2016 Annual Water Report

EXECUTIVE SUMMARY

The Town of Oliver operates an extensive Municipal and Rural water system that consists of seven ground water well sites, two surface water sources, and three reservoirs. The water system covers the Town of Oliver itself and a substantial portion of area 'C; of the Regional District of Okanagan-Similkameen. The Town provides domestic water to approximately 2,393 residential and 174 commercial/ industrial connections, which are all metered. Irrigation water is also provided to 601 connections irrigating approximately 5,200 acres of farmland with 1,025 acres of that pumping their own water from the Town's irrigation canal, excluding 455 acres of non-farm land that is also irrigated from this system.

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1.0 INTRODUCTION

The British Columbia Drinking Water Protection Act requires that each municipal government that supplies or distributes domestic drinking water must provide a water quality report that is reviewed by the local Drinking Water Officer, and published for public access. This report has been prepared for the community of the Town of Oliver, and in accordance with the requirement in the Drinking Water Protection Act.

1.1 HISTORY

In 1918, the Provincial Government, led by "Honest John Oliver", the Premier at this time, purchased over 22,000 acres of land in the South Okanagan to develop an irrigation canal system to convert 8,000 acres of desert land on each side of the Okanagan River into viable agricultural land. This land would then be for sale, at a reasonable cost, designated to the soldiers returning from World War I. This land arrangement was known as the "The Soldiers' Land Act." This project then became SOLP (South Okanagan Lands Project)

Construction of the irrigation system, including the intake dam at the base of McIntyre Bluff, began in 1918. Over the next seven years, the canal, known as "The Ditch", had an overall length of approximately 40 concrete-lined kilometres measuring 5.6m across the top, and 1.5m deep, delivering 6.5m^3 of water per second. The SOLP designed the canal to transport irrigation water from one side of the Valley to the other. To accomplish this, a 2.1m diameter siphon made out of wood stave pipe had to be built underground, which ran approximately 590m long directly beneath the center of Oliver, connecting the North and South parts of the canal.

Over the next forty years, the canal was maintained and run by the provincial government employees (SOLP), until the spring of 1964, as the province decided it was removing itself from the irrigation business. Premiere W.A.C. Bennet passed the canal to the Oliver and Osoyoos Fruit Growers' Association, which volunteered itself to become the cornerstone of the South Okanagan Lands and Irrigation District (SOLID). The district operated and maintained the canal system until 1989 when it was divided into two municipal governments: the Town of Oliver and the Town of Osoyoos. The Town of Oliver was passed along the responsibility to maintain and operate the canal, which is still a major contributor to the rest of the 100 billion liters of water that Oliver and Osoyoos delivers annually to the parched desert area of the valley.

Today, the Town of Oliver provides domestic water to approximately 2,393 residential (including rural), and 174 commercial and industrial connections. Irrigation water is also provided to 601 connections which is irrigating approximately 5,200 acres of farmland with 1,025 acres of that pumping their own water from the Town's irrigation canal. 455 acres of non-

farm land is also irrigated from this system. The change in the non-farm arable area from previous years is due to a change in the new Water Regulations Bylaw 1351 where customers previously received a half acre with the payment of their parcel tax.

2.0 WATER SYSTEM OVERVIEW

The Town of Oliver's water system is broken down into seven individual systems, which over time have been inter-connected to provide a more sustainable water supply system as a whole. Each system is defined or known due to the area, and the wells that support it:

(Please See Appendix A: Town of Oliver Water System Map)

- System 1 – also referred to as Rural North – Buchanan Road Pumphouse
- System 2 and 2B – Black Sage Area – Black Sage and Miller Rd Pumphouses
- Municipal System – also referred to as System 3 – Rockcliffe and Tucelnuit Pumphouses
- System 4-7 – also referred to as Rural South – Fairview and Miller Rd 13 Pumphouses

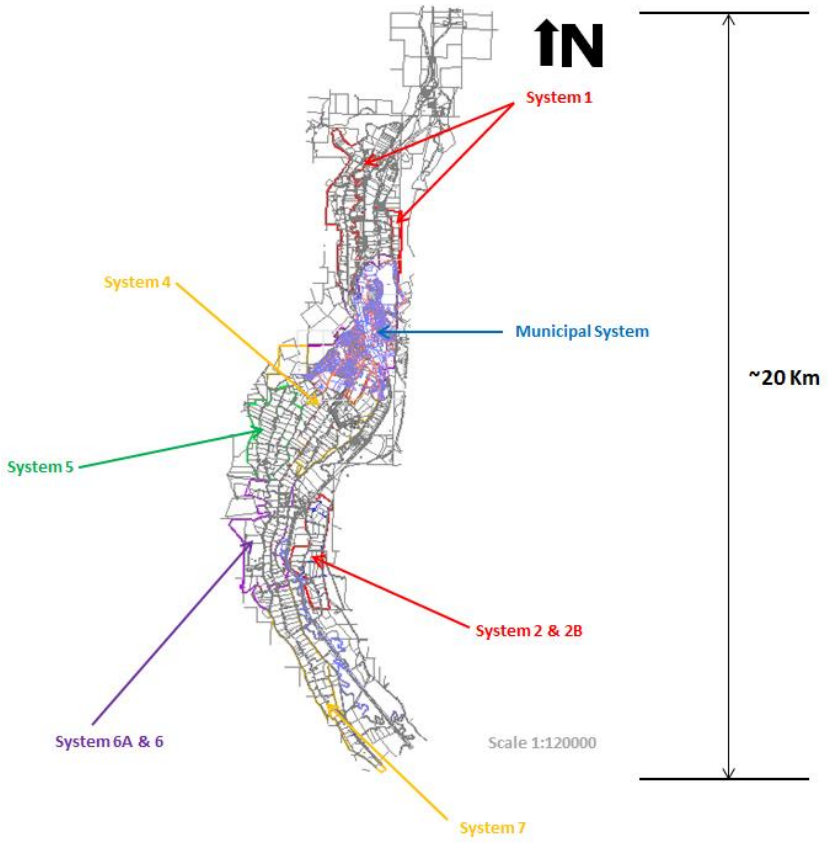


Figure 1: Town of Oliver's 7 Water System Overview

As of 2014, the Town of Oliver uses groundwater for all of its domestic water connections. Therefore, the canal surface water system is providing irrigation only, with the addition of low-pressure users who pump out of the canal using their own private pump houses. Each system is twinned with the exception of System 2 (Black Sage). This system is groundwater only, and there are no current plans to complete the twinning of System 2.

As part of the water distribution system, the Town maintains approximately 143 kilometres of water main. The distribution system is made up of Asbestos Concrete (AC), Polyvinyl Chloride (PVC), Cast Iron (CI), and High Density Polyethylene (HDPE) material, with pipe sizes ranging from 50mm to 600mm in diameter.

The age of the water mains range from new to approximately 50 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. Normal operating pressures range from 60psi to 120psi for standard pressurized services.

2.1 DOMESTIC SYSTEM

The domestic water system storage capacity is 1,025,000 US gallons (US GAL) (3880 cubic metres (m^3)) between four reservoirs. Existing Municipal reservoirs consist of a 360,000 US GAL (1360m^3) reservoir and a newer (constructed in 2010) 500,000 US GAL (2470m^3) reservoir. The other two reservoirs still in use are located in System 6a; Road 13 reservoir at 150,000 US gallons (568m^3) and Hester Creek reservoir at 15,000 US gallons (57m^3).

2.1.1 SYSTEM 1 DOMESTIC

System 1, also known as “Rural North,” supplies domestic water to approximately 161 accounts. System 1 has an irrigation main, and a domestic main that runs approximately 4.5km from the edge of town N. to the end of Sportsman Bowl Road. Buchanan pump station, which is located adjacent to 1748 Buchanan Road and near the east side of the Okanagan River, supplies both irrigation surface water and domestic ground water to System 1. Buchanan pump station has one domestic ground water pump having a total 125 horsepower (hp) that has a pumping capacity of 1,000 gallons per minute (gpm).

2.1.2 SYSTEM 2&2B DOMESTIC

System 2, also known as “Black Sage” area, supplies domestic and irrigation water to approximately 52 accounts. System 2 is unique having separated into two areas, System 2, and 2B. System 2B, along with every other system, is twinned. Whereas System 2 is the only system

that does not have separate water sources for both irrigation and domestic water. System 2 and 2B have two pump stations within its boundary; Black Sage pump station, and Miller well pump station. The Black Sage pump station is located approximately 154m W. from Ryegrass Road between Miller Road and Watters Road. The Black Sage well supplies groundwater to both domestic and irrigation services in System 2 and 2B utilizing three pumps having a total 235hp, and a pumping capacity of 2,600gpm. The Miller Well, located on the west end of Miller Road, approximately 67m E. of the Okanagan River, supplements up to 500gpm of domestic groundwater to System 2 and 2B during the peak demand season, along with Systems 4-7, and Reservoir 13.

2.1.3 MUNICIPAL SYSTEM DOMESTIC

The Municipal System, also known as System 3, supplies domestic groundwater to approximately 2400 accounts. Municipal System utilizes two pump stations, and one booster station to supply its users within the Town boundary; Rockcliffe pump station, Tucelnuit pump station, and the Airport Booster station. Rockcliffe is located between the parcels of 781 and 715 Skagit Avenue. Rockcliffe has one pump at 150hp, and a pumping capacity of 1,500gpm. Tucelnuit pump station is located on the SE corner of Merlot Avenue, and Lakeside Drive; W of the Tucelnuit elementary school. Tucelnuit utilizes two pumps having a pumping capacity of 1,750gpm. The Airport Booster station is located on the NE corner of the intersection of Airport Street, and Road 1. The Airport Booster is typically set to supply water from within the Municipal boundaries to the rural area south, but can also be used to intake water from the rural area south, and supply the Municipal System depending on demands or if there was a maintenance malfunction of another pump.

2.1.4 SYSTEM 4-7 DOMESTIC

System 4-7, also known as “Rural South,” supplies domestic ground water to approximately 483 accounts. The Systems utilize the Miller Well pump station, 6A Domestic Booster station, and the Airport Booster station. Miller Well pump station also aids in a supplement supply of domestic groundwater to System 2 during peak demands, and the Road 13 Reservoir. The Miller Well pump has 125hp, and a pumping capacity of 1,000gpm. 6A Domestic Booster feeds Hester Creek Reservoir, while the Airport Booster has the option to alternate between the Municipal System and the Rural South to have a continuous loop in the system, and so that each pump is working in its most efficient phase.

2.2 IRRIGATION SYSTEM

Surface water, specifically Okanagan River, is still the primary source for the irrigation water system, but also includes Buchannan well, Fairview well and Black Sage oxbow. The canal system runs from McIntyre Dam (where the diversion is complete with a fish screen to divert fish back to the Okanagan River) 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 multiple water licences to allow these surface water diversions. There are five additional irrigation pump stations that pump along the canal: Mud Lake, Rockcliffe, Fairview, Hester Creek, and Mount Kobau.

In January 2016, the irrigation canal siphon located at Gallagher Lake was damaged by a large rockfall event. Following the rockfall, the Town of Oliver engaged Golder Associates to conduct a geotechnical assessment of the area to determine the actions required to enable safe access to the site for repair of the siphon. Rock scaling was carried out by T&A Rockworks. A pipe repair was then completed from within the pipe, during which time a 1.2 meter (outer diameter) pipe was grouted into place. This allowed the siphon to operate during the irrigation season with a 32% reduction in supply capacity. While this flow was sufficient in 2016, due to lower temperatures and higher precipitation, it will not be adequate during warmer, drier seasons. The Canal restoration project is currently under review.

2016 irrigation season started on April 18th and ended October 11th. Crews began filling the canal and turning on spray fillers April 13st. The canal diversion was shut down on October 28th. All Town irrigation systems were shut down and winterized by the end of October.

2.2.1 SYSTEM 1 IRRIGATION

System 1 utilizes two pump stations for its irrigation; Mud Lake and Buchanan. Mud Lake pump station intakes water from the canal utilizing two pump units at a combined 200hp, and having a pumping capacity of 5,000gpm. Mud Lake is located 90m W of Buchanan Drive. Buchanan irrigation pump is 50hp, and has a capacity of 500gpm. System 1 covers 420 acres of agriculture that is pressurized irrigated. This result is excluding the number of low pressure users in the area.

2.2.2 SYSTEM 2&2B IRRIGATION

As mentioned earlier, System 2 is the only system that is not twinned, having pumps that supply groundwater for both domestic and irrigation uses with a combined 235hp, and having a pumping capacity of 2,600gpm. However, System 2B has its own irrigation pump which is called Black Sage Irrigation Pump that intakes from the Black Sage oxbow located 65m S of Road #9, and 100m E of the Okanagan River. This pump has 150hp with a capacity of 1,540gpm. System 2 and 2B provide pressurized irrigation water to approximately 405 acres of agriculture land.

2.2.3 SYSTEM 4-7 IRRIGATION

The second canal pump station is Rockcliffe Irrigation in System 4. This station utilizes three pumps having a combined 500hp, and a pump capacity of 9,100gpm. Rockcliffe supplies pressurized irrigation to approximately 916 acres of agriculture. This pump station is located between the properties of 824 and 760 of Road 2. System 4 also includes a 25,000 US GAL ($94m^3$) irrigation water reservoir, called System 4 Irrigation Reservoir.

The third canal pump station along the system is Fairview irrigation pump station, which is located in System 5 on the NE corner of Road 5 and the canal intersection. Fairview utilizes two pumping units with a combined horsepower of 300hp, and having a pumping capacity of 4,400gpm. There is also another 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. System 5 includes a 50,000 US GAL ($189m^3$) irrigation water reservoir, called Fairview Irrigation Reservoir.

Hester Creek irrigation pump station is located in System 6 at the NE corner of the W end of Road 11 and the canal intersection. Hester Creek pump station utilizes two pumping units having a combined horsepower of 175hp, and a pumping capacity of 4,000gpm. Hester Creek Irrigation pump station delivers pressurized irrigation to approximately 426 acres of land. System 6 also contains a booster pump station that has two 15hp pumps, and is utilized during the peak season.

Mt Kobau irrigation pump station is the most southern in the water system, in System 7, located at the west end of Road 18. Mt Kobau has two pumping units that have a combined total of 150hp, with a capacity of 4,000gpm. Mt Kobau provides pressurized irrigation to approximately 545 acres of land.

3.0 WATER QUALITY, SAMPLING, AND MONITORING PROGRAM

The Town of Oliver has utilized two sources of water: surface water (Okanagan River) and groundwater (well water). The surface water is now restricted to irrigation water only. Groundwater is the ONLY source of water used for domestic purposes, and the only source that is thoroughly monitored and sampled for quality purposes.

