KERR WOOD LEIDAL
consulting engineers

Vancouver Island
201 - 3045 Douglas Street
Victoria, BC V8T 4N2
T 250 595 4223
F 250 595 4224

Technical Memorandum

DATE: April 21, 2016

TO: Greg St. Louis, City of White Rock

FROM: Rose Sinnott, Kerr Wood Leidal Associates
Colwyn Sunderland, Kerr Wood Leidal Associates

RE: **City of White Rock**
Water Conservation Plan
Our File 0452.111-300

1. Introduction

In support of the application for an infrastructure grant under the New Building Canada Fund – Small Communities Fund, this Water Conservation Plan identifies targets and opportunities for sustainable water use in the White Rock Water Service Area.

Note that the City has recently purchased the water utility from EPCOR White Rock Water Ltd. and took over operation on October 30, 2015.

2. Population and Potential Growth

The City of White Rock water service area is approximately 600 ha encompassing the City of White Rock, about 85 adjacent lots in the City of Surrey, and the Semiahmoo First Nation.

The City of White Rock water service area has an existing population equivalent (PE) of approximately 25,200, including users in the City of Surrey and industrial, commercial and institutional (ICI) users. Please note that the Semiahmoo First Nation is included in the ICI category as population equivalent because the water meter is in the commercial category.

Using the 2008 OCP growth prediction of 100 new residential units each year and 1.9 persons per private household[1], the 2013 Water System Master Plan Update[2] indicates that the 2049 estimated population equivalent is 34,601. A table with projected water service area population equivalent is below.

Table 1: Estimated Water Service Area Population Equivalent

Year	Residential Population	ICI Equivalent Population	Total Population Equivalent
2012	19,552	5,634	25,186
2049	26,862	7,739	34,601

[1] The City of White Rock, Official Community Plan, September 2008.

[2] Kerr Wood Leidal Associates Ltd, EPCOR White Rock 2013 Water System Master Plan Update, November 2013.

3. Current Water Demand

Water demands from source flow records[3] from 2006 to 2014 are shown in Table 2 and on Figure 1. Base demand is the average demand over the winter. The maximum day demand, average annual demand, estimated service area population, and average demand per capita for each year is also included in the table. Despite a growing population, base demand has decreased at an average rate of 1.7 L/s per year since 2006. The seasonal component of maximum day demand (MDD) also appears to have declined, although weather is the dominant factor. Changes in lawn watering restrictions in recent years may also have influenced seasonal demand. Maximum day demand per capita has also declined from approximately 610 L/ca/d in 2006 to 520 L/ca/d in 2014.

Table 2: Annual Water Use Summary

Year	Base Demand (L/s)	Maximum Day Demand (L/s)	Average Annual Demand (L/s)	Estimated Service Area Population[4]	Average Annual Demand Per Capita[5] (L/ca/day)
2006	76	130	88	18,438	411
2007	72	117	83	18,624	383
2008	72	150	82	18,809	377
2009	71	161	85	18,995	387
2010	71	118	78	19,181	350
2011	64	103	72	19,366	323
2012	65	105	71	19,552	315
2013	61	112	72	19,742	315
2014	64	120	75	19,932	326

[3] ECPOR White Rock Water Inc. Monthly Flow Reports, 2006 – 2014.

[4] Estimated service area population for 2009 and 2012 is from 2010 and 2013 Water System Master Plan Update Reports. Other years have been interpolated.

