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2013 Water System Master Plan Update

Final Report
November 2013
KWL Project No. 102.119-302

Prepared for:

EPCOR White Rock Water Inc.

Prepared by:

Kerr Wood Leidal Associates Ltd.

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Section 1

Introduction

1. Introduction

1.1 Scope of Report

The goal of the 2013 Water System Master Plan update is to create a plan suitable to address distribution system capital planning needs for EPCOR White Rock Water's (EWR) upcoming 4-year rate filing. The scope of this project includes:

- Existing system model update;
- Proposed system model update;
- Source flow update;
- Service meter data review;
- Water main break history update;
- Develop a future growth model scenario;
- Hydraulic performance analysis; and
- Capital plan update.

1.2 Acknowledgements

The project team and contributors to this project are listed below. This project could not have been completed without timely contributions and assistance of all those listed.

EPCOR

Betty Icharia	Utility Manager
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Stephen Craik	Director of Quality Assurance and Environment
Susan Ancel	Director of Water Distribution and Transmission
Lee Jenkins	Senior Manager BC Operations
Vince Corkery	Director of Municipal Operations

1.3 Reports Referenced

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1.4 Abbreviations Used

The following abbreviations have been used throughout the report.

BD	Base Demand (Typical Indoor Winter Water Usage)
ca	Capita (Person)
CARL	Current Annual Real Losses
CI	Cast Iron Water Main
COM	Commercial
DI	Ductile Iron Water Main
EWR	EPCOR White Rock Water Inc.
GD	Geodetic Datum
ha	Hectare
HGL	Hydraulic Grade Line
HP	Horsepower
ICI	Industrial, Commercial and Institutional
ILI	Infrastructure Leakage Index
IND	Industrial
INST	Institutional
KWL	Kerr Wood Leidal Associates Ltd.
MDD	Maximum Day Demand
MF	Multifamily
ML	Mega Litre (10^6 L)
PE	Population Equivalent
PHD	Peak Hour Demand
PRV	Pressure Reducing Valve
PRS	Pressure Reducing Station
RES	Residential
SCADA	Supervisory Control and Data Acquisition
SD	Seasonal Demand (Irrigation Demand on MDD; BD+SD = MDD)
SF	Single Family
TDH	Total Dynamic Head
TWL	Top Water Level
TWQM	Total Water Quality Management
UARL	Unavoidable Annual Real Losses
VFD	Variable Frequency Drive

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Section 2

Model Update

2. Model Update

2.1 Water System Description

The water system owned and operated by EWR supplies water to the City of White Rock as well as the surrounding area, including a portion of Surrey (located on North Bluff Ave.) and the Semiahmoo First Nation. The major supply facilities in the existing EWR water distribution system include:

- Seven groundwater wells;
- The Merklin booster pump station (2 booster pumps, 1 electric fire pump, and 1 diesel fire pump);
- The Roper Reservoir;
- The Merklin Low Reservoir;
- The Merklin High Reservoir; and
- Three pressure reducing valve stations (PRS) on Roper Ave., Stevens St., and Johnston Rd.

The water service area is divided into the High Pressure Zone and the Low Pressure Zone. The High Pressure Zone is supplied by the Oxford Wells (Well 1, 2 and 3), High St. Well (Well 4) and the Merklin Wells (Well 6 and 7). The Low Zone is supplied by the Buena Vista Well (Well 5) and from the High Zone via. the three PRS.

A schematic of the water system is shown on Figure 2-1.

The schematic does not include upgrades that are planned as part of the Total Water Quality Management upgrades [20]. As discussed below, these proposed upgrades are included in the water model.

2.2 Evolution of EWR's Water Model

The existing model was developed by Kerr Wood Leidal Associates Ltd. (KWL) in 1986 using WATER hydraulic modelling software. In 1995 and 1996, the model was rebuilt using the WATERWORKS software. At that time, demands were updated, and the model was calibrated.

In 1999, the model was converted to Haestad Methods Cybernet version 3. In 2002/2003, the model was updated with new demands and minor piping upgrades and converted to WaterCAD version 5.0. The EWR system model has been upgraded since 2003 to reflect various piping upgrades. As part of the 2010 Water System Master Plan Update, the model was rebuilt using WaterCAD version 8 with a GIS-based piping network.

The model version used in the analysis for this report is WR_v41.wtg.

2.3 Model Updates

The updates to the model completed for this report are summarized in Table 2-1. Note that the projects scheduled to be completed in 2013 were included in the model update for the existing system.

