<1	<1	0.03	Fruitvale TS	<1	<1	0.20	Fairview	<1	<1	
May 22nd	1.40	Sportsmens	710	<1	0.12	Black Sage TS	3	<1				0.07	5A Booster	<1	<1									0.28	Tucelnuit	<1	<1	
			BG >200																									
May 27th	0.36	Sportsmens	<1	<1	0.07	Black Sage TS	<1	<1								0.03	6A Booster	<1	<1					0.31	Hillside	<1	<1	
June 3rd	0.63	Sportsmens	<1	<1	0.00	Well (100 HP)	<1	<1				0.13	5A Booster	<1	<1									0.40	Wolfcub	<1	<1	
					0.17	Ryegrass TS	<1	<1																				
June 10th	1.87	Sportsmens	<1	<1												0.18	6A Booster	<1	<1	0.22	Fruitvale TS	<1	<1	0.24	Fairview	<1	<1	
June 17th	0.97	Sportsmens	21	<1	0.18	Black Sage TS	8	<1				0.16	5A Booster	<1	<1									0.35	Hillside	<1	<1	
June 20th					0.14	Black Sage TS	4	<1																				
June 24th	Hi	Sportsmens	380	<1	0.24	Black Sage TS	<1	<1								0.13	6A Booster	<1	<1					0.36	Meadows	<1	<1	
			BG >200		0.00	Well (100 HP)	<1	<1																				
June 25th					0.14	Black Sage TS	<1	<1																				
					N/A	Well	<1	<1																				
June 26th					0.12	Black Sage TS	1	<1																				
					N/A	Well (100 HP)	<1	<1																				