[5] Average annual demand per capita is calculated using actual population (i.e. does not included ICI population equivalent)

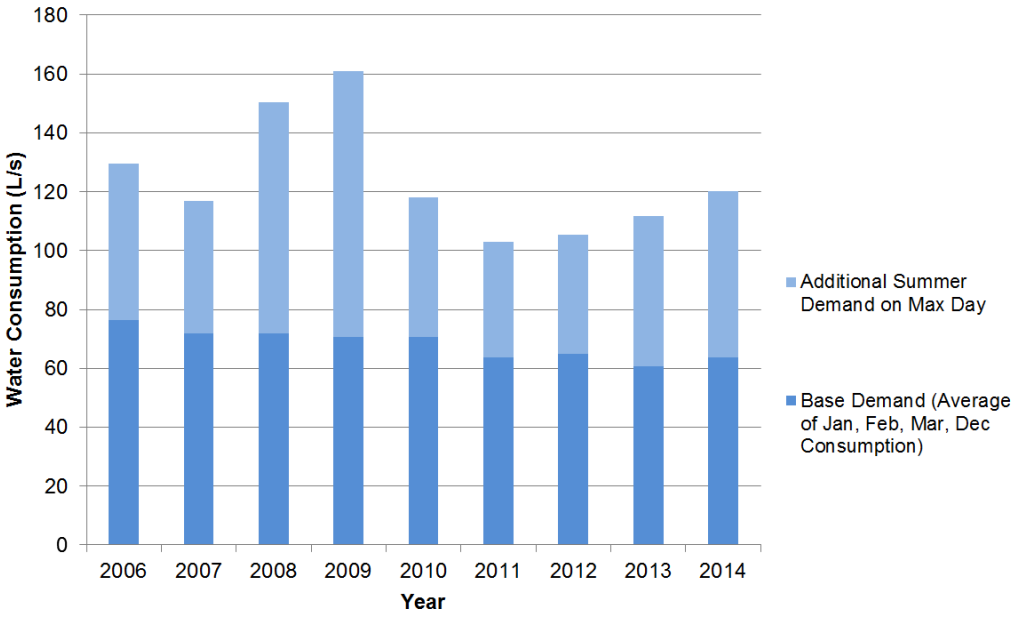

Figure 1: Peak Day Water Use Trends

All customer connections to the White Rock water system are metered. Non-revenue water for 2012 was 8.2 L/s; this was estimated by comparing source flow data to service meter flow records. Figure 2 shows the breakdown between non-revenue water, residential and ICI base demand use based on 2012 service meter records.

Leakage was estimated from the non-revenue water by including allowances for hydrant flushing and meter under reading. Leakage was estimated to be 6.1 L/s in 2012. This accounts for approximately 9% of the total base demand.

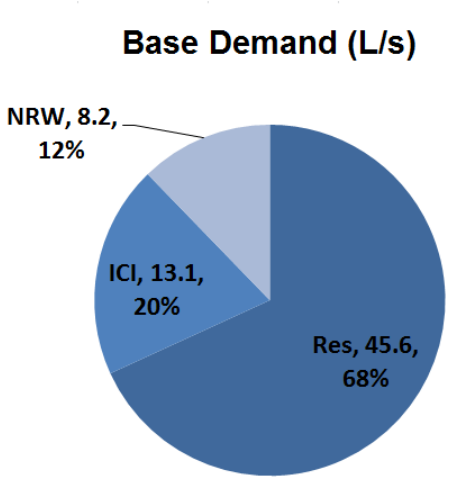

Figure 2: 2012 Service Meter Base Demand Breakdown

4. Water Supply Capacity

The City of White Rock supply system consists of seven groundwater wells located at four sites throughout the City of White Rock.

Information on the current status and capacity of each of well is summarized in Table 3.

Table 3: Well Capacity Summary

Well Number	Location	Current Treatment	Capacity[6] (L/s)
Well No. 1	Oxford Site	Chlorinated at Oxford Facility	24
Well No. 2	Oxford Site	Chlorinated at Oxford Facility	20
Well No. 3	Oxford Site	Chlorinated at Oxford Facility	26
Well No. 4	High Street	None, pumps directly to distribution system	19
Well No. 5	Buena Vista Ave	None, pumps directly to distribution system	28
Well No. 6	Merklin Site	Individually chlorinated via temporary chlorination system	20
Well No. 7	Merklin Site	Individually chlorinated via temporary chlorination system	35
Total Capacity (Including All Wells):			**172**
Total (With the Largest Well Out of Service):			**137**
Total (Excluding Wells Without Chlorination)			**126**

All wells extract water from the Water Rock / Sunnyside Uplands Aquifer, which is estimated to extend from White Rock to South Surrey including up to the Nicomekl River to the north, 168 Street to the east, Semiahmoo Bay to the south, and Boundary Bay to the west. The Ministry of Environment has classified this aquifer as IIC (moderately utilized relative to water availability, II, with low vulnerability, C)[7].