3.1 SAMPLING AND MONITORING

The Town of Oliver works closely with CARO Analytical Services out of Kelowna, BC to monitor drinking water quality in accordance with the BC Drinking Water Protection Act, and Guidelines for Canadian Drinking Water Quality (GCDWQ). The Town's staff submits weekly samples for bacteriological testing for Total Coliforms, and E-Coli Bacteria at various sampling sites throughout the system. In congruence with the submittals, the Town also conducts their own in house presence/absence tests. The Town also monitors the Nitrate levels in the drinking water sampling six times a year in February, April, June, August, October, and December. Once a year, and usually mid-summer, the Town will commence a full spectrum test on the domestic water system. The spectrum analyzes all physical parameters and characteristics of The Town of Oliver's drinking water. The results are then compared to the GCDWQ.

- *(Please See Appendix A: The Town of Oliver Water System Map for Sampling Sites)*
- *(Please See Appendix B: 2015 Full Spectrum Results and GCDWQ)*
- *(Please See Appendix C: 2015 Weekly Water Sampling Result Table)*

There are seven test stations located in the Municipal boundaries. The rural area north of Town has one test station and there are six testing sites (excluding wells) south of Town. When any sample shows the presence of Total Coliform or E-Coli, the Interior Health Environmental Health Officer is consulted and standard protocols are initiated with a flushing of the contaminated system and a resample of water where contamination was located. The sample is then immediately resubmitted for testing by the lab.

4.0 WATER CONSUMPTION

4.1 TOTAL CONSUMPTION

The water works system again is twinned in Oliver, meaning that the groundwater used for domestic purposes has its own pipe network along with the surface water, used for irrigation purposes, also has its own pipe network except for System 2, which is using groundwater for

both irrigation and domestic purposes. The Town of Oliver consumed 3,344,540,895 US GAL of water in 2016. That is 12,660,458,550 liters (L) of water or 12,660,459m^3 of water.

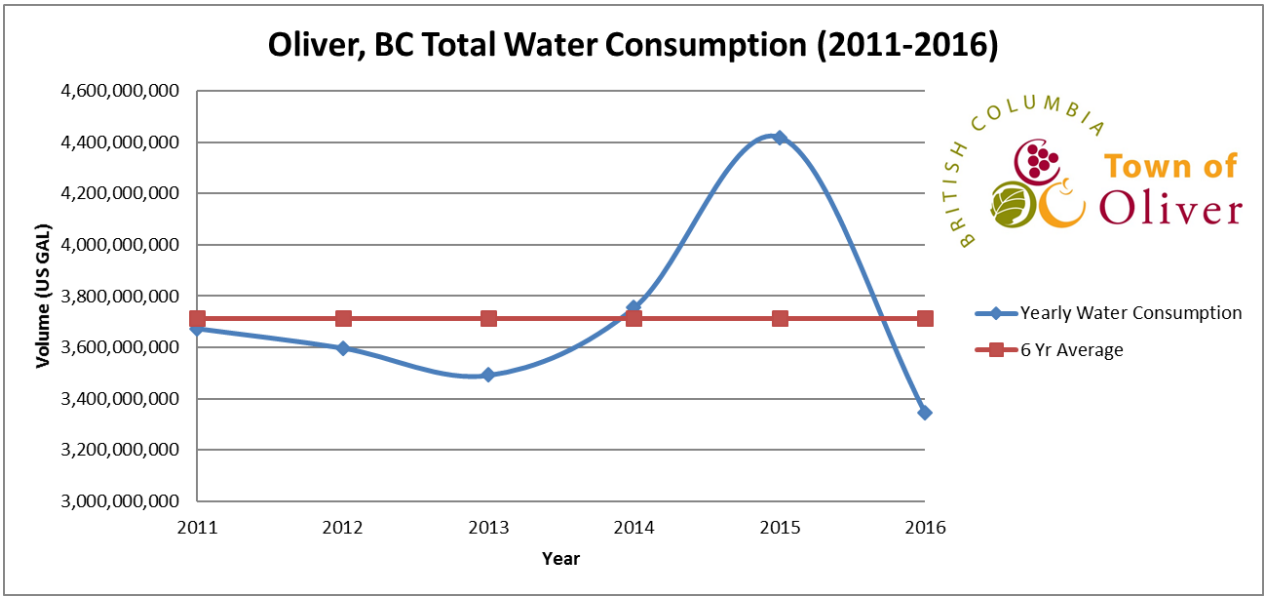


Figure 2: Total Water Consumption 6 Year Trend

As we can see in *Figure 2,* Oliver consumed 24% less water than the previous year in 2015. The six-year average is 3,713,234,854 US GAL. In 2016, Oliver consumed 10% less than the six-year average. The demand is influenced by the population usage, and population has been slightly increasing each year in Oliver. The 2016 Census reported Oliver having a new population of 4,928. However, the Town of Oliver estimates are based on actual accounts multiplied by 2.5 having a residential per person of 5,775 that is roughly the same number as last year and this is excluding the Industrial/Commercial/Institutional, and Irrigation connections. The other major contributing factor is weather and precipitation. The South Okanagan was declared, by the government of BC, a drought level of 4 in 2015. Level 4 is the highest level of drought before loss of supply or emergency response is taken where health and safety become the main priority. In 2016, the South Okanagan did not reach a drought level of four, instead it had a normal snowpack season, and was considered a “dry” year, but did not see the same level of drought as 2015. Oliver’s max residential domestic water demand was on August 10, 2016. *See Figure 3.* Oliver had a maximum daily water demand peak at 5,651,881 US GAL, while minimum daily demand occurred on March 1, 2016 at 638,195 US GAL.

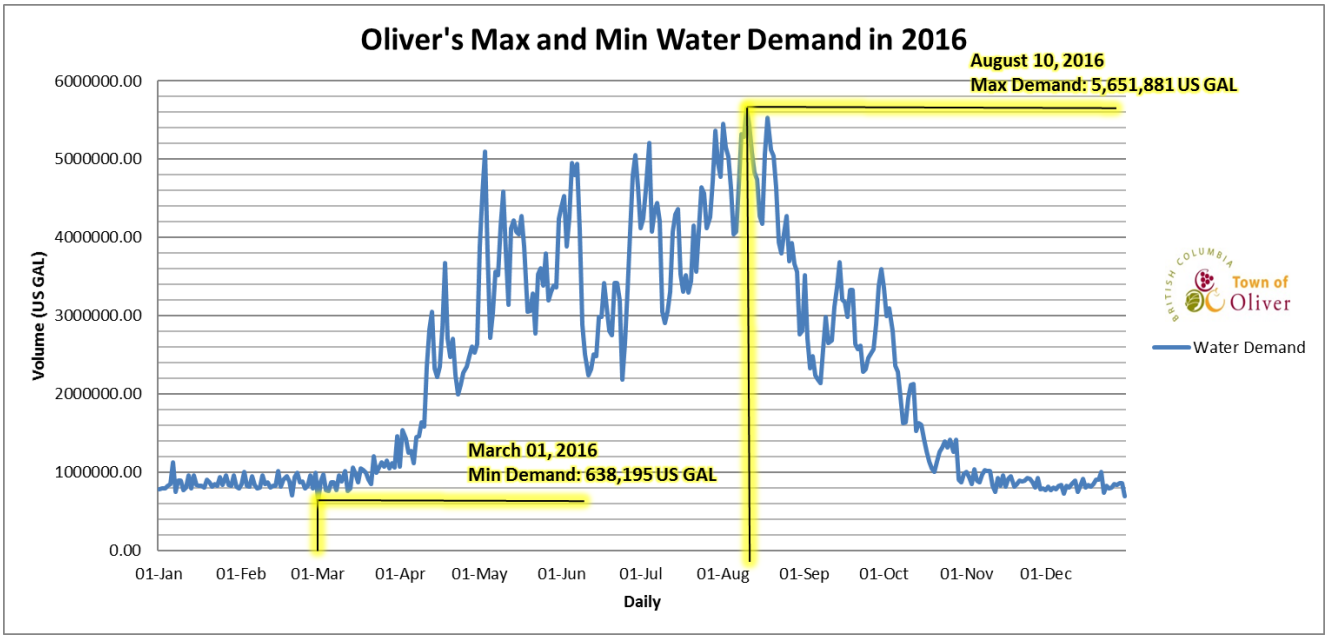


Figure 3: Oliver's 2016 Max and Min Domestic Water Demand

4.2 BREAKDOWN OF CONSUMPTION

The Town of Oliver consumed 821,817,652 US GAL (3,110,916m^3, 3,110,916,760L) of groundwater in 2016. This amount is 25% of the total consumption. The remaining 75% is surface water, which is used for irrigation, having a total consumption of 2,522,723,243 US GAL (9,549,541m^3, 9,549,541,790L). *See Table 1 below for the breakdown of percentages*.

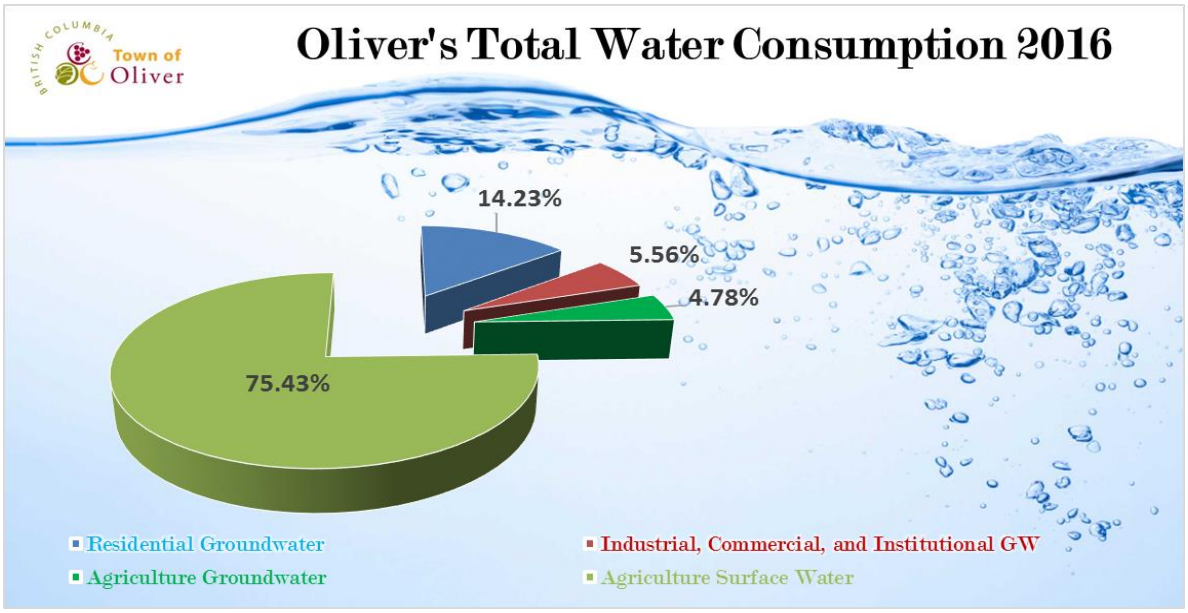


Figure 4: Oliver's Total Water Consumption 2016

WURC CALCULATIONS	US GAL	CUBIC METERS	PERCENTAGE
TOTAL GW USED	821817652.43	3110916.76	24.57%
TOTAL SW USED	2522723242.75	9549541.79	75.43%
TOTAL RES GW	475910560.90	1801516.60	14.23%
TOTAL RES SW	0.00	0.00	0.00%
TOTAL ICI GW	185958027.35	703927.38	5.56%
TOTAL ICI SW	0.00	0.00	0.00%
TOTAL AG GW	159949064.17	605472.79	4.78%
TOTAL AG SW	2522723242.75	9549541.79	75.43%
TOTAL WATER	3344540895.18	12660458.55	100.00%

Table 1: Oliver's Groundwater Breakdown: Groundwater (GW), Surface Water (SW), Residential (RES), Industrial, Commercial, Institutional (ICI), and Agriculture (AG).

According to the OBWB, an average person in the Okanagan uses 675L of water each day. That is twice more water than the average Canadian uses which is 329L per day. On average, Oliver residents used approximately 845L of water per day in 2016, which is 516L above the Canadian average. *See Figure 5.*

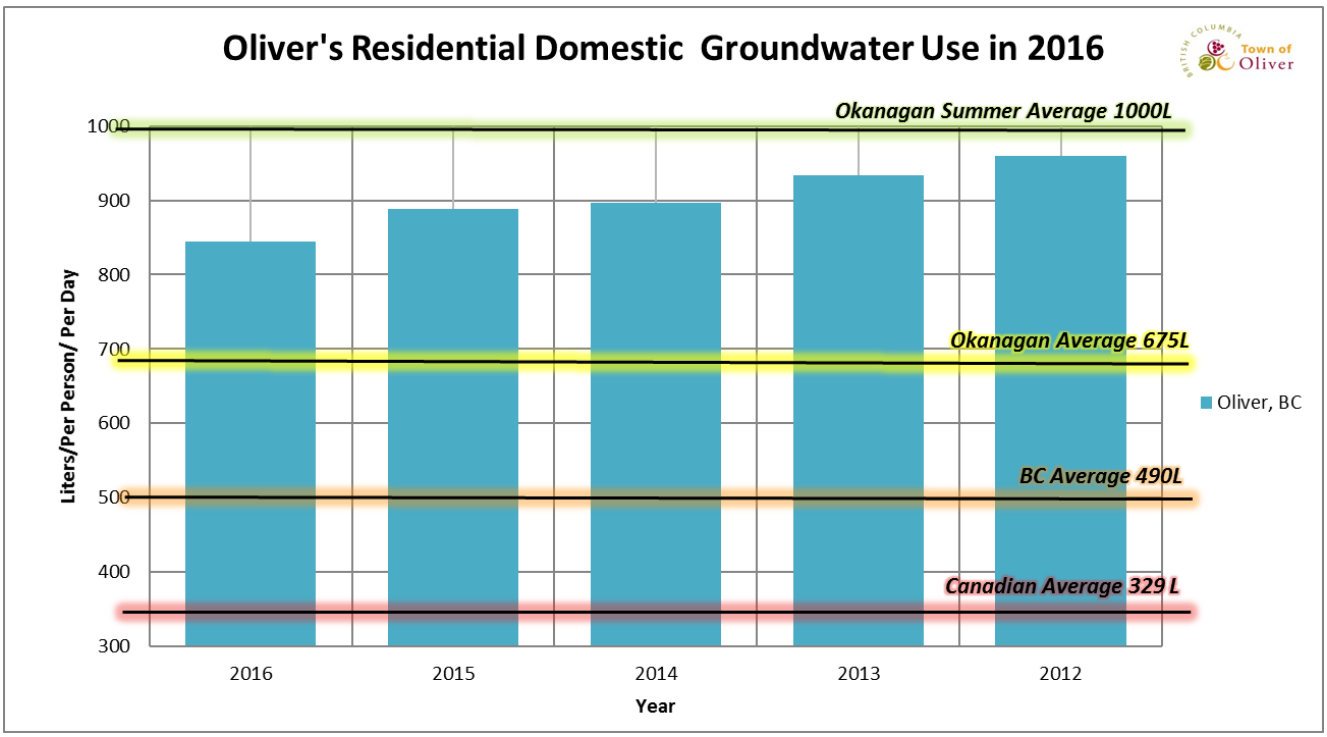


Figure 5: Oliver (2012-2016) vs OBWB Estimated Averages (1996-2006)

During the summer months the average consumption rate exceeds the Okanagan summer average of 1,000L (1m^3) with Oliver using 1182L per person per day while the pumps are in Summer Mode (April to October). However, when the pumps are in Winter Mode (November-March), Oliver used 370L per person per day, which is below the Okanagan average of 675L. These numbers are approximate values and estimates; if a person would like to know their household usage from year to year, all you need to do is take the volume consumed on your monthly water bill, convert it to liters, and divide it by the number of people in the household and the number of days in the month, and you will get your answer in liters per person per day. Once you have your results, you can compare your usage of each year to your previous years along with the Canadian, BC, Okanagan, and Okanagan Summer Averages. *See Below and Figures 5-7*.