Table 2-1: Model Updates

KWL Project No.	Project Name	Project Description	Project Completion Date
102.096	Chestnut St. Looping	70 m of 150 mm diameter ductile iron water main on Chestnut St. between North Bluff Rd. and Blackburn Ave. (in two sections).	2011
102.097	Hospital St. Looping	Installation of 260 meters of 200 mm ductile iron water main on Hospital St. and Vine Ave. connecting with the water mains on Best St., and the existing 200 mm diameter water main stub on Hospital St. south of North Bluff Rd.	2013
102.106	Kerfoot Rd. Looping	Installation of 70 meters of 150 mm diameter ductile iron water main on Kerfoot Rd., linking the existing water main on Vine Ave. with the water main on North Bluff Rd.	2011
102.107	Cory Rd. Looping	Installation of 20 meters of 150 mm diameter ductile iron water main on Cory Rd., linking the existing 100 mm dia. water main on Cory Rd. to the 200 mm dia. water main on North Bluff Rd.	2011
102.108	13700 Block Blackburn Ave. Water Main	Installation of 300 m of 200 mm diameter ductile iron water main on Blackburn Ave. between Chestnut St. and Lancaster St. (13700 to 13800 blocks) and installation of 200 m of 150 mm diameter ductile iron water main on Coldicutt Ave. between Chestnut St. and Lancaster St.	2012
102.110	800 Block Finlay St. Water Main	Installation of 140 m of 150 mm diameter ductile iron water main on Finlay St. between Columbia Ave. and Victoria Ave.	2012
102.111	15300 Block Royal Ave. Water Main	Installation of 130 m of 150 mm diameter water main looping the existing water main on Royal Ave. to Dolphin St.	2013
102.112	1400 Block George St. Water Main	Installation of 110 meters of 200 mm diameter ductile iron water main on the 1400 block of George St. between Russell Ave. and Thrift Ave.	2012
102.113	Well 7 Completion Project	Complete the installation of a groundwater well at the Merklin Reservoir site to meet increased customer demands.	2012
102.115	Bishop Hill Subdivision Water Main	Installation of 70 m of 100 mm diameter ductile iron water main to service the Bishop Hill subdivision.	2012
102.116	15449 Marine Dr. Water Main Extension	Installation of 30 m of 200 mm diameter ductile iron water main on Marine Dr. west of Balsam St.	2012
102.120	15500 Block Oxenham Ave. Water Main	Installation of 410 meters of 150 mm diameter ductile iron water main on Oxenham Ave. between Best and Finlay St. (15400 &15500 blocks).	Scheduled for 2013

2.4 Pipe Inventory

The size and material of the existing water mains in the model is summarized in the table below.

Table 2-2: Inventory of Water Mains (Length in m)

Nominal Diameter (mm)	Cast Iron	Ductile Iron	PVC	Steel	Unknown	Galvanized Iron	All Materials
25	0	172	0	0	38	0	**210**
50	26	336	184	0	54	114	**714**
100	9,548	3,136	45	0	10	0	**12,739**
150	8,087	25,364	206	223	262	0	**34,142**
200	6,565	15,554	0	260	91	0	**22,470**
250	1,612	3,925	0	20	9	0	**5,567**
300	0	1,927	0	0	0	0	**1,927**
All Diameters	**25,838**	**50,414**	**435**	**503**	**464**	**114**	**77,769**

2.5 Pending Supply System Upgrades

A Total Water Quality Management (TWQM) plan was developed to address the following deficiencies in the water system:

- Treatment (chlorination);
- Storage; and
- Supply capacity.