5. Wastewater System Capacity

The existing City of White Rock sanitary sewer system includes the following:

- 10 major catchment areas;
- 82 km of gravity sewers;
- 700 m of forcemains;
- 2.3 km siphon; and
- 3 pump stations (Keil, Ash and Bergstrom).

All City of White Rock wastewater flows are directed to the Metro Vancouver (MV) pump station located at Oxford Street and Marine Drive. From the MV pump station wastewater is pumped to North Bluff Road to a connection with the South Surrey Interceptor.

[6] Current operating flow, Whiteside Engineering Ltd., Summer 2016 Operation Technical Memorandum #1, Draft, March 11, 2016.

[7] Ministry of Environment Aquifer Classification Worksheet, Aquifer Number 0057, October 2007.

The capacity of the pump stations and siphon are summarized in Table 4.

Table 4: Wastewater Facility Capacity Summary

Sanitary Facility Name	Estimated Capacity[8] L/s
Marine Drive Siphon	189
Keil Pump Station	52 – 63
Ash Pump Station	49 – 52
Bergstrom Pump Station	20 – 24
Oxford Pump Station (Metro Vancouver)	370

The 2013 Sewer Master Plan Update uses a design value of 360 L/ca/day to estimate future base sanitary flows (compared to 210 L/ca/day measured via flow monitoring). Based on 360 L/ca/day and the 2031 projected population (23,500), the estimated future dry weather flow is 98 L/s.

The 2013 Sewer Master Plan Update indicates that the Bergstrom and Oxford (MV) pump stations do not have sufficient capacity for future (2031) peak wet weather flows (future scenario base flows were calculated using 360 L/ca/day, not actual observed values).

Water conservation measures have contributed to the declining trend in base water demands (as shown in Table 2 and Figure 1), which are similar to average dry weather sewer flows. Refining future sewer flow estimates on the basis of forecast water demands that consider water conservation measures may enable some wastewater system capacity upgrades to be deferred or reduced in size and cost. Although most sewer collection infrastructure must be sized to accommodate peak wet weather flows that consist predominantly of stormwater inflow and infiltration (I&I), as these issues are addressed over time through infrastructure renewals, the benefit of reducing sewer flows from buildings through water conservation will become more significant.

6. Climate Change Adaptation and Mitigation

In general, weather is likely to become wetter on average in the future, although summers are expected to be hotter and drier on average. According to the Pacific Climate Impacts Consortium (PCIC; plan2adapt.ca), by the 2050s, precipitation in the Greater Vancouver area is expected to change from current normals as follows (median of forecasts, and range of 10th to 90th percentiles):

- Annual +7% (-2% to +11%)
- Summer -15% (-25% to +3%)
- Winter +6% (-4% to +15%)

Extreme weather events (temperature and precipitation, drought and flooding) are expected to increase in frequency. The impacts on water and sewer services may include increased storage requirements for balancing peak flows, and increased peak inflow into the wastewater system. Peak water demands may significantly increase as summers become hotter and drier on average.

The carbon footprint per capita of the City's water service is estimated to be somewhat greater than the provincial average, primarily due to the use of deep wells as a water source, whereas most of BC's population is served water sourced at high elevation relative to the communities. The wastewater service is estimated to have a typical carbon footprint. Greenhouse gas emissions are likely to increase slightly

[8] AECOM, City of White Rock Sewer Master Plan Update, January 2013.

in the future, as treatment upgrades required to comply with current drinking water regulations will increase electricity demands. Conserving water and reducing sewer I&I will mitigate the increase in electrical demand by reducing pump duty cycles.