1. $Total\ Volume\ of\ Water\ used\ from\ Water\ Bill\ (cubic\ meters) = x(m^3)$

2. $Convert\ x(m^3)\ to\ \big(liters\ (l)\big) = x(m^3) \times 1000 = x(l)$

3. $Divide\ x(l) by\ number\ of\ persons\ in\ household\ (pp) = \dfrac{x(l)}{(\#\ of persons)}$

4. $Then\ Divide\ that\ result\ \left(\dfrac{x(l)}{(pp)}\right)\ by\ the\ number\ of\ days\ the\ water\ bill\ is\ accounting\ for\ (pd) = \dfrac{(x(l/pp\ )}{(\#\ of\ days\ )}$

5. $This\ answer\ is\ your\ final\ result = x(l/pp/pd)$

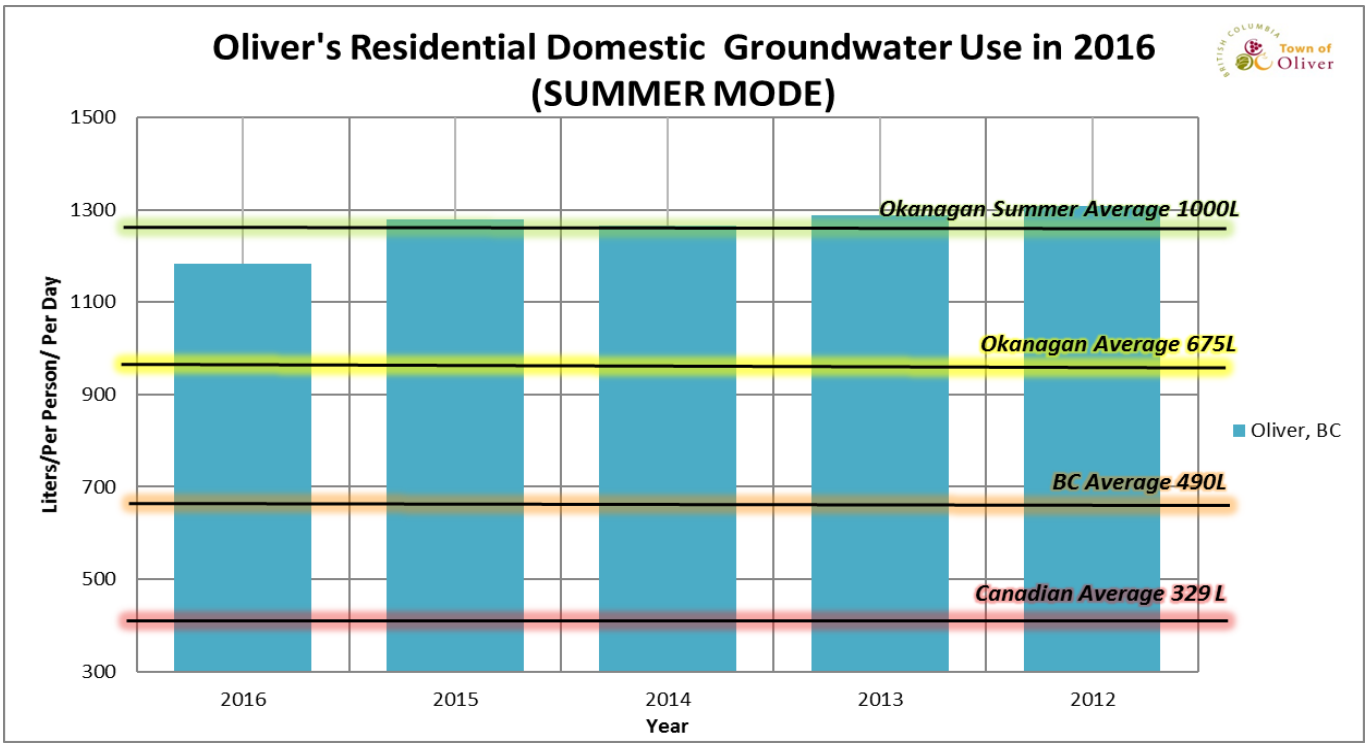


Figure 6: Oliver's (April-October 2012-2016) average vs OBWB Estimated Averages (1996-2006)

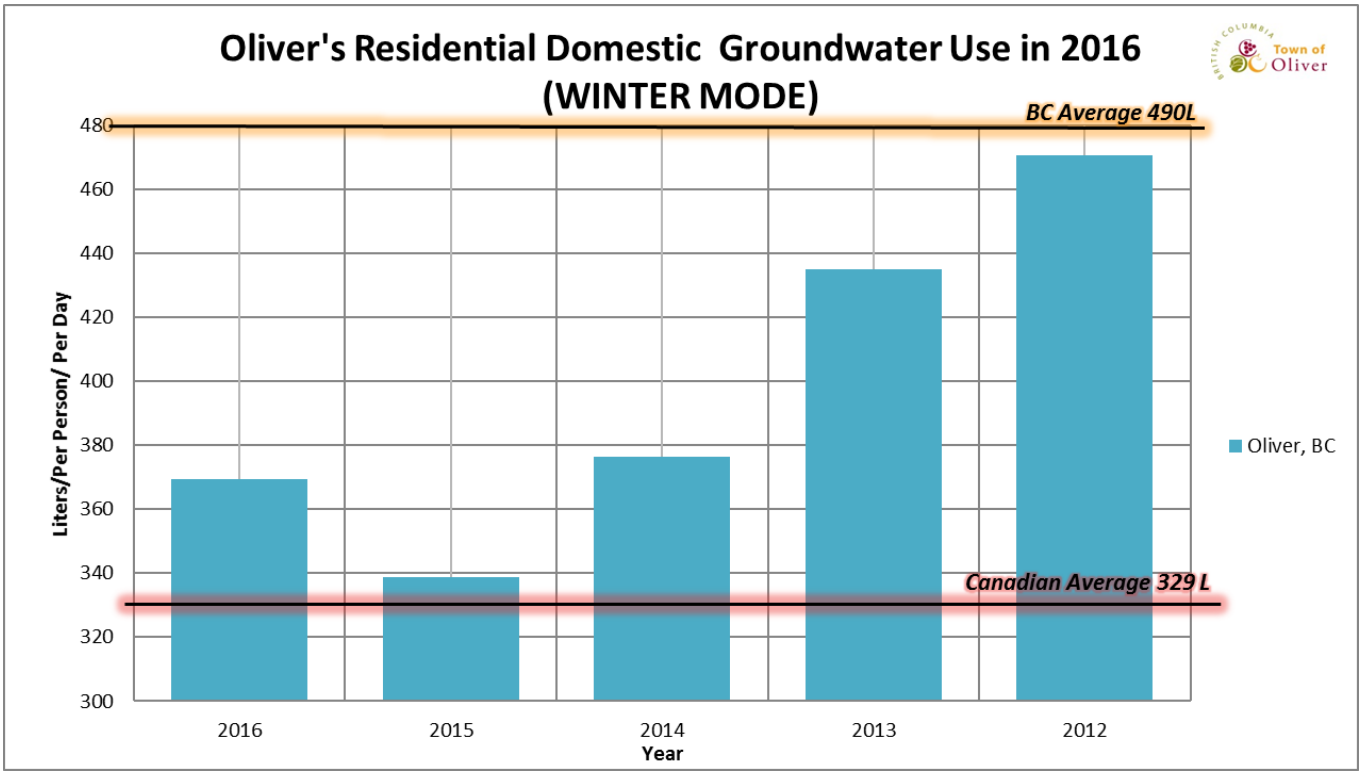


Figure 7: Oliver's (November - March 2012-2016) average vs OBWB Estimate Averages (1996-2006)

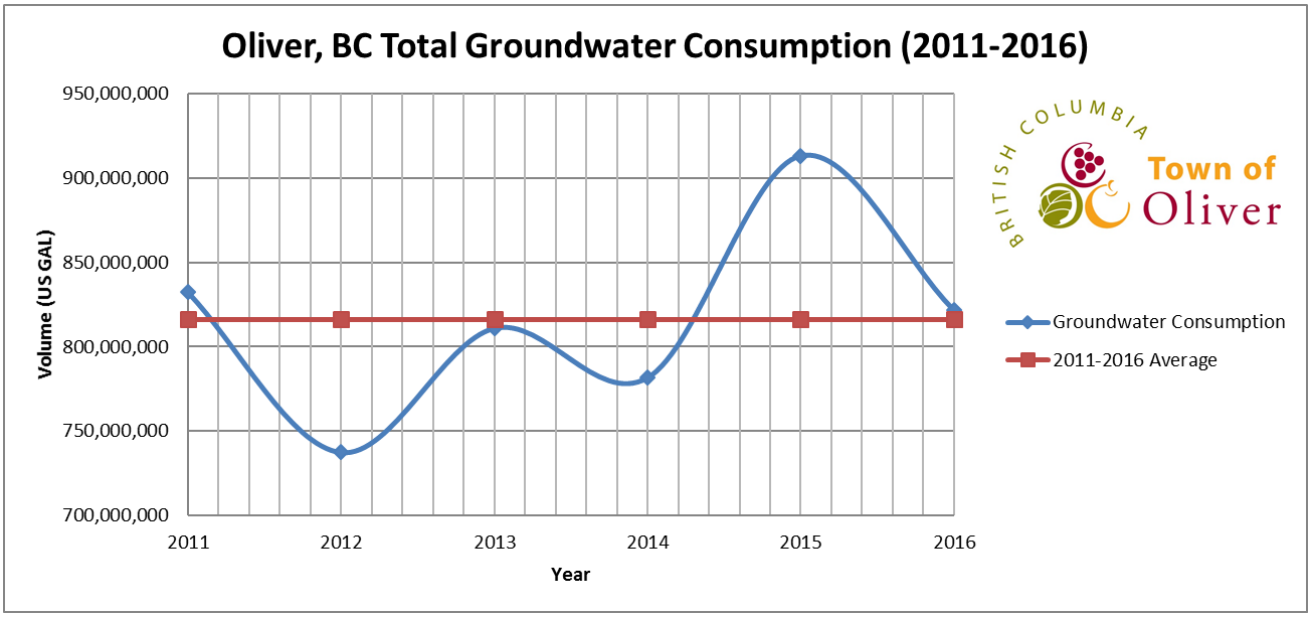


Figure 8: Oliver's Total Groundwater Consumption Trend (2011-2016)

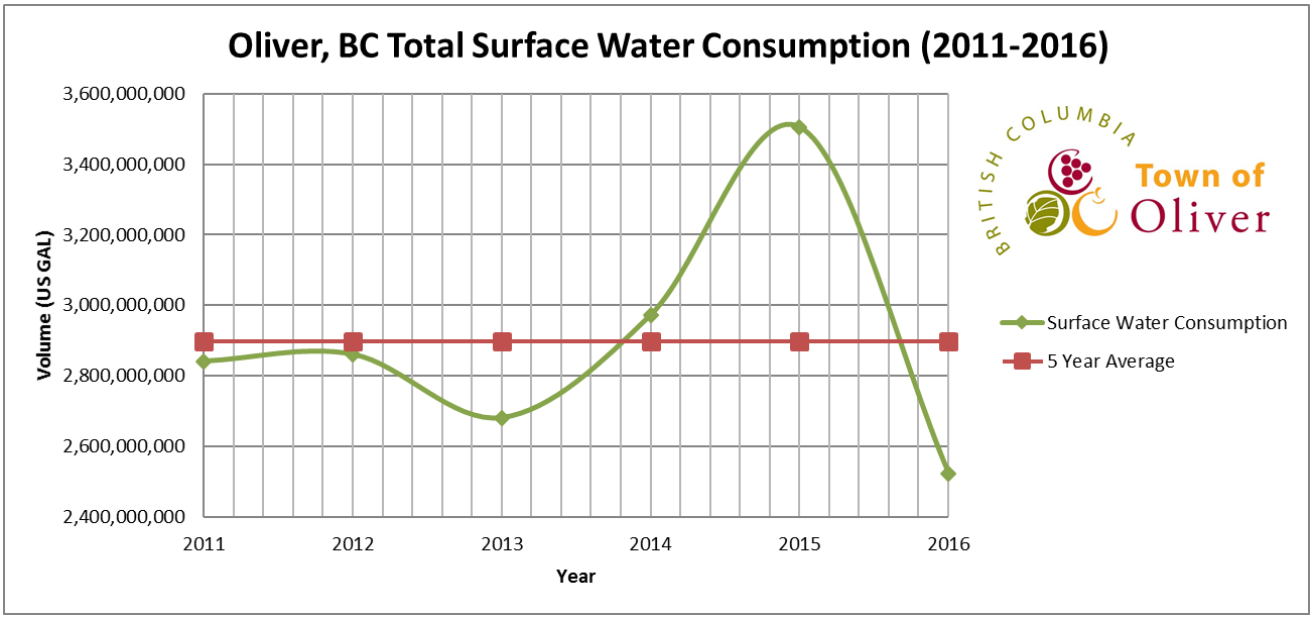


Figure 9: Oliver's Total Surface Water Consumption Trend (2011-2016)