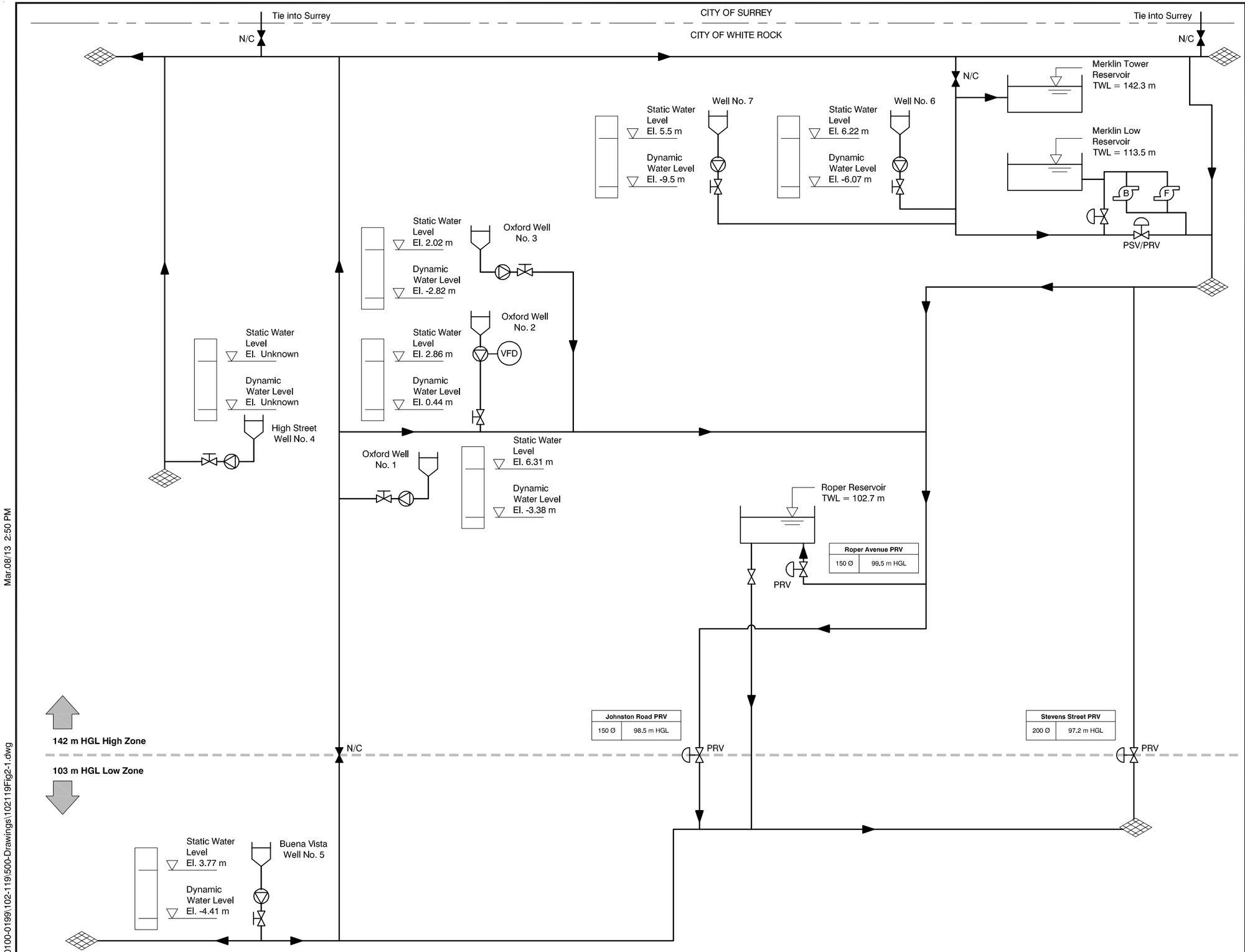
The current design[1] for the TWQM plan is included in the water model. The table below summarizes the components included.

Table 2-3: Future System Components From TWQM Plan

Site	Component	Details
Merklin Site	Merklin High Reservoir	Decommission / remove from service
	New Merklin Reservoir	1.55 ML 113.5 m TWL
	New Merklin Pump Station	2 booster pumps (40 L/s at 30 m TDH) 1 fire pump (172 L/s at 30 m TDH)
	Merklin Wells (Wells 6 and 7)	Merklin wells pump to reservoir via. chlorine injection station (do not pump directly to distribution system)
Oxford Site	New Oxford Reservoir	1.73 ML 92.8 m TWL

[1] Current TWQM design is described in Stantec's June 20, 2012 report. [See reference 20.]

Site	Component	Details
Oxford Site	New Oxford Pump Station	3 booster pumps (75 L/s at 60 m TDH)
	Oxford Wells (Wells 1, 2 and 3)	Oxford wells pump to the new Oxford reservoir (do not pump directly to distribution system)
High St.	High St. Well (Well 4)	High St. well (Well 4) pumps to the distribution system directly
Buena Vista Ave.	Buena Vista Well (Well 5)	Decommission / remove from service



EPCOR

Water System Master Plan Update

Legend

- Transmission Main
- Control Valve
  - PRV (Pressure Reducing Valve)
  - PSV/PRV (Pressure Sustaining Valve/Pressure Reducing Valve)
- Well Pump
- B — Balancing Pump
- F — Fire Pump
- Manual Flow Control Valve
- N/C — Valve Normally Closed
- VFD — Variable Frequency Drive
- To Distribution Network

Notes:

1. Static and dynamic water levels are based on well depths and approximate ground elevations.
2. TWL are based on WaterCAD input data.
3. Existing TWQM plan upgrades not shown.