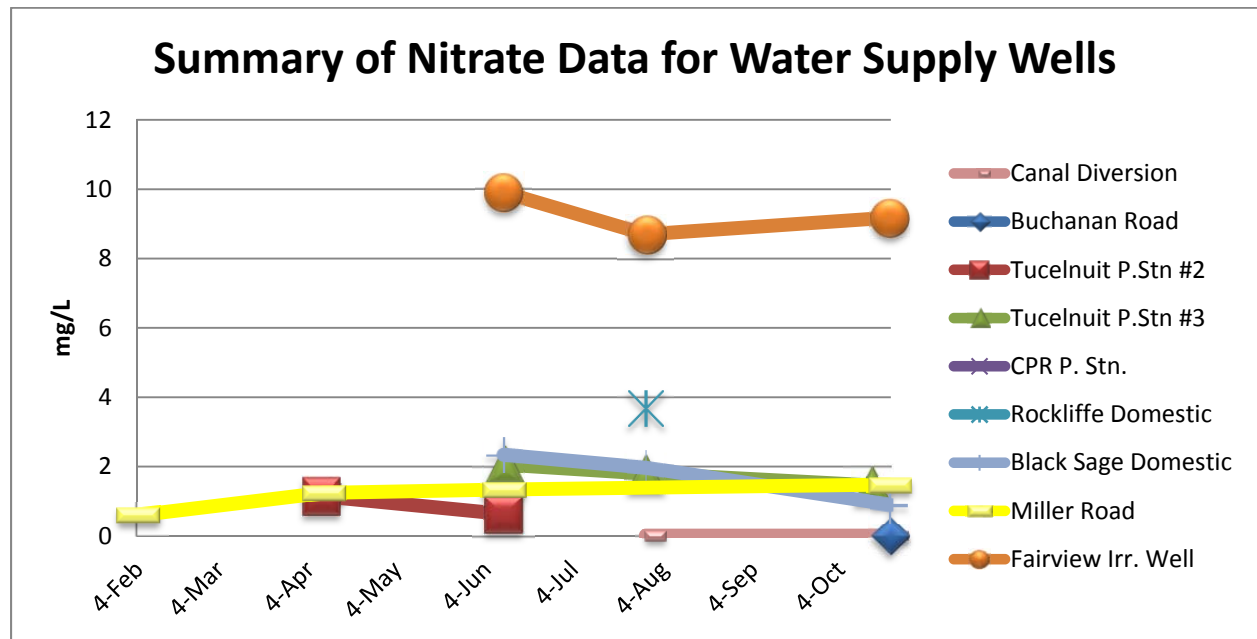
DATE	RURAL NORTH UN-TWINNED				BLACK SAGE				RURAL SOUTH														MUNICIPAL						
	System #1				System #2				System #4				System #5				System #6				System #7				Groundwater Source				
	Surface Water Source				Groundwater Source				Ground Water Source				Groundwater Source				Groundwater Source				Groundwater Source				Groundwater Source				
	Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		Chlorine Residual	Sample Location	Coliform Total Ecoli		
July 2nd					0.10	Black Sage TS	<1	<1					0.15	5A Booster	<1	<1									0.46	Tucelnuit	<1	<1	
					N/A	Well	<1	<1																					
July 3rd	0.81	Sportsmens	OG	OG	0.16	Black Sage TS	<1	<1																					
July 4th					0.18	Black Sage TS																							
July 8th	1.10	Sportsmens	<1	<1	0.15	Black Sage TS	<1	<1									0.17	6A Booster	<1	<1					0.36	Fairview	<1	<1	
					N/A	Well	<1	<1																					
July 15th	1.08	Sportsmens	<1	<1	0.26	Ryegrass TS	<1	<1					0.14	5A Booster	<1	<1					0.15	Fruitvale TS	<1	<1	0.52	Hillside	<1	<1	
July 22nd	1.29	Sportsmens	<1	<1	0.18	Ryegrass TS	<1	<1									0.13	6A Booster	<1	<1					0.42	Meadows	<1	<1	
July 29th	1.20	Sportsmens	1	<1	0.15	Black Sage TS	<1	<1													0.20	Fruitvale TS	<1	<1	0.34	Wolfcub	<1	<1	
August 6th	1.64	Sportsmens	6	<1		Ryegrass TS	<1	<1					0.11	5A Booster	<1	<1									0.06	Fairview	<1	<1	
August 12th	1.59	Sportsmens	<1	<1	0.13	Ryegrass TS	<1	<1					0.02	5A Booster	<1	<1									0.19	Hillside	<1	<1	
August 19th	1.89	Sportsmens	<1	<1	0.12	Black Sage TS	<1	<1													0.10	Fruitvale TS	<1	<1	0.32	Hillside	<1	<1	
																									0.45	Meadows	<1	<1	
August 20th																									0.23	Hillside	<1	<1	
August 21st																									0.34	Hillside	<1	<1	
August 22nd																									0.46	Hillside	<1	<1	
August 26th	1.64	Sportsmens	<1	<1	0.15	Black Sage TS	<1	<1					0.01	5A Booster	<1	<1									0.40	Hillside	<1	<1	
																									0.40	Tucelnuit	<1	<1	
Sept 3rd	1.52	Sportsmens	<1	<1	0.38	Ryegrass TS	<1	<1													0.08	Fruitvale TS	<1	<1	0.36	Wolfcub	<1	<1	
																									0.37	Hillside	<1	<1	
Sept 9th	0.18	Sportsmens	520	<1	0.34	Black Sage TS	<1	<1									0.12	6A Booster	<1	<1					0.28	Fairview	<1	<1	
Sept 16th		Sportsmens	32	<1	0.51	Ryegrass TS	<1	<1														Fruitvale TS	<1	<1			Hillside	<1	<1
Sept 23rd	1.62	Sportsmens			0.53	Black Sage TS							0.13	5A Booster											0.03	Meadows			
Sept 30th	0.77	Sportsmens	<1	<1	0.20	Ryegrass TS	<1	<1									0.18	6A Booster	<1	<1					0.45	Vineyard	<1	<1	
Oct 7th																													
Oct 15th	1.09	Sportsmens	<1	<1	0.31	Ryegrass TS	<1	<1					0.09	5A Booster	<1	<1									0.28	Hospital	<1	<1	
Oct 21st	0.13	Sportsmens	>35	<1	0.11	Black Sage TS	<1	<1									0.10	6A Booster	<1	<1					0.17	Rockcliffe	<1	<1	
Oct 24th						Black Sage TS	<1	<1																					
Oct 28th	0.03	Sportsmens	>200	<1	0.10	Ryegrass TS	<1	<1													0.09	Fruitvale TS	<1	<1	0.05	Hillside	<1	<1	
Nov 12th	0.01	Sportsmens	>67	<1									0.17	5A Booster	<1	<1									0.41	Vineyard	<1	<1	
Nov 18th	0.16	Sportsmens	22	<1													0.17	6A Booster	<1	<1					0.25	Wolfcub	<1	<1	
Nov 19th	0.11	Sportsmens	>21	<1																									
Nov 20th	0.10	Sportsmens	>35	<1																									
Nov 21st	0.13	Sportsmens	>24	<1																									
Nov 25th	0.16	Sportsmens	2	<1									0.24	5A Booster	<1	<1									0.17	Sawmill	<1	<1	
Dec 2nd	0.09	Sportsmens	<1	<1													0.05	6A Booster	<1	<1					0.34	Fairview	<1	<1	
Dec 9th	0.15	Sportsmens	<1	<1									0.05	5A Booster	<1	<1									0.11	Hillside Rd	<1	<1	
Dec 10th	0.10	Sportsmens	<1	<1																									
Dec 16th																	0.27	6A Booster	<1	<1					0.40	Meadows	<1	<1	
Dec 17th		Sportsmens	<1	<1																									
Dec 30th	0.22	Sportsmens	<1	<1													0.15	6A Booster	<1	<1					0.41	Wolfcub	<1	<1	