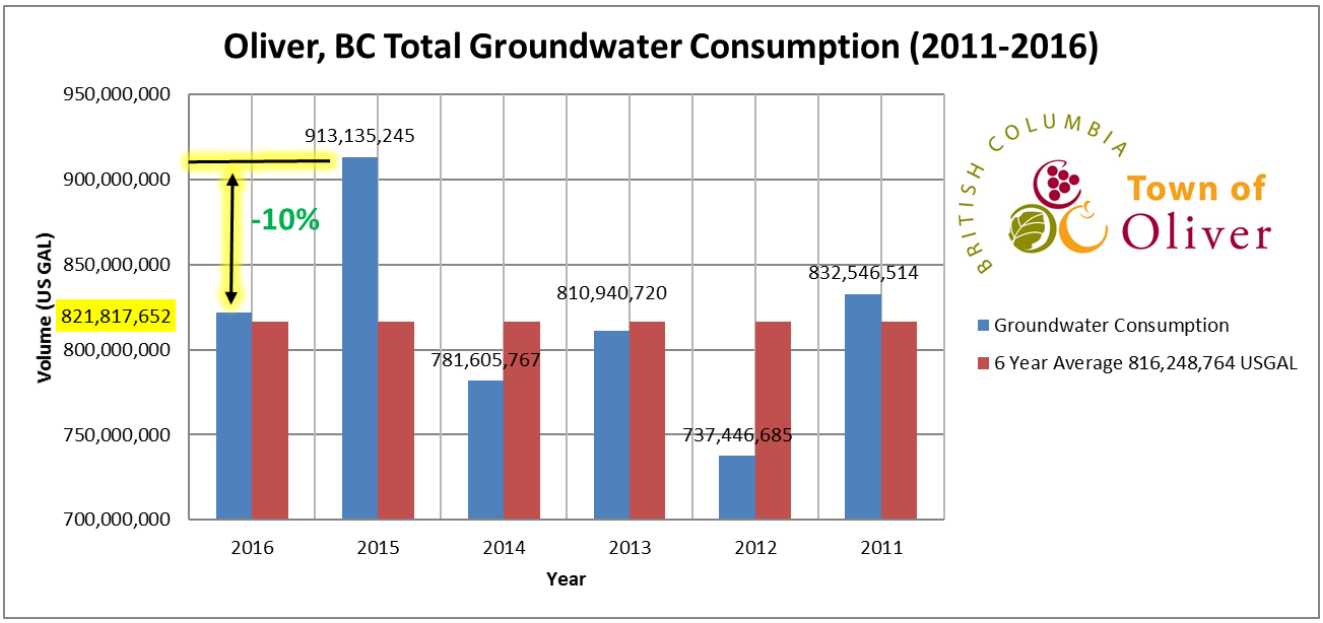


Figure 10: Oliver's Groundwater Consumption (2011-2016)

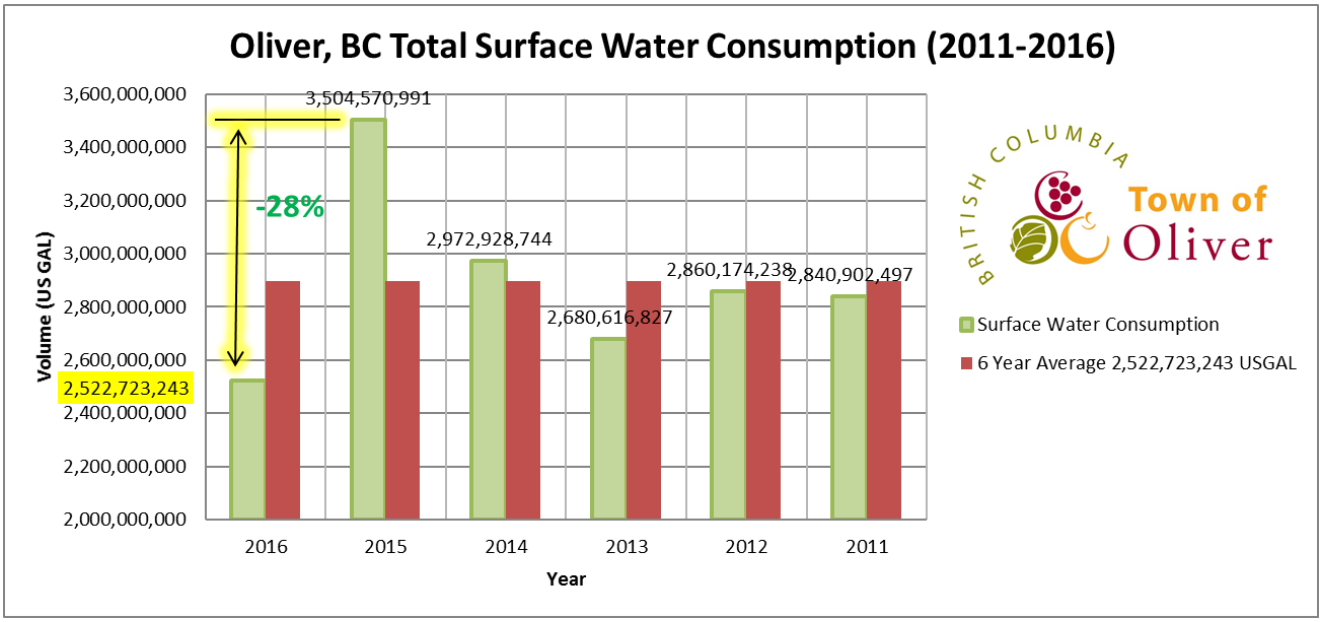


Figure 11: Oliver's Surface water Consumption (2011-2015)

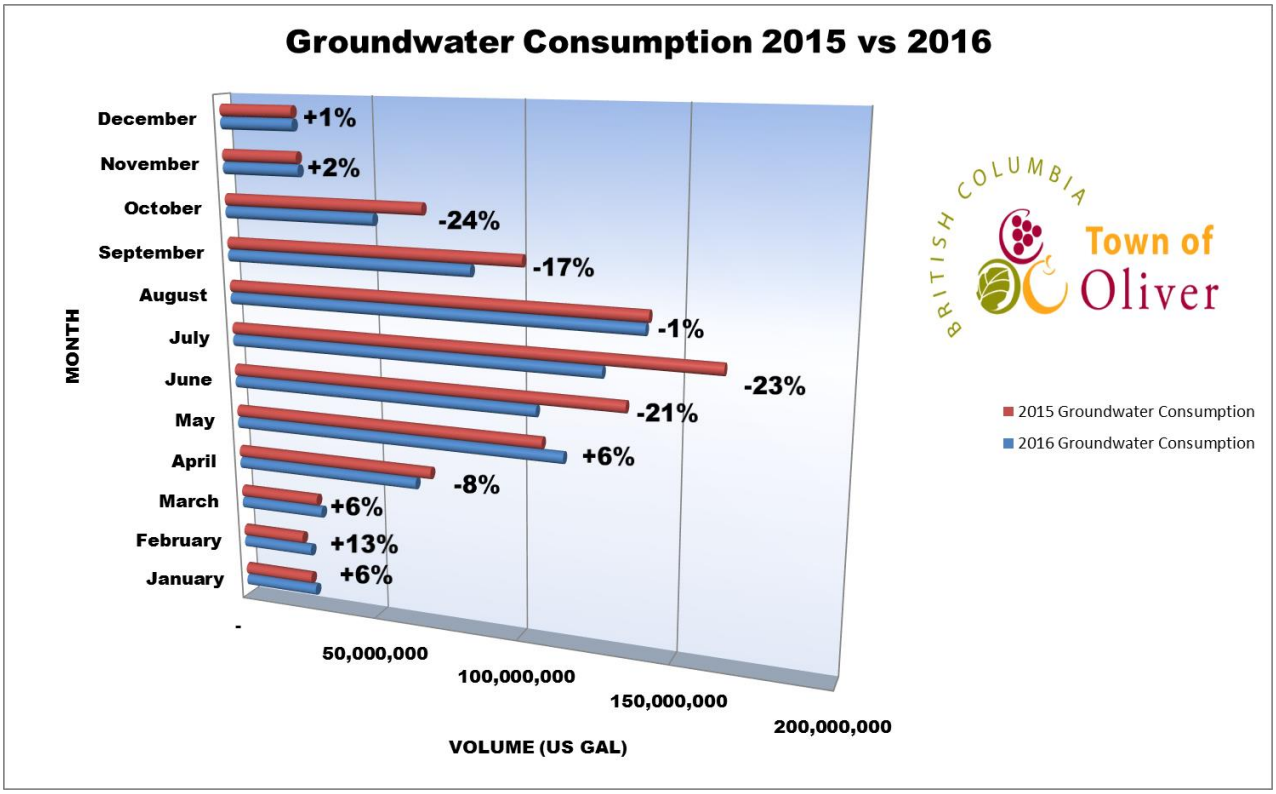


Figure 12: Groundwater Demand Percentages in 2016 Compared to the Previous Year 2015

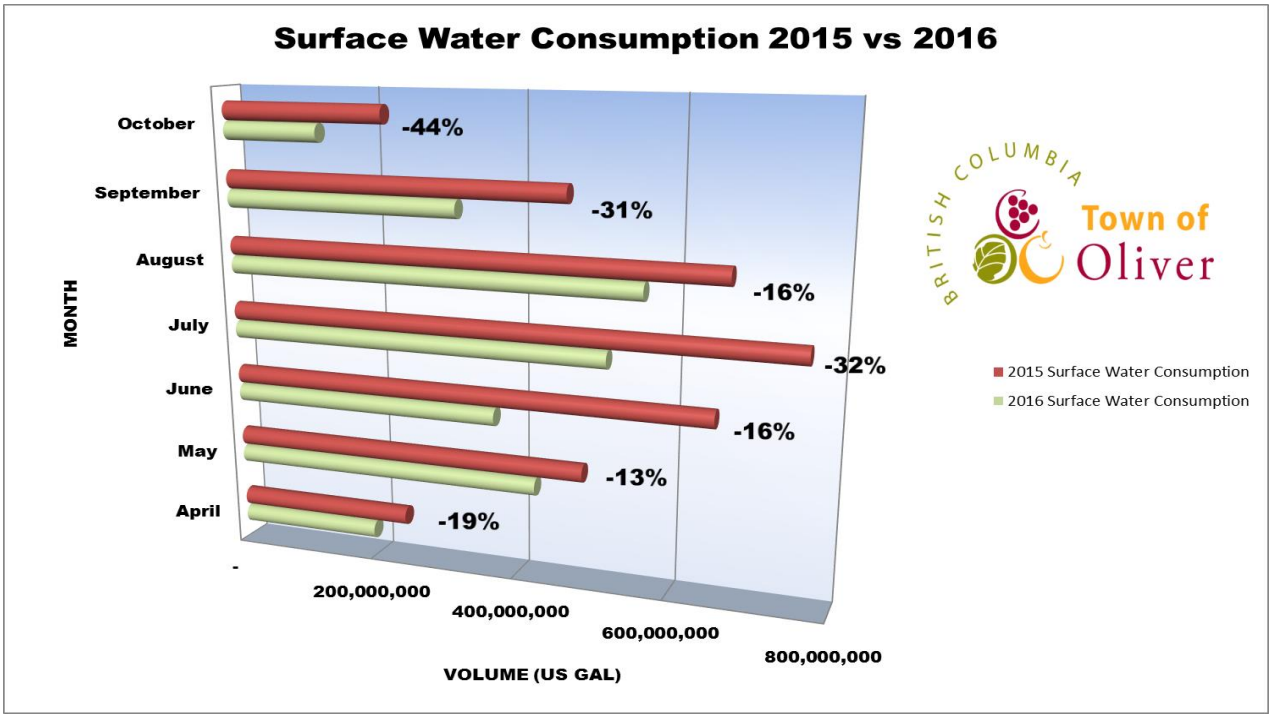


Figure 13: Surface Water Demand Percentages in 2016 Compared to the Previous Year 2015

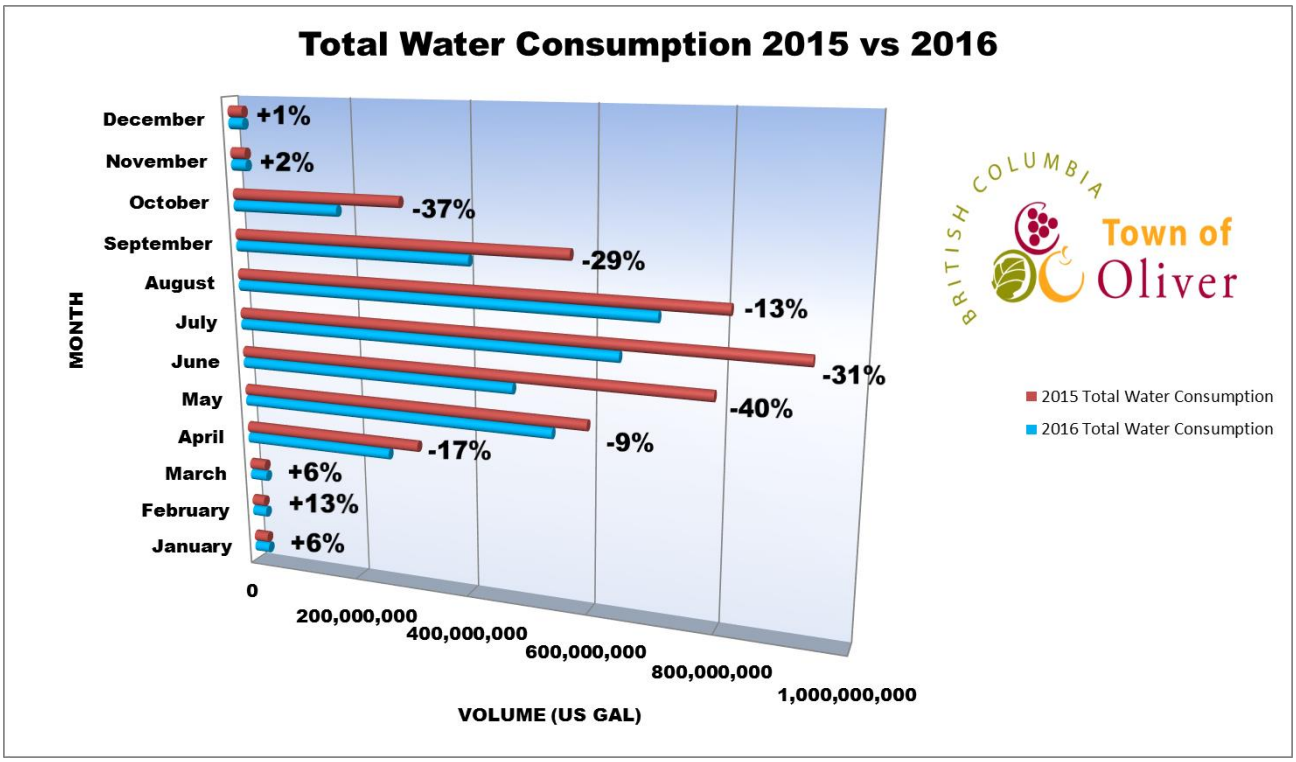


Figure 14: Total Water Demand Percentages in 2016 Compared to the Previous Year 2015

- *(Please See Appendix D: 2016 Pumping Data Table)*
- *(Please See Appendix E: Groundwater and Surface Water Consumption Data Tables)*

4.3 WATER CONSERVATION

The Town of Oliver works closely with the OBWB and its Okanagan Water Wise program called "Make Water Work", to spread a valley wide awareness on water conservation in the Okanagan. The program acts as a campaign where residents take water conservation survey pledges. OBWB will bring awareness in 2017 with more Radio Ads, Facebook Ads, Billboards, other social media support, yard signs, posters, and magnets linking the Make Water Work website. www.makewaterwork.ca.