Benefits of water conservation (mitigation and adaptation):

- Reducing costs and carbon emissions of expanding the infrastructure to accommodate growth (e.g. manufacturing, transporting and installing larger water mains); and
- Maintaining more water in aquifer storage for emergencies such as extreme drought, which may increase due to climate change.

7. Water Demand Targets

The following water conservation targets are recommended:

- Overall water supply flow (annual average): Maintain below 90 L/s on average through year 2049;
- Maximum day demand: Maintain below 137 L/s (total of all current wells with largest well out of service) through year 2049; and
- End user demand (L/ca/day): Reduce to 440 L/ca/day maximum day demand and 290 L/ca/day annual average demand by year 2049.

Achieving these targets will rely on a combination of pricing, educational and regulatory measures to reduce water demands in existing buildings, water-efficient new construction, and implementation of a water distribution loss management program. If these measures are implemented, the targets are expected to be achieved with a water service area population of 26,862 in year 2049.

8. Current and Planned Water Conservation Measures

A planned adaptive strategy enables conservation measures to be tailored to meet the changing needs of the community over time. The following conservation measures are currently undertaken or are planned for implementation as required:

1. **Consumption based billing (current)** – The City of White Rock is 100% metered. Water is currently billed quarterly on a base charge plus excess consumption (water budget) structure for all accounts (residential and ICI), which provides an incentive to use less water than the threshold for excess consumption. Adjustments to the rate structure based on a cost of service study using the methodology set out in the American Water Works Association Manual of Water Supply Practices M1 – Principles of Water Rates, Fees and Charges would provide a basis for increasing incentives to limit seasonal water demands while ensuring stable revenues and affordable service for the basic needs of residents and businesses.
2. **Regulation (current)** – Outdoor watering restrictions are in effect from June 1 to September 30 every year. There are four stages:
    - Stage 1 is in effect from June 1 to September 30.

      Residential: Lawn sprinkling is allowed only between 4:00 a.m. and 9:00 a.m. Even numbered addresses may sprinkle only on Mondays, Wednesdays and Saturdays. Odd numbered addresses, may sprinkle only on Tuesdays, Thursdays and Sundays. These sprinkling restrictions only apply to lawns; hand watering of gardens, shrubs, trees and flower beds is allowed. When washing a boat or motor vehicle other than at commercial car wash, water hoses must be equipped with an automatic shut off device.

Commercial: Even numbered properties may water on Mondays and Wednesdays between 1:00 a.m. and 6:00 a.m. Odd numbered properties may water on Tuesdays and Thursdays between 1:00 a.m. and 6:00 a.m. All commercial addresses may also water on Fridays between 4:00 a.m. and 9:00 a.m. These sprinkling regulations apply only to lawns, and not to hand watering of gardens, shrubs, trees and flower beds.

- Stage 2 is implemented as needed.

  Residential: Lawn sprinkling is allowed only between 4:00 a.m. and 9:00 a.m. Even numbered addresses may sprinkle only on Wednesdays. Odd numbered addresses may sprinkle only on Thursdays. These sprinkling regulations apply only to lawns, and not to hand watering of gardens, shrubs, trees and flower beds. When washing a boat or motor vehicle other than commercial car wash, water hoses must be equipped with an automatic shutoff devise.

  Commercial: Even numbered premises may water on Mondays between 1:00 a.m. and 6:00 a.m. Odd numbered premises may water on Tuesdays between 1:00 a.m. and 6:00 a.m. These sprinkling regulations apply only to lawns, and not to hand watering of gardens, shrubs, trees and flower beds

- Stage 3 is implemented as needed.

  Lawn sprinkling is not allowed by residential or commercial properties.