Appendix F – Nitrate, and Trihalomethanes Sampling Results

Nitrates:

Date	Canal Diversion	Buchanan Road	Tucelnuit P.Stn #2	Tucelnuit P.Stn #3	Rockliffe Domestic	Black Sage Domestic	Miller Road	Fairview Irr. Well
4-Feb							0.60	
8-Apr			1.15					
9-Apr							1.24	
10-Jun			0.63	2.06		2.34	1.34	9.91
29-Jul	0.01			1.80	3.70	1.97		8.70
15-Oct				1.46				
21-Oct	0.01	0.01				0.90	1.48	9.18

*Maximum acceptable concentration per Canadian Drinking Water Guidelines is 10



Annual Trihalomethanes or THM (mg/L):

Date	Sample Site	Result
Aug 19	Sportsmen Bowl	0.060

*Canadian Drinking Water Guideline recommends maximum of 0.1

Appendix G – Full Spectrum Analysis Results

Parameter			In-Town (1)						Rural (2)					
			CPR Well	Rockcliffe	Tucelnuit 2	Tucelnuit 3	Black Sage 1	Black Sage 2	Black Sage 3	Buchanan	Fairview Irr.	Miller Road	Canal Intake	
			Domestic	Domestic	Domestic	Domestic	Both	Both	Both	Both	Irrigation	Domestic	Irrigation	
Guide-line	Unit	Aug 8, 2011	July 29, 2013	Aug 8, 2011	July 29, 2013	Aug 1, 2012	Aug 1, 2012	Apr 19, 2010	Apr 20, 2010	Sept 23, 2009	July 29, 2013	Aug 8, 2011		
Alkalinity, Total as CaCO3	-	mg/L	194	243	187	197	149	180	300	130	280	234	108	
Chloride	≤250	mg/L	10.9	14.7	5.79	14.3	5.37	6.9	11.4	3.96	16	8.34	3.81	
Fluoride	1.5	mg/L	0.43	0.34	0.45	0.36	0.12	0.11	0.26	0.32	0.27	0.3	0.15	
Nitrogen, Nitrate as N	10	mg/L	0.23	3.75	0.52	1.78	0.379	0.824	3.18	0.01	9.06	1.42	<0.01	
Nitrogen, Nitrite as N	1	mg/L	<0.01	<0.010	<0.01	<0.010	<0.01	<0.01	nt	nt	<0.002	<0.010	<0.01	
Sulfate	≤500	mg/L	64.6	54.7	35.6	50.8	nt	nt	94	25.3	90	66.4	25.7	
Colour, True	≤15	TCU	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	8	
Solids, Total Dissolved	≤500	mg/L	317	376	253	310	211	274	449	166	470	346	156	
Turbidity	Varies	NTU	0.3	<0.1	<0.1	<0.1	nt	nt	0.2	<0.1	0.14	<0.1	0.7	
pH	6.5 to 8.5	pH Units	8.18	7.92	8.12	8.03	7.86	7.92	7.98	8	8.1	7.95	8.12	
Conductivity (EC)	-	uS/cm	501	633	412	530	378	456	703	293	776	595	263	
Hardness, Total (as CaCO3)	-	mg/L	206	303	176	241	159	204	373	145	395	295	109	
Nitrogen, Nitrate+Nitrite as N	-	mg/L	nt	3.75	nt	1.78	nt	nt	nt	nt	nt	1.42	nt	
Aluminum	≤0.1	mg/L	0.008	<0.005	0.008	<0.005	<0.005	0.005	0.005	0.008	0.0007	<0.005	0.028	
Antimony	0.006	mg/L	0.0001	0.0002	0.0001	<0.0001	nt	nt	nt	nt	nt	0.0001	<0.0001	
Arsenic	0.01	mg/L	0.0043	0.0018	0.0031	0.0033	0.0008	0.0008		<0.0005	0.00072	0.0033	<0.0005	
Barium	1	mg/L	0.093	0.058	0.055	0.076	0.039	0.046	0.061	0.0488	0.0905	0.081	0.022	
Beryllium	-	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	nt	nt	nt	nt	nt	<0.0001	<0.0001	
Bismuth	-	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	nt	nt	nt	nt	nt	<0.0001	<0.0001	