In 2016, Peachland had the most pledges per capita. Oliver residents who followed through with the pledges taken, 75% indicated they made additional changes to conserve water around their home, by adding rain barrels, maintained or reset their irrigation system, and removed or plan to remove water thirsty lawns. Among the people who followed through with their pledges, 52% felt they saved water as a result of making pledges. Among this 52%, 33% knew they saved water, because they changed the settings on their irrigation systems, and the other 24% indicated that their water bill was less than the previous years.

5.0 STAFF

According to EOCP (Environmental Operator Certification Program), Oliver's Water Distribution System is a Class III. Oliver's operations has five certified Water Distribution Operators on staff, four of these are full-time regular Operators; 2 Level I, 2 Level II, and 1 Level IV. One staff member has been a Water Operator in training since April 2013 at Public Works with a view to succession planning and became an Operator Level I in 2015. One certified Level I Operator moved into a new Management position within the Town.

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

6.0 CAPITAL PROJECTS AND IMPROVEMENTS

6.1 PROJECTS COMPLETED IN 2016

The Town of Oliver continues to make minor and major improvements to the Town's water system every year and works with the Interior Health Authority (IHA) to prioritize some of these goals. Here are the main projects that were completed and started in 2016:

Canal Rehabilitation Study

Allnorth was hired, through an RFP process, to study the Town's irrigation canal system. This project is anticipated to come to a close in 2017 and will give the Town a document that will help prioritize projects, costs and give solutions to some of the problems on maintaining the canal system that was built in the early 1920's.

Ground Water Protection Plan

True Consulting started this study in 2016 with help from Western Water Associates Ltd. for completing an assessment of the Town's water supply wells, and the aquifer sources in order to define proposed groundwater protection areas and potential threats for the delivery of safe drinking water. The Town received some funding from the OBWB to help achieve the funding to complete this and satisfy IHA requirements on the Towns, "Conditions on Permit". This assessment is the first step in the groundwater protection plan, as it is important to take protective measures to minimize and prevent undesirable impacts. It is easier and cheaper to protect our drinking water instead of fixing it or finding a new source.

Fairview Irrigation Control Improvements

This project, started in 2016, will be completed in 2017 to help upgrade and improve electrical, and controls for the Fairview Irrigation Pump house Station. Our pump houses are several decades old and finding replacement parts has become more difficult over the years. By installing new controls compatible with our Supervisory Control and Data Acquisition (SCADA) system, it gives us more control of the irrigation system that feeds irrigation water for System #5.

Reservoir Supply Watermain Repurposing

This project is to utilize an existing dedicated domestic water mainline from the wells in Lion's Park to the reservoir. This will give us the use of a 350mm domestic line that goes directly to the reservoirs, making it the second line in use and the system more versatile.

Gallagher Lake Siphon Damage Repair

The Town had to make an unexpected repair to the siphon located on the canal system next to Gallagher Lake. The Town undertook some Engineering, rock scaling and construction in the spring to ensure the irrigation canal would be operable for the coming irrigation season. The repairs in the siphon are classified as temporary but will last many years, unless the siphon encounters a similar rock fall in the same area. The Town will be working on a permanent solution to either remedy the existing system or relocate it altogether.

Mud Lake Irrigation Control Improvements

This project is similar to the recent Rockcliffe upgrade giving the pump house much needed electrical upgrades and controls for the SCADA system. It will give the Town one Variable Frequency Drive (VFD) motor on a pump for better power efficiencies as well. This project started in late 2015 and completed in 2016.

6.2 CONTINUING PROJECTS INTO 2017

Head of the Lake Watermain Looping

The Watermain Looping at Head of Lake project will help back up (better serve) the Town's overall domestic water system. The new Buchanan well recently built and working and is not running at full efficiency when helping to supply water back in-Town as a main domestic pump or back up because of water mainline bottleneck's in the system. The Town is looking at looping a new mainline from the north end of Tuc-el-nuit Lake and tying into the existing water system

at Lakeside Drive. Part of this project will also bring in a new on-site chlorination generation system installed at the new Buchanan well building.

6A Reservoir Pipe Outfall Improvements

We need to repair broken pipe that has become separated in a couple of sections that acts as the outfall of the reservoir located in the 6A water system. There was a washout years ago and this pipe was quickly repaired but not to a permanent standard, this will be repaired, and the pipe (HDPE), which is on a steep slope (top to bottom), requires anchoring and installation of a man hole junction that will be screened off so no animals get into the reservoir.

Fairview Revolving Screen & Brushes

We have an older screen/brush system at our Fairview Irrigation pump house intake off the canal that no longer has parts that are available to us and is corroding more each year. We need to replace the system and retro fit everything into the existing space because it is a specialized piece of equipment. This will help maintain more consistent and less sediment into our irrigation distribution system.

Gallagher Lake Siphon Damage Repair

The Town was exploring re-routing of the existing canal under the rock bluffs located at Gallagher Lake to avoid future problems at this location. The Town is also looking to secure funding with the Provincial and Federal Governments to help with the estimated $10.5 million relocation, which would burden the taxpayers too much. Design Engineering is continuing through 2017.

6.3 LONG TERM IMPROVEMENT PLANS

The Town has a 5 year budgeted capital plan for known upgrades and new infrastructure and/or projects. These projects include Canal rehabilitation on an annual basis:

2018

- Water Capital Plan Update
- 6A Booster station SCADA addition
- Canal Rehabilitation Continued
- Forbes Development & Centennial Park– Station Street Upgrades
- Black Sage Domestic VFD upgrade on 100HP Motor
- Gallagher Lake Re-Routing
- Kootenay Street Service Upgrades

2019

- Gallagher Lake Re-Routing continuation
- Black Sage Domestic VFD upgrade on 100HP Motor continuation
- McGowan Mainline and service upgrades
- Canal Rehabilitation Continued
- Kobau irrigation pump house control and electrical upgrades

2020

- Canal Rehabilitation Continued
- Various undersized water line upgrades
- 7D Drainage re-route final section

2021

- Canal Rehabilitation Continued
- New control panel for Fairview Irrigation
- 7D Drainage full upgrade
- Manganese Removal

7.0 EMERGENCY RESPONSE PLAN

The Town of Oliver has an Emergency Response Plan pertaining to any natural disaster, and 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 updated in 2012, and is currently being updated in 2017.

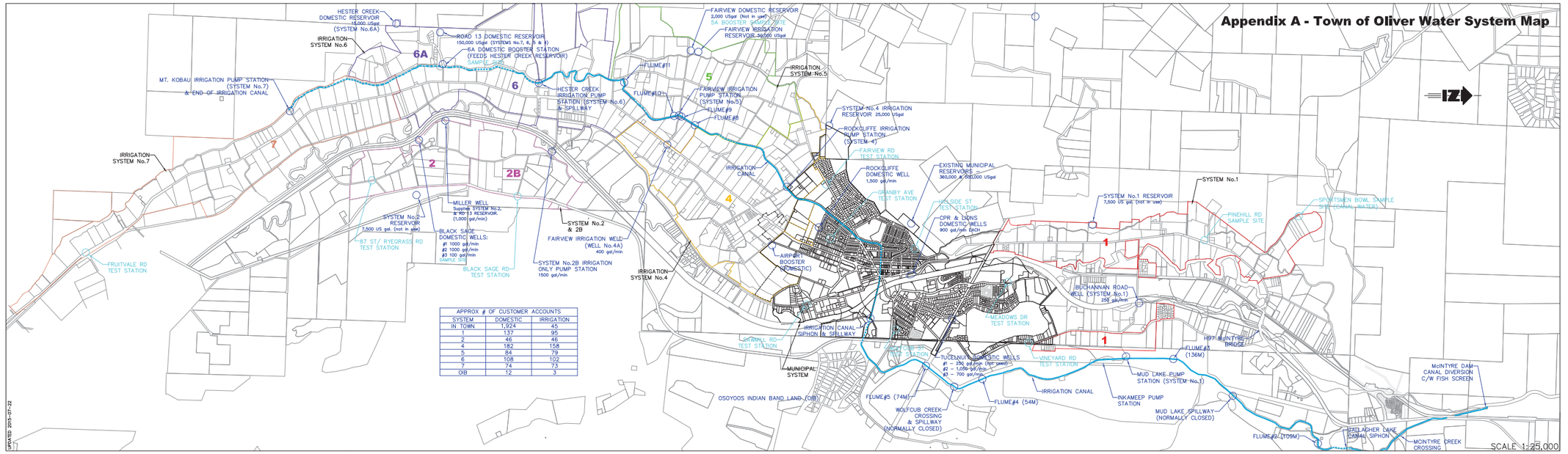
8.0 CROSS CONNECTION CONTROL PROGAM

Cross connection is an actual or potential connection between a potable water supply and a non-potable source, where it is possible for a contaminant to enter the drinking water supply. 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 domestic water system. The program focuses on premise isolation for commercial and industrial customers. In 2016, there were 255 testable backflow assemblies in service (including agricultural devices) being tracked.

9.0 CONCLUSION

The Town of Oliver works hard to maintain water quality and quantity for their residents as well as numerous customers in Regional District area 'C'. Efforts are made to ensure appropriate water usage and educate the public 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: THE TOWN OF OLIVER WATER SYSTEM MAP FOR SAMPLING SITES



APPROX # OF CUSTOMER ACCOUNTS		
SYSTEM IN TOWN	DOMESTIC	IRRIGATION
1	1,924	45
2	137	95
4	46	46
5	182	158
6	84	79
7	108	102
OIB	74	73
	12	3

APPENDIX B: 2016 FULL SPECTRUM

CARO ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

REPORTED TO	Oliver, Town of 5971 Sawmill Road, PO Box 638 Oliver, BC V0H 1T0	**TEL** **FAX**	(250) 485-6213 (250) 498-2456
ATTENTION	Patti Hannas	**WORK ORDER**	6080681
PO NUMBER	37965	**RECEIVED / TEMP**	2016-08-09 10:00 / 12°C
PROJECT	Full Spectrum Analysis	**REPORTED**	2016-08-16
PROJECT INFO	A.1.	**COC NUMBER**	B44237

General Comments:

CARO Analytical Services employs methods which are conducted according to procedures accepted by appropriate regulatory agencies, and/or are conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts, except where otherwise agreed to by the client.

The results in this report apply to the samples analyzed in accordance with the Chain of Custody or Sample Requisition document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.

Authorized By: **Ed Hoppe, B.Sc., P.Chem.**
Division Manager, Kelowna

If you have any questions or concerns, please contact your Account Manager:
Kristin McKeown (kmckeown@caro.ca)

Locations:

#110 4011 Viking Way
Richmond, BC V6V 2K9
Tel: 604-279-1499 Fax: 604-279-1599

#102 3677 Highway 97N
Kelowna, BC V1X 5C3
Tel: 250-765-9646 Fax: 250-765-3893

17225 109 Avenue
Edmonton, AB T5S 1H7
Tel: 780-489-9100 Fax: 780-489-9700

www.caro.ca

ANALYSIS INFORMATION

REPORTED TO	Oliver, Town of	**WORK ORDER**	6080681
PROJECT	Full Spectrum Analysis	**REPORTED**	2016-08-16

Analysis Description	Method Reference	Technique	Location
Alkalinity in Water	APHA 2320 B*	Titration with H2SO4	Kelowna
Anions by IC in Water	APHA 4110 B	Ion Chromatography with Chemical Suppression of Eluent Conductivity	Kelowna
Colour, True in Water	APHA 2120 C	Spectrophotometry (456 nm)	Kelowna
Conductivity in Water	APHA 2510 B	Conductivity Meter	Kelowna
Hardness (as CaCO3) in Water	APHA 2340 B*	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Estimated)	N/A
pH in Water	APHA 4500-H+ B	Electrometry	Kelowna
Solids, Total Dissolved in Water	APHA 2540 C*	Gravimetry (Dried at 103-105C)	Kelowna
Total Metals by ICPMS in Water	APHA 3030E* / APHA 3125 B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma Mass Spectrometry (ICP-MS)	Richmond
Turbidity in Water	APHA 2130 B	Nephelometry	Kelowna

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Method Reference Descriptions:

APHA	Standard Methods for the Examination of Water and Wastewater, 22nd Edition, American Public Health Association/American Water Works Association/Water Environment Federation

Glossary of Terms:

MRL	Method Reporting Limit
<	Less than the Reported Detection Limit (RDL) - the RDL may be higher than the MRL due to various factors such as dilutions, limited sample volume, high moisture, or interferences
AO	Aesthetic objective
MAC	Maximum acceptable concentration (health based)
OG	Operational guideline (treated water)
CU	Colour Units (referenced against a platinum cobalt standard)
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
pH units	pH < 7 = acidic, ph > 7 = basic
µS/cm	Microsiemens per centimetre

Standards / Guidelines Referenced in this Report:

Guidelines for Canadian Drinking Water Quality (Oct 2014)

Website: http://www.hc-sc.gc.ca/ewh-semt/alt_formats/pdf/pubs/water-eau/sum_guide-res_recom/sum_guide-res_recom-eng.pdf

Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user

SAMPLE ANALYTICAL DATA

REPORTED TO Oliver, Town of
PROJECT Full Spectrum Analysis

WORK ORDER 6080681
REPORTED 2016-08-16

Analyte	Result / *Recovery*	Standard / Guideline	MRL / *Limits*	Units	Prepared	Analyzed	Notes
Sample ID: Miller Rd Well (6080681-01) [Water] Sampled: 2016-08-08 08:30							
Anions							
Chloride	**11.0**	AO ≤ 250	0.10	mg/L	N/A	2016-08-10	
Fluoride	**0.29**	MAC = 1.5	0.10	mg/L	N/A	2016-08-10	
Nitrate (as N)	**1.96**	MAC = 10	0.010	mg/L	N/A	2016-08-10	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	N/A	2016-08-10	
Sulfate	**68.7**	AO ≤ 500	1.0	mg/L	N/A	2016-08-10	
General Parameters							
Alkalinity, Total (as CaCO3)	**249**	N/A	2	mg/L	N/A	2016-08-10	
Alkalinity, Phenolphthalein (as CaCO3)	< 1	N/A	2	mg/L	N/A	2016-08-10	
Alkalinity, Bicarbonate (as CaCO3)	**249**	N/A	2	mg/L	N/A	2016-08-10	
Alkalinity, Carbonate (as CaCO3)	< 1	N/A	2	mg/L	N/A	2016-08-10	
Alkalinity, Hydroxide (as CaCO3)	< 1	N/A	2	mg/L	N/A	2016-08-10	
Colour, True	< 5	AO ≤ 15	5	CU	N/A	2016-08-10	
Conductivity (EC)	**611**	N/A	2	µS/cm	N/A	2016-08-10	
pH	**7.88**	6.5-8.5	0.01	pH units	N/A	2016-08-10	HT2
Solids, Total Dissolved	**373**	AO ≤ 500	10	mg/L	N/A	2016-08-10	
Turbidity	< 0.10	OG < 0.1	0.10	NTU	N/A	2016-08-10	
Calculated Parameters							
Hardness, Total (as CaCO3)	**306**	N/A	0.50	mg/L	N/A	N/A	
Nitrate+Nitrite (as N)	**1.96**	N/A	0.020	mg/L	N/A	N/A	
Total Metals							
Aluminum, total	< 0.005	OG < 0.1	0.005	mg/L	2016-08-12	2016-08-12	
Antimony, total	**0.0002**	MAC = 0.006	0.0001	mg/L	2016-08-12	2016-08-12	
Arsenic, total	**0.0026**	MAC = 0.01	0.0005	mg/L	2016-08-12	2016-08-12	
Barium, total	**0.086**	MAC = 1	0.005	mg/L	2016-08-12	2016-08-12	
Beryllium, total	< 0.0001	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Bismuth, total	< 0.0001	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Boron, total	**0.073**	MAC = 5	0.004	mg/L	2016-08-12	2016-08-12	
Cadmium, total	**0.00002**	MAC = 0.005	0.00001	mg/L	2016-08-12	2016-08-12	
Calcium, total	**73.7**	N/A	0.2	mg/L	2016-08-12	2016-08-12	
Chromium, total	< 0.0005	MAC = 0.05	0.0005	mg/L	2016-08-12	2016-08-12	
Cobalt, total	< 0.00005	N/A	0.00005	mg/L	2016-08-12	2016-08-12	
Copper, total	**0.0074**	AO ≤ 1	0.0002	mg/L	2016-08-12	2016-08-12	
Iron, total	< 0.01	AO ≤ 0.3	0.01	mg/L	2016-08-12	2016-08-12	
Lead, total	**0.0004**	MAC = 0.01	0.0001	mg/L	2016-08-12	2016-08-12	
Lithium, total	**0.0062**	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Magnesium, total	**29.5**	N/A	0.01	mg/L	2016-08-12	2016-08-12	
Manganese, total	**0.0768**	AO ≤ 0.05	0.0002	mg/L	2016-08-12	2016-08-12	
Molybdenum, total	**0.0059**	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Nickel, total	**0.0006**	N/A	0.0002	mg/L	2016-08-12	2016-08-12	
Phosphorus, total	< 0.02	N/A	0.02	mg/L	2016-08-12	2016-08-12	
Potassium, total	**5.31**	N/A	0.02	mg/L	2016-08-12	2016-08-12	
Selenium, total	**0.0034**	MAC = 0.05	0.0005	mg/L	2016-08-12	2016-08-12	
Silicon, total	**8.5**	N/A	0.5	mg/L	2016-08-12	2016-08-12	
Silver, total	**0.00063**	N/A	0.00005	mg/L	2016-08-12	2016-08-12	

REPORTED TO Oliver, Town of
PROJECT Full Spectrum Analysis

WORK ORDER 6080681
REPORTED 2016-08-16

Analyte	Result / *Recovery*	Standard / Guideline	MRL / *Limits*	Units	Prepared	Analyzed	Notes
Sample ID: Miller Rd Well (6080681-01) [Water] Sampled: 2016-08-08 08:30, Continued							
Total Metals, Continued							
Sodium, total	**16.0**	AO ≤ 200	0.02	mg/L	2016-08-12	2016-08-12	
Strontium, total	**0.860**	N/A	0.001	mg/L	2016-08-12	2016-08-12	
Sulfur, total	**26**	N/A	1	mg/L	2016-08-12	2016-08-12	
Tellurium, total	< 0.0002	N/A	0.0002	mg/L	2016-08-12	2016-08-12	
Thallium, total	**0.00006**	N/A	0.00002	mg/L	2016-08-12	2016-08-12	
Thorium, total	< 0.0001	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Tin, total	**0.0006**	N/A	0.0002	mg/L	2016-08-12	2016-08-12	
Titanium, total	< 0.005	N/A	0.005	mg/L	2016-08-12	2016-08-12	
Uranium, total	**0.00798**	MAC = 0.02	0.00002	mg/L	2016-08-12	2016-08-12	
Vanadium, total	**0.002**	N/A	0.001	mg/L	2016-08-12	2016-08-12	
Zinc, total	**0.010**	AO ≤ 5	0.004	mg/L	2016-08-12	2016-08-12	
Zirconium, total	< 0.0001	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Sample ID: Tucelnuit P#2 (6080681-02) [Water] Sampled: 2016-08-08 11:15							
Anions							
Chloride	**4.25**	AO ≤ 250	0.10	mg/L	N/A	2016-08-10	
Fluoride	**0.47**	MAC = 1.5	0.10	mg/L	N/A	2016-08-10	
Nitrate (as N)	**0.198**	MAC = 10	0.010	mg/L	N/A	2016-08-10	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	N/A	2016-08-10	
Sulfate	**31.5**	AO ≤ 500	1.0	mg/L	N/A	2016-08-10	
General Parameters							
Alkalinity, Total (as CaCO3)	**162**	N/A	2	mg/L	N/A	2016-08-10	
Alkalinity, Phenolphthalein (as CaCO3)	< 1	N/A	2	mg/L	N/A	2016-08-10	
Alkalinity, Bicarbonate (as CaCO3)	**162**	N/A	2	mg/L	N/A	2016-08-10	
Alkalinity, Carbonate (as CaCO3)	< 1	N/A	2	mg/L	N/A	2016-08-10	
Alkalinity, Hydroxide (as CaCO3)	< 1	N/A	2	mg/L	N/A	2016-08-10	
Colour, True	< 5	AO ≤ 15	5	CU	N/A	2016-08-10	
Conductivity (EC)	**366**	N/A	2	µS/cm	N/A	2016-08-10	
pH	**8.03**	6.5-8.5	0.01	pH units	N/A	2016-08-10	HT2
Solids, Total Dissolved	**220**	AO ≤ 500	10	mg/L	N/A	2016-08-10	
Turbidity	< 0.10	OG < 0.1	0.10	NTU	N/A	2016-08-10	
Calculated Parameters							
Hardness, Total (as CaCO3)	**159**	N/A	0.50	mg/L	N/A	N/A	
Nitrate+Nitrite (as N)	**0.198**	N/A	0.020	mg/L	N/A	N/A	
Total Metals							
Aluminum, total	< 0.005	OG < 0.1	0.005	mg/L	2016-08-12	2016-08-12	
Antimony, total	**0.0002**	MAC = 0.006	0.0001	mg/L	2016-08-12	2016-08-12	
Arsenic, total	**0.0032**	MAC = 0.01	0.0005	mg/L	2016-08-12	2016-08-12	
Barium, total	**0.052**	MAC = 1	0.005	mg/L	2016-08-12	2016-08-12	
Beryllium, total	< 0.0001	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Bismuth, total	< 0.0001	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Boron, total	**0.020**	MAC = 5	0.004	mg/L	2016-08-12	2016-08-12	
Cadmium, total	**0.00001**	MAC = 0.005	0.00001	mg/L	2016-08-12	2016-08-12	

REPORTED TO Oliver, Town of
PROJECT Full Spectrum Analysis

WORK ORDER 6080681
REPORTED 2016-08-16

Analyte	Result / *Recovery*	Standard / Guideline	MRL / *Limits*	Units	Prepared	Analyzed	Notes
Sample ID: Tucelnuit P#2 (6080681-02) [Water] Sampled: 2016-08-08 11:15, Continued							
Total Metals, Continued							
Calcium, total	**43.6**	N/A	0.2	mg/L	2016-08-12	2016-08-12	
Chromium, total	< 0.0005	MAC = 0.05	0.0005	mg/L	2016-08-12	2016-08-12	
Cobalt, total	< 0.00005	N/A	0.00005	mg/L	2016-08-12	2016-08-12	
Copper, total	**0.0064**	AO ≤ 1	0.0002	mg/L	2016-08-12	2016-08-12	
Iron, total	< 0.01	AO ≤ 0.3	0.01	mg/L	2016-08-12	2016-08-12	
Lead, total	**0.0002**	MAC = 0.01	0.0001	mg/L	2016-08-12	2016-08-12	
Lithium, total	**0.0049**	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Magnesium, total	**12.2**	N/A	0.01	mg/L	2016-08-12	2016-08-12	
Manganese, total	**0.0008**	AO ≤ 0.05	0.0002	mg/L	2016-08-12	2016-08-12	
Molybdenum, total	**0.0052**	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Nickel, total	< 0.0002	N/A	0.0002	mg/L	2016-08-12	2016-08-12	
Phosphorus, total	< 0.02	N/A	0.02	mg/L	2016-08-12	2016-08-12	
Potassium, total	**3.47**	N/A	0.02	mg/L	2016-08-12	2016-08-12	
Selenium, total	**0.0021**	MAC = 0.05	0.0005	mg/L	2016-08-12	2016-08-12	
Silicon, total	**8.8**	N/A	0.5	mg/L	2016-08-12	2016-08-12	
Silver, total	**0.00051**	N/A	0.00005	mg/L	2016-08-12	2016-08-12	
Sodium, total	**13.2**	AO ≤ 200	0.02	mg/L	2016-08-12	2016-08-12	
Strontium, total	**0.499**	N/A	0.001	mg/L	2016-08-12	2016-08-12	
Sulfur, total	**11**	N/A	1	mg/L	2016-08-12	2016-08-12	
Tellurium, total	< 0.0002	N/A	0.0002	mg/L	2016-08-12	2016-08-12	
Thallium, total	< 0.00002	N/A	0.00002	mg/L	2016-08-12	2016-08-12	
Thorium, total	< 0.0001	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Tin, total	< 0.0002	N/A	0.0002	mg/L	2016-08-12	2016-08-12	
Titanium, total	< 0.005	N/A	0.005	mg/L	2016-08-12	2016-08-12	
Uranium, total	**0.00382**	MAC = 0.02	0.00002	mg/L	2016-08-12	2016-08-12	
Vanadium, total	**0.002**	N/A	0.001	mg/L	2016-08-12	2016-08-12	
Zinc, total	< 0.004	AO ≤ 5	0.004	mg/L	2016-08-12	2016-08-12	
Zirconium, total	< 0.0001	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Sample ID: Tucelnuit P#3 (6080681-03) [Water] Sampled: 2016-08-08 11:15							
Anions							
Chloride	**17.9**	AO ≤ 250	0.10	mg/L	N/A	2016-08-10	
Fluoride	**0.37**	MAC = 1.5	0.10	mg/L	N/A	2016-08-10	
Nitrate (as N)	**2.50**	MAC = 10	0.010	mg/L	N/A	2016-08-10	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	N/A	2016-08-10	
Sulfate	**52.3**	AO ≤ 500	1.0	mg/L	N/A	2016-08-10	
General Parameters							
Alkalinity, Total (as CaCO3)	**208**	N/A	2	mg/L	N/A	2016-08-10	
Alkalinity, Phenolphthalein (as CaCO3)	< 1	N/A	2	mg/L	N/A	2016-08-10	
Alkalinity, Bicarbonate (as CaCO3)	**208**	N/A	2	mg/L	N/A	2016-08-10	
Alkalinity, Carbonate (as CaCO3)	< 1	N/A	2	mg/L	N/A	2016-08-10	
Alkalinity, Hydroxide (as CaCO3)	< 1	N/A	2	mg/L	N/A	2016-08-10	
Colour, True	< 5	AO ≤ 15	5	CU	N/A	2016-08-10	
Conductivity (EC)	**549**	N/A	2	µS/cm	N/A	2016-08-10	

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PROJECT Full Spectrum Analysis

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Analyte	Result / *Recovery*	Standard / Guideline	MRL / *Limits*	Units	Prepared	Analyzed	Notes
Sample ID: Tucelnuit P#3 (6080681-03) [Water] Sampled: 2016-08-08 11:15, Continued							
General Parameters, Continued							
pH	**7.95**	6.5-8.5	0.01	pH units	N/A	2016-08-10	HT2
Solids, Total Dissolved	**333**	AO ≤ 500	10	mg/L	N/A	2016-08-10	
Turbidity	< 0.10	OG < 0.1	0.10	NTU	N/A	2016-08-10	
Calculated Parameters							
Hardness, Total (as CaCO3)	**243**	N/A	0.50	mg/L	N/A	N/A	
Nitrate+Nitrite (as N)	**2.50**	N/A	0.020	mg/L	N/A	N/A	
Total Metals							
Aluminum, total	< 0.005	OG < 0.1	0.005	mg/L	2016-08-12	2016-08-12	
Antimony, total	**0.0001**	MAC = 0.006	0.0001	mg/L	2016-08-12	2016-08-12	
Arsenic, total	**0.0026**	MAC = 0.01	0.0005	mg/L	2016-08-12	2016-08-12	
Barium, total	**0.082**	MAC = 1	0.005	mg/L	2016-08-12	2016-08-12	
Beryllium, total	< 0.0001	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Bismuth, total	< 0.0001	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Boron, total	**0.036**	MAC = 5	0.004	mg/L	2016-08-12	2016-08-12	
Cadmium, total	**0.00001**	MAC = 0.005	0.00001	mg/L	2016-08-12	2016-08-12	
Calcium, total	**68.9**	N/A	0.2	mg/L	2016-08-12	2016-08-12	
Chromium, total	< 0.0005	MAC = 0.05	0.0005	mg/L	2016-08-12	2016-08-12	
Cobalt, total	< 0.00005	N/A	0.00005	mg/L	2016-08-12	2016-08-12	
Copper, total	**0.0010**	AO ≤ 1	0.0002	mg/L	2016-08-12	2016-08-12	
Iron, total	< 0.01	AO ≤ 0.3	0.01	mg/L	2016-08-12	2016-08-12	
Lead, total	**0.0002**	MAC = 0.01	0.0001	mg/L	2016-08-12	2016-08-12	
Lithium, total	**0.0070**	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Magnesium, total	**17.1**	N/A	0.01	mg/L	2016-08-12	2016-08-12	
Manganese, total	< 0.0002	AO ≤ 0.05	0.0002	mg/L	2016-08-12	2016-08-12	
Molybdenum, total	**0.0039**	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Nickel, total	< 0.0002	N/A	0.0002	mg/L	2016-08-12	2016-08-12	
Phosphorus, total	**0.04**	N/A	0.02	mg/L	2016-08-12	2016-08-12	
Potassium, total	**4.36**	N/A	0.02	mg/L	2016-08-12	2016-08-12	
Selenium, total	**0.0044**	MAC = 0.05	0.0005	mg/L	2016-08-12	2016-08-12	
Silicon, total	**9.1**	N/A	0.5	mg/L	2016-08-12	2016-08-12	
Silver, total	**0.00032**	N/A	0.00005	mg/L	2016-08-12	2016-08-12	
Sodium, total	**21.2**	AO ≤ 200	0.02	mg/L	2016-08-12	2016-08-12	
Strontium, total	**0.760**	N/A	0.001	mg/L	2016-08-12	2016-08-12	
Sulfur, total	**18**	N/A	1	mg/L	2016-08-12	2016-08-12	
Tellurium, total	< 0.0002	N/A	0.0002	mg/L	2016-08-12	2016-08-12	
Thallium, total	**0.00002**	N/A	0.00002	mg/L	2016-08-12	2016-08-12	
Thorium, total	< 0.0001	N/A	0.0001	mg/L	2016-08-12	2016-08-12	
Tin, total	**0.0002**	N/A	0.0002	mg/L	2016-08-12	2016-08-12	
Titanium, total	< 0.005	N/A	0.005	mg/L	2016-08-12	2016-08-12	
Uranium, total	**0.00871**	MAC = 0.02	0.00002	mg/L	2016-08-12	2016-08-12	
Vanadium, total	**0.002**	N/A	0.001	mg/L	2016-08-12	2016-08-12	
Zinc, total	< 0.004	AO ≤ 5	0.004	mg/L	2016-08-12	2016-08-12	
Zirconium, total	< 0.0001	N/A	0.0001	mg/L	2016-08-12	2016-08-12	