  Residential and commercial gardens, shrubs, trees and flower beds may only be watered by hand, by containers or drip irrigation. Hand washing of vehicles is restricted to features required for safety (i.e. windows, lights and license plates). Refilling of private, commercial and public swimming pools is prohibited.

- Stage 4 is implemented as needed.
  - No lawn sprinkling by residential and commercial properties
  - No watering of residential or non-residential gardens, shrubs, trees and flower beds by any method
  - No washing of vehicles using any method except for features required for safety (i.e. windows, lights and license plates)
  - No refilling of private, commercial and public garden ponds, ornamental fountains, hot-tubs or swimming pools

The City's watering restriction program is nearly identical to the Metro Vancouver Water Shortage Response Plan (WSRP), which is among the most effective seasonal water use regulation programs in North America. Having consistent policy with other municipalities in the region also minimizes confusion among residents and businesses, particularly where the City provides water service to properties located in Surrey.

The triggers and timing for escalating watering restrictions are unique to the City's water system, and the City may be in a different level of restrictions from neighbouring municipalities at times. This is appropriate, and cannot reasonably be avoided.

Under Stage 2, residential lawn watering days in the City's program differ from those in the WSRP. If harmonizing watering days under Stage 2 with the WSRP has a neutral or beneficial impact on MDD, the City should consider making this change.

3. **Cast Iron Condition Assessment and Water Main Asset Management Study** (planned) – Cast iron piping failures constitute 92% of the recorded water main breaks in the White Rock

water system. This study includes a comprehensive condition assessment of 2 km of cast iron water mains in a high break rate area. The information collected during the condition assessment will be used to develop a system-wide asset management strategy. This study will help identify areas prone to leaks and breaks and will allow these mains to be replaced before they fail. The study is included in the five-year financial plan for the water utility.

4. Water Loss Management Program (recommended) – This program would include identification and prioritization of measures for reducing and managing water distribution system leakage, in accordance with utility best practices for:
    a. Leakage measurement and location using a combination of night flow analysis, district metered area analysis, step-testing, acoustic leak detection and correlation;
    b. Timely identification and repair of significant leaks;
    c. Pressure management, including effective use of existing control infrastructure; and
    d. Prioritized asset renewal, targeting high leakage areas first.
5. Reporting usage and water budgets on water bills (recommended) – Displaying information about water use on water bills would raise customer awareness about their water use. Comparing each customer's water use to a system average, or to a water use budget based on system constraints will enable customers to make informed and timely decisions about how they use water.
6. Water Conservation Plan Renewal (recommended for 2021, and every five years thereafter) – A review of this plan would be conducted approximately every five years to update forecasts and targets, consider new information, and adjust program activities as required to meet targets.

9. Program Implementation Responsibility, Cost and Schedule

The Director of Engineering will have overall responsibility for the water conservation program. Aspects of the program may be delivered by other departments. The program will be budgeted under the water fund. Planned items will proceed within the next five years (subject to budget approvals), and it is anticipated that the recommended measures could be implemented within the current operating budget of the utility.

10. Linkages to Other Plans and Policies

This Plan supports the Official Community Plan, Water Master Plan, and Sewer Master Plan, and is consistent with the City's climate action and sustainability objectives.

KERR WOOD LEIDAL ASSOCIATES LTD.

Prepared by:

Rose Sinnott, P.Eng.
Project Engineer

Reviewed by:

Colwyn Sunderland, AScT
Asset and Demand Management Specialist

RS/

Statement of Limitations

This document has been prepared by Kerr Wood Leidal Associates Ltd. (KWL) for the exclusive use and benefit of the intended recipient. No other party is entitled to rely on any of the conclusions, data, opinions, or any other information contained in this document.

This document represents KWL's best professional judgement based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by members of the engineering profession currently practising under similar conditions. No warranty, express or implied, is made.

Copyright Notice

Revision History

Revision #	Date	Status	Revision Description	Author
A	April 20, 2016	Draft		RS/CPS
B	April 21, 2016	Final		RS/CPS

OQM | Organizational Quality Management Program