Boron	5	mg/L	0.036	0.077	0.021	0.04	0.032	0.049	0.104	0.007	0.141	0.077	0.011	
Cadmium	0.005	mg/L	0.00005	0.00002	0.00001	<0.00001	0.00006	0.00003	<0.00001	<0.00001	0.000019	0.00002	0.00001	
Calcium	-	mg/L	56.5	82.4	48	67.3	37.9	48	90.7	39.7	114	68.9	29.6	
Chromium	0.05	mg/L	<0.0005	0.0006	0.0008	0.0006	<0.0005	<0.0005	0.0019	0.0016	0.0006	<0.0005	<0.0005	
Cobalt	-	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.0001	0.00005	0.000176	<0.00005	0.00007	
Copper	≤1	mg/L	0.0195	0.002	0.0126	0.0035	0.0258	0.011	0.0035	0.0018	0.0703	0.0051	0.0031	
Iron	≤0.3	mg/L	0.03	<0.01	<0.01	<0.01	<0.01	0.01	0.1	0.05	0.016	<0.01	0.03	
Lead	0.01	mg/L	0.0011	<0.0001	0.0002	<0.0001	0.0018	0.0016	0.0003	0.0001	0.0117	0.0006	<0.0001	
Lithium	-	mg/L	0.0053	0.0086	0.0062	0.0081	nt	nt	nt	nt	nt	0.0065	0.0031	
Magnesium	-	mg/L	15.8	23.6	13.6	17.7	15.7	20.4	35.5	11	27.1	29.8	8.46	
Manganese	≤0.05	mg/L	0.174	<0.0002	0.0012	<0.0002	0.0196	0.0053	0.0003	0.0597	0.00403	0.0866	0.0056	
Mercury	0.001	mg/L	<0.00002	<0.00002	<0.00002	<0.00002	nt	nt	<0.00005	<0.00005	nt	<0.00002	<0.00002	
Molybdenum	-	mg/L	0.0127	0.005	0.0055	0.0036	0.0068	0.0049	0.0077	0.0035	0.00506	0.0052	0.0034	
Nickel	-	mg/L	0.0005	0.0005	0.0003	0.0003	0.0009	0.0006	0.0028	0.0011	0.00188	0.0007	0.0005	
Phosphorus	-	mg/L	0.02	<0.020	0.03	0.042	nt	nt	nt	nt	nt	<0.020	<0.02	
Potassium	-	mg/L	5.19	5.27	3.56	4.55	3.55	4.14	6.34	2.79	5.79	5.35	2.08	
Selenium	0.01	mg/L	0.0018	0.0022	0.0015	0.0046	<0.0005	0.001	0.0031	<0.0003	0.00631	0.0036	<0.0005	
Silicon	-	mg/L	9.3	9.8	8.9	11.4	nt	nt	nt	nt	nt	10.6	2.6	
Silver	-	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.000021	<0.00005	<0.00005	
Sodium	≤200	mg/L	23.2	17.4	15.1	21.5	13.8	16	21	11.2	18.8	15.4	10.2	
Strontium	-	mg/L	0.709	0.872	0.557	0.772	nt	nt	nt	nt	nt	0.838	0.247	
Sulfur	-	mg/L	nt	17	nt	16	nt	nt	nt	nt	nt	21	nt	
Tellurium	-	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	nt	nt	nt	nt	nt	<0.0002	<0.0002	
Thallium	-	mg/L	<0.00002	0.00002	<0.00002	<0.00002	nt	nt	nt	nt	nt	<0.00002	<0.00002	
Thorium	-	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	nt	nt	nt	nt	nt	<0.0001	<0.0001	
Tin	-	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	nt	nt	nt	nt	nt	<0.0002	<0.0002	
Titanium	-	mg/L	<0.005	<0.005	<0.005	<0.005	nt	nt	nt	nt	nt	<0.005	<0.005	
Uranium	0.02	mg/L	0.0236	0.0106	0.00454	0.00754	0.00311	0.00546	0.0093	0.00186	0.014	0.00619	0.00211	
Vanadium	-	mg/L	0.003	<0.001	0.002	0.001	0.002	0.002	<0.001	<0.001	0.0005	<0.001	0.001	
Zinc	≤5	mg/L	0.026	<0.004	<0.004	<0.004	0.036	0.013	0.004	0.01	0.0069	0.014	0.009	
Zirconium	-	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	nt	nt	nt	nt	nt	<0.0001	<0.0001	