SAMPLE ANALYTICAL DATA

REPORTED TO	Oliver, Town of	**WORK ORDER**	6080681
PROJECT	Full Spectrum Analysis	**REPORTED**	2016-08-16

Sample / Analysis Qualifiers:

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

APPENDIX C: 2016 WEEKLY WATER SAMPLING

2016 WEEKLY CHLORINE RESIDUAL & COLIFORM SAMPLING
(Target 0.2 to 1.50 - Chlorine Residual)

	RURAL NORTH				BLACK SAGE				RURAL SOUTH												MUNICIPAL			
	System #1				System #2				System #4				System #5				System #6				System #7				
	Surface Water Source				Groundwater Source				Ground Water Source				Groundwater Source				Groundwater Source				Groundwater Source				Groundwater Source			
	Chlorine	Sample	Coliform		Chlorine	Sample	Coliform		Chlorine	Sample	Coliform		Chlorine	Sample	Coliform		Chlorine	Sample	Coliform		Chlorine	Sample	Coliform		Chlorine	Sample	Coliform	
DATE	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli
Jan 4th																					0.11	Fruitvale TS	<1	<1	0.39	Wolfcub TS	<1	<1
Jan 11th	0.30	Pinehill TS	<1	<1																					0.18	Sawmill TS	<1	<1
Jan 18th													0.17	5A Booster	<1	<1									0.31	Granby TS	<1	<1
Jan 25th																	0.09	6a Booster	<1	<1					0.25	Fairview TS	<1	<1
Feb 2nd									0.25	Snowbrush TS	<1	<1													0.05	Hillside TS	<1	<1
Feb 9th																					0.07	Fruitvale TS	<1	<1	0.30	Meadows Dr	<1	<1
Feb 16th	0.12	Pinhill TS	<1	<1																					0.22	Tucelnuit Dr	<1	<1
Feb 22													0.09	5A Booster	<1	<1									0.16	Wolfcub TS	<1	<1
Feb 29																	0.12	6A Booster	<1	<1					0.12	Sawmill TS	<1	<1
Mar 7									0.22	Snowbrush TS	<1	<1													0.22	Granby TS	<1	<1
Mar 14																					0.15	Fruitvale TS	<1	<1	0.40	Fairview TS	<1	<1
Mar 21	0.16	Pinehill TS	<1	<1																					0.18	Hillside St TS	<1	<1
Mar 29													0.20	5A Booster	<1	<1									0.22	Meadows Dr	<1	<1
Apr 4																	0.17	6A Booster	<1	<1					0.16	Tucelnuit Dr	<1	<1
Apr 11									0.27	Snowbrush TS	<1	<1													0.46	Wolfcub Pl.	<1	<1
Apr 18					0.13	Black Sage Rd TS	<1	<1													0.06	Fruitvale TS	<1	<1	0.33	Sawmill TS	<1	<1
Apr 25	0.22	Sportsman B	<1	<1	0.28	Ryegrass TS	<1	<1					0.18	5A Booster	<1	<1									0.28	Granby	<1	<1
May 2	0.18	Pinehill TS	<1	<1	0.37	Black Sage Rd TS	<1	<1									0.28	6A Booster	<1	<1					0.31	Fairview Rd	<1	<1
May 9	0.10	Pinehill TS	<1	<1	0.30	Black Sage Rd TS	<1	<1	0.10	Snowbrush TS	<1	<1													0.10	Hillside TS	<1	<1
May 16	0.21	Pinehill TS	<1	<1	0.24	Ryegrass Rd TS	<1	<1													0.15	Fruitvale TS	<1	<1	0.21	Meadows Dr	<1	<1
May 24	0.16	Pinehill TS	<1	<1	0.26	Black Sage Rd TS	<1	<1					0.15	5a Booster	<1	<1									0.24	Tucelnuit Dr	<1	<1
May 30	0.11	Pinehill TS	<1	<1	0.17	Ryegrass Road	<1	<1									0.16	Road 13	<1	<1					0.17	Wolfcub TS	<1	<1
Jun 6	0.13	Pinehill TS	<1	<1	0.28	Ryegrass Road	<1	<1	0.20	Snowbrush TS	<1	<1													0.17	Sawmill Rd TS	<1	<1
Jun 13	0.20	Pinehill TS	<1	<1	0.30	Black Sage Rd TS	<1	<1													0.16	Fruitvale TS	<1	<1	0.23	Fairview TS	<1	<1
Jun 20	0.20	Pinehill TS	<1	<1	0.38	Ryegrass Rd TS	<1	<1					0.13	5A Booster	<1	<1									0.20	Granby St TS	<1	<1
Jun 27	0.15	Pinehill TS	<1	<1	0.20	Black Sage Rd TS	<1	<1									0.10	6a Booster	<1	<1					0.27	Fairview Rd	<1	<1
Jul-04	0.17	Pinehill TS	<1	<1	0.18	Ryegrass Rd TS	<1	<1	0.06	Snowbrush TS	<1	<1													0.18	Hillside TS	<1	<1
Jul-11	0.12	Pinehill TS	<1	<1	0.20	Blacksage Rd TS	<1	<1													0.00	Fruitvale TS	<1	<1	0.19	Meadows Dr	<1	<1
Jul-11	0.00	Buchannan Well	<1	<1																					0.15	Fairview - N Line	<1	<1
Jul-12																									0.25	Fairview - N Line	<1	<1
Jul-18	0.15	Pinehill TS	<1	<1		Bl'kSge Well # 2	<1	<1	0.15	Snowbrush	<1	<1													0.25	Vineyard Rd	<1	<1
					0.15	Ryegrass	<1	<1																					

2016 WEEKLY CHLORINE RESIDUAL & COLIFORM SAMPLING
(Target 0.2 to 1.50 - Chlorine Residual)

	RURAL NORTH				BLACK SAGE				RURAL SOUTH												MUNICIPAL			
	System #1				System #2				System #4				System #5				System #6				System #7				
	Surface Water Source				Groundwater Source				Ground Water Source				Groundwater Source				Groundwater Source				Groundwater Source				Groundwater Source			
	Chlorine	Sample	Coliform		Chlorine	Sample	Coliform		Chlorine	Sample	Coliform		Chlorine	Sample	Coliform		Chlorine	Sample	Coliform		Chlorine	Sample	Coliform		Chlorine	Sample	Coliform	
DATE	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli	Residual	Location	Total	Ecoli
Jul-27	0.15	Pinehill TS	<1	<1	0.15	Back Sage Rd TS	<1	<1									0.11	6a Booster	<1	<1					0.17	Wolfcub TS	<1	<1
Aug-02	0.20	Pinehill TS	<1	<1	0.22	Ryegrass Rd TS	<1	<1	0.05	Snowbrush	<1	<1													0.18	Sawmill Rd TS	<1	<1
Aug-02					0.00	Miller Rd. Well	<1	<1																				
Aug-08	0.08	Pinehill TS	<1	<1	0.18	Black Sage Rd	<1	<1													0.05	Rd 22 TS	<1	<1	0.35	Granby St	<1	<1
Aug-15	0.15	Pinehill TS	<1	<1	0.23	Ryegrass Rd TS	<1	<1					0.10	5A Booster	<1	<1									0.35	Fairview Rd	<1	<1
Aug-22	0.10	Pinhill TS	<1	<1	0.11	Blacksage Rd	<1	<1									0.06	6A Booster	<1	<1					0.20	Hillside TS	<1	<1
Aug-29	0.16	Pinehill TS	<1	<1	0.22	Ryegrass Rd TS	<1	<1	0.08	Snowbrush	<1	<1													0.35	Meadows Dr	<1	<1
Sep-06	0.17	Pinehill TS	<1	<1	0.21	Blacksage Rd	<1	<1													0.08	Fruitvale	<1	<1	0.20	Tucelnuit	<1	<1
Sep-12	Low Res	Pinehill TS	<1	<1	0.24	Ryegrass	<1	<1					0.06	5A Booster	<1	<1									0.34	Wolfcub	<1	<1
Sep-19	Lo Res	Pinehill TS	<1	<1	0.26	Blacksage Rd	<1	<1									0.13	6a Booser	<1	<1					0.30	Sawmill Rd	<1	<1
	0.02	Buchannan W	<1	<1																								
Sep-26	0.27	Pinehill TS	<1	<1	0.23	Ryegrass	<1	<1	0.06	Snowbrush	<1	<1													0.24	Granby TS	<1	<1
Oct-03	Low Res	Pinehill TS			0.11	Ryegrass																			0.27	Fairview TS		
Oct-11	0.18	Pinehill TS	<1	<1	0.21	Blacksage Rd	<1	<1					0.03	5A Booster	<1	<1									0.20	Hillside	<1	<1
Oct-17	0.08	Pinehill Ts	<1	<1	0.09	Ryegrass	<1	<1									0.08	6A Booster	<1	<1					0.15	Meadows	<1	<1
Oct-24	0.13	Pinehill TS	<1	<1					0.11	Snowbrush	<1	<1													0.17	Meadows	<1	<1
Oct-31	0.10	Pinehill TS	<1	<1																	0.04	Fruitvale	<1	<1	0.06	Tucelnuit	<1	<1
Nov-07	0.12	Pinehill TS	<1	<1									0.19	5A Booster	<1	<1									0.19	Wolfcub Pld	<1	<1
Nov-14	Lo Res	Pinehill TS	<1	<1													0.14	6A Booster	<1	<1					0.13	Sawmill Rd	<1	<1
Nov-21	0.10	Mike's Auto	<1	<1					0.21	Snowbrush	<1	<1													0.37	Granby TS	<1	<1
Nov-28	0.20	Pinehill TS	<1	<1					0.39	Snowbrush	<1	<1													0.28	Fairview Rd	<1	<1
Dec-05	0.20	Mike's Auto	<1	<1																	0.09	Fruitvale	<1	<1	0.16	Hillside	<1	<1
Dec-12	0.21	Pinehill TS	<1	<1									0.05	5A Booster	<1	<1									0.31	Meadows Dr	<1	<1
Dec-19	0.41	Mike's Auto	<1	<1													0.36	6A Booster	<1	<1					0.19	Sawmill Rd	<1	<1
Dec-28	0.26	Pinehill							0.20	Snowbrush															0.32	Wolfcub		

MONTH	GROUNDWATER SOURCES (US GALLONS)													SURFACE WATER SOURCE (US GALLONS)								TOTAL WATER USED IN 2016
	Scada ROCKCLIFFE DOMESTIC PS Mun used for DOMESTIC	Scada TUCELNUIT PS 2 Mun used for DOMESTIC	Scada TUCELNUIT PS 3 Mun used for DOMESTIC	Scada BUCHANAN DOM WELL Sys 1 used for DOMESTIC	Scada MILLER RD RD 13 4,5,6,7 used for DOMESTIC	TOTAL GROUNDWATER USED FOR DOMESTIC	Scada MILLER RD DOM/IRR PS Sys 2 used for BOTH	Scada BLACK SAGE DOM/IRR PS Sys 2 used for BOTH	Scada TOTAL GROUNDWATER USED FOR Both	Scada FAIRVIEW IRR WELL Sys 5A used for AGRICULTURE	Scada BUCHANAN ROAD PS * Sys 1 used for AGRICULTURE	TOTAL GROUNDWATER USED FOR AGRICULTURE	TOTAL GROUNDWATER USED	Scada MUD LAKE PS Sys 1 used for AGRICULTURE	Scada ROCKCLIFFE IRR PS Sys 4 used for AGRICULTURE	Scada FAIRVIEW IRR PS Sys 5 used for AGRICULTURE	Scada HESTER CREEK PS Sys 6 used for AGRICULTURE	Scada MT KOBAU PS Sys 7 used for AGRICULTURE	Scada BLK SAGE IRR PS Sys 2B used for AGRICULTURE	TOTAL SURFACE WATER USED	TOTAL WATER used for AGRICULTURE	
January	785,289	10,729,930	-	14,980,124	-	26,495,344	360	-	360	-	-	-	**26,495,703**	-	-	-	-	-	-	**-**	-	26,495,703
Febuary	9,481,588	4,064,213	15,831	11,734,485	8,700	25,304,817	1,721	-	1,721	-	-	-	**25,306,538**	-	-	-	-	-	-	**-**	-	25,306,538
March	7,502,918	5,909,186	1,577,278	14,979,345	-	29,968,727	-	-	-	-	-	-	**29,968,727**	-	-	-	-	-	-	**-**	-	29,968,727
April	17,304,264	10,109,330	3,043,034	15,211,296	7,913,518	53,581,443	838,264	7,913,518	8,751,782	2,223,334	-	2,223,334	**64,556,558**	34,661,499	79,939,783	-	36,995,878	34,913,736	9,309,669	**195,820,565**	198,043,899	260,377,123
May	17,594,221	19,202,044	7,139,620	14,764,845	9,006,400	67,707,130	1,715,300	38,788,190	40,503,490	-	6,238,956	6,238,956	**114,449,576**	67,176,912	172,042,142	-	86,559,710	76,042,861	22,598,824	**424,420,450**	430,659,405	538,870,026
June	20,529,258	14,106,760	7,642,382	14,902,182	7,914,900	65,095,482	1,519,800	34,808,782	36,328,582	4,164,864	-	4,164,864	**105,588,928**	67,541,978	141,026,356	-	74,589,051	67,955,377	18,031,474	**369,144,236**	373,309,100	474,733,164
July	20,871,319	23,196,249	8,917,158	13,148,293	10,109,300	76,242,318	3,069,100	41,284,498	44,353,598	-	5,994,652	5,994,652	**126,590,568**	99,702,916	204,341,560	-	96,049,306	89,845,500	27,549,977	**517,489,259**	523,483,911	644,079,827
August	20,723,424	21,169,702	11,843,375	24,145,795	5,747,400	83,629,695	733,454	51,632,648	52,366,102	-	3,725,926	3,725,926	**139,721,723**	103,094,448	217,925,635	-	109,473,796	101,839,635	30,407,777	**562,741,291**	566,467,216	702,463,014
September	18,019,683	16,419,179	4,778,291	9,543,898	7,066,400	55,827,451	1,192,496	25,804,080	26,996,576	-	1,673,677	1,673,677	**84,497,704**	58,271,143	119,574,204	-	59,106,201	69,070,399	14,855,838	**320,877,783**	322,551,460	405,375,487
October	8,095,663	2,947,596	9,131,640	12,380,114	-	32,555,013	447,337	13,807,955	14,255,292	-	5,409,323	5,409,323	**52,219,628**	26,910,661	52,228,719	-	27,263,226	21,583,991	4,243,062	**132,229,659**	137,638,982	184,449,287
Novemeber	11,851,904	10,151,091	4,889,711	-	-	26,892,706	-	-	-	-	-	-	**26,892,706**	-	-	-	-	-	-	**-**	-	26,892,706
December	7,270,068	7,760,204	10,499,021	-	-	25,529,293	-	-	-	-	-	-	**25,529,293**	-	-	-	-	-	-	**-**	-	25,529,293
TOTALS	**160,029,600**	**145,765,483**	**69,477,342**	**145,790,377**	**47,766,618**	**568,829,419**	**9,517,832**	**214,039,672**	**223,557,503**	**6,388,197**	**23,042,533**	**29,430,730**	**821,817,652**	**457,359,557**	**987,078,398**	**0**	**490,037,167**	**461,251,500**	**126,996,621**	**2,522,723,243**	**2,552,153,973**	3,344,540,895
WHEN ACTIVE					double-check:	568,829,419					double-check:	467,027,905	821,817,652							double-check:	2,522,723,243	double-check:	3,344,540,895
Max Flow	20,871,319	23,196,249	11,843,375	24,145,795	10,109,300	83,629,695	3,069,100	51,632,648	52,366,102	4,164,864	6,238,956	6,238,956	139,721,723	103,094,448	217,925,635	0	109,473,796	101,839,635	30,407,777	562,741,291	566,467,216	702,463,014
Min Flow	785,289	2,947,596	0	0	0	25,304,817	0	7,913,518	8,751,782	0	1,673,677	1,673,677	25,306,538	26,910,661	52,228,719	0	27,263,226	21,583,991	4,243,062	0	137,638,982	25,306,538
Avg Year Flow	13,335,800	12,147,124	5,789,778	12,149,198	3,980,552	47,402,452	793,153	17,836,639	18,629,792	532,350	1,920,211	2,452,561	68,484,804	38,113,296	82,256,533	0	40,836,431	38,437,625	10,583,052	210,226,937	212,679,498	278,711,741
NOTE	Black Sage PS values are recorded as one combined value. These values have been calculated into agriculture as the activation of the pump pertains to the IRR Season.																					
* Meter only read on a periodic basis																						