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Not to Scale

Project No.	Date
102-119	March 2013

EPCOR White Rock Water Supply Facility System Schematic (Pre-TWQM Upgrades) Figure 2-1

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Section 3

Existing Demands

3. Existing Demands

3.1 System Demands

Water demands have been calculated using monthly flow reports provided by EWR. The reports include daily volume totals and run hours for each well pump. Note that the reports do not account for reservoir filling or emptying. Table 3-1 summarizes the monthly volume totals for 2012. The base demand is the average demand over the winter months (December, January, February and March).

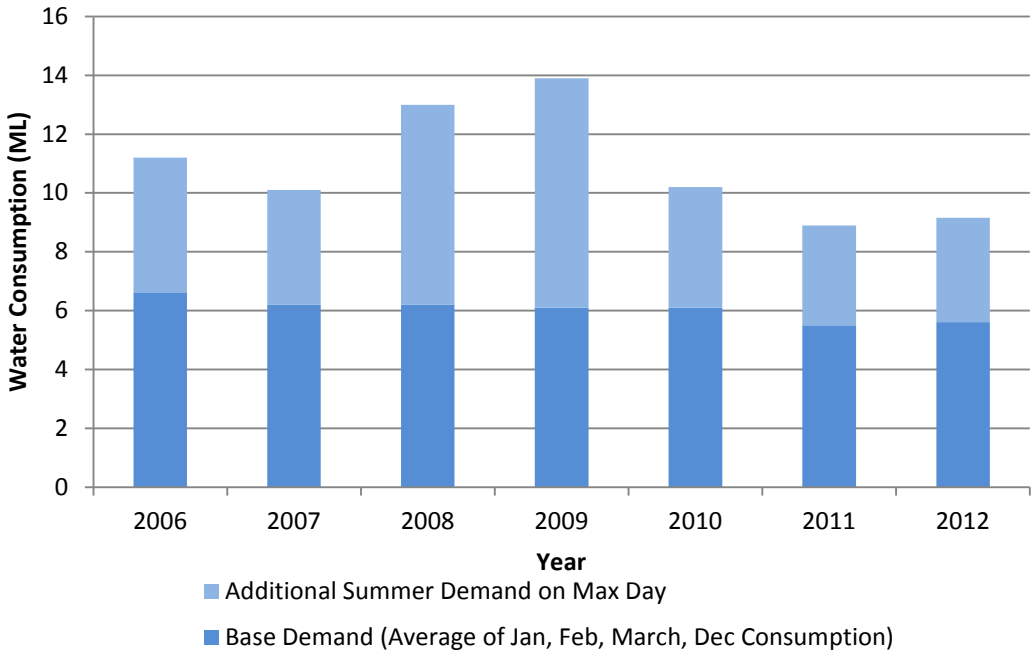
Table 3-1: 2012 Monthly Flow Totals

Month	Total Volume Pumped (ML)	Max. Day Volume (ML)
January	177.4	6.384
February	164.8	6.191
March	175.9	6.039
April	176.3	6.188
May	205.0	8.080
June	197.8	7.337
July	207.8	8.209
August	237.4	9.153
September	191.9	7.663
October	189.7	7.728
November	164.3	5.999
December	165.6	5.758
Total in Year	**2,253.9**	
ADD (ML/day)	6.158	
ADD (L/s)	71	
BDD (ML/day)	5.604	
BDD (L/s)	64.9	
MDD (ML/day)		9.153
MDD (L/s)		106
Data Source: EPCOR White Rock Water Inc., 2012 Flow Records		

The max day demand in 2012 is notably lower than in previous years. Figure 3-1 shows the usage trend since 2006.

Reductions in base usage are consistent with the increased use of low-flow fixtures - particularly toilets as mandated in the 2008 BC Building Code. Similar reductions in base demands have been observed in other municipalities in B.C.

Figure 3-1: Peak Day Water Use Trends



The current base demands in the model were globally adjusted to equal the overall base flows measured in 2012. This resulted in a reduction of 0.550 ML/day (6.3 L/s).

The seasonal demands were kept constant (as per 2009 values and distribution). The overall MDD which is the sum of seasonal and based demands was reduced by the amount of the change in base demand, i.e. from 14 MLD (162 L/s) to 13.5 MLD (156 L/s).