Appendix H – Turbidity Records
(Monitored by Scada at #1 Mud Lake Pump Station)

Date	April	May	June	July	August	September	October
1	0.0	2.8	1.4	1.6	0.8	0.7	0.7
2	0.0	2.7	1.4	1.6	0.8	0.7	0.8
3	0.0	2.5	1.4	1.2	0.8	0.7	0.7
4	0.0	2.2	1.5	7.1	0.8	0.7	0.8
5	0.0	1.9	1.3	7.5	0.7	0.7	0.7
6	0.0	3.5	1.1	1.2	0.8	0.4	0.8
7	0.0	6.5	1.3	1.2	0.8	0.1	0.7
8	0.0	10.1	1.4	1.2	0.7	0.3	0.8
9	0.0	10.1	1.3	1.2	0.8	0.1	0.8
10	0.0	10.0	1.3	1.1	0.8	0.1	0.7
11	0.1	8.4	1.4	1.0	0.7	0.7	0.7
12	0.1	6.2	1.3	1.2	0.7	0.8	0.7
13	0.2	5.0	1.4	1.1	0.8	0.8	0.7
14	1.7	4.6	1.3	0.6	0.7	0.8	0.7
15	1.9	3.8	1.2	1.0	0.7	0.8	0.7
16	2.0	3.3	1.1	1.2	0.6	0.8	0.5
17	1.9	2.9	1.2	1.1	0.7	0.8	0.2
18	1.9	2.6	1.3	1.0	0.8	0.9	0.1
19	1.7	2.5	1.4	1.0	0.7	0.9	0.1
20	1.6	2.3	1.2	1.0	0.8	0.9	0.0
21	1.6	2.1	1.2	0.9	0.8	0.9	0.0
22	1.6	5.0	2.0	1.0	0.8	0.8	0.0
23	1.7	7.6	1.4	0.8	0.7	0.8	0.0
24	1.7	2.0	1.5	0.8	0.7	0.8	0.0
25	1.5	1.6	0.4	0.8	0.8	0.8	0.0
26	1.2	1.3	0.1	0.8	0.8	0.7	0.0
27	1.5	1.7	0.1	0.7	0.8	0.8	0.0
28	1.9	1.9	1.3	0.7	0.7	0.4	0.0
29	2.5	1.7	1.9	0.9	0.9	0.3	0.0
30	2.5	1.7	1.7	0.8	0.8	0.7	0.0
31		0.6		0.8	0.8		0.0
MAX	2.0	10.1	2.0	7.1	0.9	0.9	0.8
MIN	0.0	0.6	0.1	0.7	0.6	0.1	0.0