MONTH	GROUNDWATER SOURCES (CUBIC METERS)													SURFACE WATER SOURCE (CUBIC METERS)								TOTAL WATER USED IN 2015
	Scada ROCKCLIFFE DOMESTIC PS Mun used for DOMESTIC	Scada TUCELNUIT PS 2 Mun used for DOMESTIC	Scada TUCELNUIT PS 3 Mun used for DOMESTIC	Scada BUCHANAN DOM WELL Sys 1 used for DOMESTIC	Scada MILLER RD RD 13 4,5,6,7 used for DOMESTIC	TOTAL GROUNDWATER USED FOR DOMESTIC	Scada MILLER RD DOM/IRR PS Sys 2 used for BOTH	Scada BLACK SAGE DOM/IRR PS Sys 2 used for BOTH	Scada TOTAL GROUNDWATER USED FOR Both	Scada FAIRVIEW IRR WELL Sys 5A used for AGRICULTURE	Scada BUCHANAN ROAD PS * Sys 1 used for AGRICULTURE	TOTAL GROUNDWATER USED FOR AGRICULTURE	TOTAL GROUNDWATER USED	Scada MUD LAKE PS Sys 1 used for AGRICULTURE	Scada ROCKCLIFFE IRR PS Sys 4 used for AGRICULTURE	Scada FAIRVIEW IRR PS Sys 5 used for AGRICULTURE	Scada HESTER CREEK PS Sys 6 used for AGRICULTURE	Scada MT KOBAU PS Sys 7 used for AGRICULTURE	Scada BLK SAGE IRR PS Sys 2B used for AGRICULTURE	TOTAL SURFACE WATER USED	TOTAL WATER used for AGRICULTURE	
January	2,973	40,617	-	56,706	-	100,296	1	-	1	-	-	-	**100,297**	-	-	-	-	-	-	**-**	-	100,297
February	35,892	15,385	60	44,420	33	95,789	7	-	7	-	-	-	**95,796**	-	-	-	-	-	-	**-**	-	95,796
March	28,402	22,369	5,971	56,703	-	113,444	-	-	-	-	-	-	**113,444**	-	-	-	-	-	-	**-**	-	113,444
April	65,504	38,268	11,519	57,581	29,956	202,828	3,173	29,956	33,129	8,416	-	8,416	**244,373**	131,208	302,605	-	140,045	132,163	35,241	**741,261**	749,677	985,634
May	66,601	72,688	27,026	55,891	34,093	256,299	6,493	146,829	153,322	-	23,617	23,617	**433,239**	254,292	651,250	-	327,664	287,853	85,546	**1,606,605**	1,630,222	2,039,844
June	77,712	53,400	28,930	56,411	29,961	246,413	5,753	131,766	137,519	15,766	-	15,766	**399,697**	255,674	533,843	-	282,350	257,239	68,257	**1,397,362**	1,413,128	1,797,060
July	79,006	87,807	33,755	49,772	38,268	288,608	11,618	156,279	167,897	-	22,692	22,692	**479,197**	377,416	773,517	-	363,586	340,102	104,288	**1,958,909**	1,981,601	2,438,106
August	78,447	80,136	44,832	91,402	21,756	316,573	2,776	195,451	198,227	-	14,104	14,104	**528,904**	390,255	824,938	-	414,403	385,505	115,106	**2,130,207**	2,144,311	2,659,111
September	68,212	62,153	18,088	36,128	26,749	211,330	4,514	97,679	102,193	-	6,336	6,336	**319,858**	220,580	452,637	-	223,741	261,460	56,235	**1,214,654**	1,220,990	1,534,512
October	30,645	11,158	34,567	46,864	-	123,234	1,693	52,269	53,962	-	20,477	20,477	**197,673**	101,868	197,707	-	103,202	81,704	16,062	**500,543**	521,020	698,216
November	44,864	38,426	18,510	-	-	101,800	-	-	-	-	-	-	**101,800**	-	-	-	-	-	-	**-**	-	101,800
December	27,520	29,376	39,743	-	-	96,639	-	-	-	-	-	-	**96,639**	-	-	-	-	-	-	**-**	-	96,639
TOTALS	**605,778**	**551,782**	**263,000**	**551,876**	**180,816**	**2,153,253**	**36,029**	**810,228**	**846,257**	**24,182**	**87,225**	**111,407**	**3,110,917**	**1,731,293**	**3,736,496**	**0**	**1,854,992**	**1,746,026**	**480,734**	**9,549,542**	**9,660,949**	12,660,459
WHEN ACTIVE					double-check:	2,153,253					double-check:	1,767,892	3,110,917							double-check:	9,549,542		
Max Flow	79,006	87,807	44,832	91,402	38,268	316,573	11,618	195,451	198,227	15,766	23,617	23,617	528,904	390,255	824,938	0	414,403	385,505	115,106	2,130,207	2,144,311	2,659,111
Min Flow	2,973	11,158	0	0	0	95,789	0	29,956	33,129	0	6,336	6,336	95,796	101,868	197,707	0	103,202	81,704	16,062	0	521,020	95,796
Avg Year Flow	50,481	45,982	21,917	45,990	15,068	179,438	3,002	67,519	70,521	2,015	7,269	9,284	259,243	144,274	311,375	0	154,583	145,502	40,061	795,795	805,079	1,055,038
NOTE	Black Sage PS values are recorded as one combined value. These values have been calculated into agriculture as the activation of the pump pertains to the IRR Season.																					
* Meter only read on a periodic basis																						

APPENDIX D: 2016 PUMPING DATA

US GAL		GROUNDWATER CONSUMPTION													
YEAR	January	February	March	April	May	June	July	August	September	October	November	December	YTD	Average	Average
2016	26,495,703	25,306,538	29,968,727	64,556,558	114,449,576	105,588,928	126,590,568	139,721,723	84,497,704	52,219,628	26,892,706	25,529,293	**821,817,652**	***68,484,804***	**816,248,764**
2015	24,995,670	22,331,907	28,348,130	69,828,360	107,509,652	134,080,260	163,478,571	140,709,274	101,276,667	68,802,269	26,439,576	25,334,906	**913,135,245**	***76,094,604***	**816,248,764**
2014	24,199,544	21,567,526	24,744,328	54,446,855	90,368,412	100,455,656	133,158,307	123,562,365	88,162,857	72,119,009	24,827,571	23,993,338	**781,605,767**	***65,133,814***	**816,248,764**
2013	26,822,480	25,225,568	32,194,465	46,945,213	99,359,703	105,530,172	153,640,351	131,088,478	71,923,869	70,689,721	23,627,363	23,893,335	**810,940,720**	***67,578,393***	**816,248,764**
2012	26,446,789	24,931,551	26,707,218	43,328,887	86,287,310	72,429,739	102,567,255	137,385,689	100,953,172	57,715,080	32,379,972	26,314,026	**737,446,685**	***61,453,890***	**816,248,764**
2011	28,652,294	26,730,845	40,517,297	43,749,730	68,352,373	106,500,319	132,281,037	160,235,971	113,873,155	56,602,653	27,875,517	27,175,323	**832,546,514**	***69,378,876***	**816,248,764**
Average	***26,268,747***	***24,348,989***	***30,413,361***	***53,809,267***	***94,387,838***	***104,097,512***	***135,286,015***	***138,783,917***	***93,447,904***	***63,024,727***	***27,007,117***	***25,373,370***	***816,248,764***		

CUBIC METERS		GROUNDWATER CONSUMPTION													
YEAR	January	February	March	April	May	June	July	August	September	October	November	December	YTD	Average	Average
2016	100,297	95,796	113,444	244,373	433,239	399,697	479,197	528,904	319,858	197,673	101,800	96,639	**3,110,917**	***259,243***	**3,116,064**
2015	94,619	84,535	107,309	264,329	406,968	507,549	618,833	532,642	383,374	260,445	100,085	95,903	**3,456,591**	***288,049***	**3,116,064**
2013	101,534	95,489	121,869	177,707	376,117	399,475	581,592	496,224	272,261	267,590	89,439	90,446	**3,069,743**	***255,812***	**3,116,064**
2012	100,112	94,376	101,098	164,018	326,633	274,176	388,259	520,061	382,149	218,475	122,571	99,609	**2,791,538**	***232,628***	**3,116,064**
2011	108,461	101,187	153,375	165,611	258,742	403,147	500,738	606,559	431,057	214,264	105,520	102,870	**3,151,530**	***262,627***	**3,116,064**
Average	***101,005***	***94,277***	***119,419***	***203,207***	***360,340***	***396,809***	***513,724***	***536,878***	***357,740***	***231,689***	***103,883***	***97,093***	***3,116,064***		

US GAL		SURFACE WATER CONSUMPTION													
YEAR	January	February	March	April	May	June	July	August	September	October	November	December	YTD	***Average***	Average
2016	-	-	-	195,820,565	424,420,450	369,144,236	517,489,259	562,741,291	320,877,783	132,229,659	-	-	**2,522,723,243**	***210,226,937***	**2,896,986,090**
2015	-	-	-	242,341,115	487,581,169	653,959,751	763,431,674	667,904,291	465,978,262	223,374,730	-	-	**3,504,570,991**	***292,047,583***	2,896,986,090
2014	-	-	-	9,259,933	450,829,671	532,264,210	770,607,532	655,345,192	415,486,514	139,133,678	-	-	**2,972,928,744**	***247,743,894***	2,896,986,090
2013	-	-	-	111,513,914	414,598,794	427,810,480	826,320,197	585,448,024	187,664,000	127,259,405	-	-	**2,680,616,827**	***223,384,568***	2,896,986,090
2012	-	-	-	54,565,999	435,058,354	329,074,308	498,062,630	778,108,564	562,112,733	203,189,639	-	-	**2,860,174,238**	***238,347,686***	2,896,986,090
2011	-	-	-	81,923,968	217,955,384	487,428,539	703,413,225	800,592,760	466,730,956	82,855,654	-	-	**2,840,902,497**	***236,741,707***	2,896,986,090
Average	***0***	***0***	***0***	***115,904,249***	***405,073,970***	***466,613,587***	***679,887,419***	***675,023,353***	***403,141,708***	***151,340,461***	***0***	***0***	***2,896,986,090***		

CUBIC METERS		SURFACE WATER CONSUMPTION													
YEAR	January	February	March	April	May	June	July	August	September	October	November	December	YTD	***Average***	Average
2016	-	-	-	741,261	1,606,605	1,397,362	1,958,909	2,130,207	1,214,654	500,543	-	-	**9,549,542**	***795,795***	10,967,617
2015	-	-	-	917,360	1,845,695	2,475,506	2,889,902	2,528,292	1,763,919	845,565	-	-	**13,266,238**	***1,105,520***	10,967,617
2014	-	-	-	35,053	1,706,575	2,014,838	2,917,065	2,480,750	1,572,787	526,678	-	-	**11,255,761**	***937,812***	10,967,617
2013	-	-	-	422,126	1,569,426	1,619,438	3,127,961	2,216,161	710,385	481,729	-	-	**10,149,239**	***845,602***	10,967,617
2012	-	-	-	206,555	1,646,874	1,245,681	1,885,371	2,945,460	2,127,827	769,156	-	-	**10,828,937**	***902,244***	10,967,617
2011	-	-	-	310,116	825,050	1,845,117	2,662,707	3,030,572	1,766,768	313,643	-	-	**10,755,984**	***896,164***	10,967,617
Average	***0***	***0***	***0***	***438,745***	***1,533,371***	***1,766,324***	***2,573,653***	***2,555,240***	***1,526,057***	***572,886***	***0***	***0***	***10,967,617***		

US GAL		*6 YR AVG*
YEAR	ANNUAL TOTAL	
2016	3,344,540,895	*3,786,973,646*
2015	4,417,706,236	*3,786,973,646*
2014	3,754,534,511	*3,786,973,646*
2013	3,491,557,547	*3,786,973,646*
2012	3,597,620,923	*3,786,973,646*
2011	3,673,449,011	*3,786,973,646*
AVERAGE	***3,786,973,646***	

CUBIC METERS		*6 YR AVG*
YEAR	ANNUAL TOTAL	
2016	12,660,459	*14,335,248*
2015	16,722,829	*14,335,248*
2014	14,212,452	*14,335,248*
2013	13,216,977	*14,335,248*
2012	13,618,470	*14,335,248*
2011	13,905,511	*14,335,248*
AVERAGE	***14,335,248***	

APPENDIX E: GROUNDWATER AND SURFACE WATER CONSUMPTION DATA 2016