Appendix J – Well Details

Groundwater Source	Depth (m)	Diameter (cm)	Pump rate (US gpm)	Notes
Buchanan irrigation well	34.75	20.32	250	Used to supply System No.1 in the shoulder seasons.
Tucelnuit domestic well #1	14.02	20.32	n/a	Not in use, no pumps.
Tucelnuit domestic well #2	14.32	30.48	1,050	
Tucelnuit domestic well #3	13.72	25.40	700	
Lions Park domestic well	25.90	15.24	900	Not used because of uranium levels.
CPR domestic well	15.20	15.24	900	Rarely used because of uranium levels.
Centennial Park	25.90	15.24	n/a	Not in use, no pumphouse. Hydrocarbons.
Rockcliffe domestic well	24.4	40.64	1,500	
Fairview Irrigation well	42.67	20.32	400	Was removed from the domestic system when nitrate levels became too high. Is used to supplement the irrigation system.
Miller domestic well	17.98	30.48	1,000	Supplies System 2 and Road 13 Reservoir. High manganese levels.
Black Sage domestic well #1	33.53	40.64	1,000	
Black Sage domestic well #2	33.53	40.64	1,000	
Black Sage domestic well #3	33.22	20.32	100	

Appendix K – SCADA Details

MUNICIPAL SYSTEM	CONTROLS
Municipal Reservoirs (2)	Levels, security (hatches), temperatures
Rockcliffe domestic pump station	Pump hours & starts, well levels, pump controls, totalized flows, station pressure, chlorine residual, alarms for low level & low discharge flow, room temperatures, security
Tucelnuit sells #2 & #3	Pump hours & starts, well levels, pump controls, totalized flows, station pressure, alarms for low level & low discharge flow, high/ low discharge pressures, security
CPR & Lions	Pump hours & starts, well level, totalized flow and security
Airport booster station	Pump starts, flow (into Town & into rural), pressure c/w high & low set points, reservoir start & stop levels on municipal and Rd 13 reservoirs, pump suction, room temperatures, security

RURAL SYSTEM	CONTROLS
Diversion	Gate controls, river levels, up & down stream levels, high flow alarms, fish screen (vfd speed, different level, cycle timer & number of cycles)
Mud Lake pump station	Canal level, check gate, pump start & stops, chlorine residual, turbidity, pressure, flow, low & high level alarms, level control, voltage, power & current for MCC, security
Syphon	Canal level, flow, low & high alarms, gate and security
Rockcliffe irrigation pump station	Canal level, pump controls, totalized flows, pressure, Rockcliffe reservoir level, alarms for low & high canal level, check gate, sump level, security
Flume 6 & 7	Canal level, high level alarm & shutdown, kiosk temperature with high & low alarm
Fairview irrigation pump station	Pump hours & starts, totalized flows, station pressure, Fairview reservoir level, sump level
Hester Creek pump station	Pump hours & starts, canal levels, pump controls, totalized flows, station pressure, low & high level alarms, security
Mount Kobau pump station	Pump hours & starts, totalized flows, station pressure, security
Black Sage irrigation pump station	Pump hours & starts, oxbow level with alarm & shutdown, totalized flows, station pressure, alarms for low level & discharge flow, pressure control for vfd, room temperatures, security
Black Sage domestic pump station	Pump hours & starts, totalized flows, station pressure, room temperatures, security
Miller Road domestic pump station	Pump hours & starts, Rd 13 reservoir level, pump controls, system 2 flow, system 6 & 7 flow, station pressure, chlorine residual, NaOCl generator pumps & tank levels, room temperatures, security

FLOW METERS & PRV CHAMBERS	CONTROLS
Road No. 1	Flow (totalize & system), kiosk temperature, pressure (Municipal & Rural sides)
Road No.2	Flow (totalize & system), kiosk temperature, pressure (Municipal & Rural sides)
Vineyard Rd	Flow (totalize & system), kiosk temperature, pressure (Municipal & Rural sides)
System 1 PRV	Flow (totalize & system), kiosk temperature, pressure (Municipal & Rural sides)