Even though 2012 seasonal usage was significantly lower than the design year (2009), this could be partially or entirely due to specific weather for 2012 and not an overall reduction in seasonal demands. Adjustment of the current design values for seasonal usage would require a review of the historical weather and precipitation, which is outside the scope of this report.

3.2 Metered Water Usage

All of EWR's services are metered (4,466 metered services in 2012). The Utility's meter reading/billing database[2] was used for the following:

- To assess non-revenue water (by comparing meter records with source flow data); and
- To determine the percentage each type of demand (single-family residential, multi-family residential, and institutional, commercial, and industrial (ICI)), contributes to the total.

[2] Water meter records for the year of 2012 were used.

3.3 Non-Revenue Water and Leakage Assessment

Non-Revenue Water (NRW)

The American Water Works Association (AWWA) and the International Water Association (IWA) has formulated an approach to conducting water audits and calculating non-revenue water (NRW) [1]. Non-revenue water is the difference between the system input volume (total source flow), and the total revenue water (metered water).

Comparing the 2012 source flow data with the 2012 meter records, the NRW was estimated to be 8.2 L/s. To distribute the NRW in the water model, allowances were made for EWR's hydrant flushing program and meter under-reading. Table 3-2 shows the NRW adjustment.

Table 3-2: NRW Adjustment

	Yearly Volume (ML)	Flow (L/s)	Comments
NRW - Total	259 ML	8.2	Estimate based on the 2012 source flow data compared to 2012 meter records.
Allowance for Hydrant Flushing Program	13 ML	0.4	Based on historical averages of yearly flushing volume totals.
Allowance for Meter Under-Reading	54 ML	1.7	2.5% - Based on expected under registry of 0.1% per year of age of the meter.
NRW - Adjusted	**192 ML**	**6.1**	**Includes leakage and service meter bypass.**

Leakage Assessment

A water system's Infrastructure Leakage Index (ILI) is the ratio of Currant Annual Real Losses (CARL) to Unavoidable Annual Real Losses (UARL).

According to the section above, the CARL for White Rock is 0.53 ML/day (6.1 L/s).

The UARL calculation is based on leakage data gathered from well-maintained and well managed system. Equations for calculating expected UARL for individual system were developed and tested by the International Water Association's Water Loss Task Force in 2000 [2]. The equation is expressed as:

$$UARL\left(\frac{L}{day}\right) = (18 \times L_m + 0.8 \times N_c + 25 \times L_c) \times P$$

Where:

L_m = water main length (km) = 77.6 km

N_c = Number of service connections = 4,466 (as of October 2012 read date)

L_c = Total length of service connections (km) = 23.8 km (average service connection length estimated at 5 m per connection)

P = Average system pressure (m water column) = 59 m (estimated using average of all water model junctions).

The calculated UARL for the White Rock water system is 0.33 ML/day or 4 L/s. The Infrastructure leakage index (ILI) for the White Rock System based on 2012 data is 1.6.

ILI is used as a performance indicator for water loss management. A worldwide comparison of water audit ILI results [2] showed that utilities had a median ILI of 2.94 and an average ILI of 4.38. ILI rates for well-managed systems (with established best management practices for lowering water losses), are typically around 2. Costs for lowering ILI rates below 2 increase exponentially.

3.4 Per Capita Consumption

Statistics Canada's 2011 Census indicates a population of 19,339 people for the City of White Rock. In addition to the City of White Rock, EWR also supplies water to homes in Surrey and the Semiahmoo First Nation. There are approximately 85 metered lots in Surrey, corresponding to a population of 213 based on 2.5 persons per single family lot. The total serviced population for EWR is estimated at 19,552 people.

Population equivalents (PE) for commercial usages were derived based on the percentage of the metered winter commercial usage to the total winter residential usage. A total service population for EWR is estimated at 25,186 PE (including 19,552 people and 5,634 PE for commercial).

The population living on the Semiahmoo First Nation Reserve is 110, according to Aboriginal Affairs and Northern Development Canada. The Semiahmoo First Nation's water demand is included in the commercial category as population equivalents (PE) because the water meter is in the commercial category. One hundred and seventy four (174) of the total 5,634 commercial PE are attributed to the Semiahmoo First Nation.

Based on the above and actual meter readings (with allowance for meter under-reading), the base (winter) consumption is 202 L/PE/day for 2012. The per capita consumption value has decreased since the last master plan update by 13% (233 L/PE/day calculated from 2009 data).

3.5 Existing Demand Summary

Existing demands for the system are summarized in Table 3-3.

Table 3-3: Existing Demand Summary

		ICI	SF-RES	MF-RES	Total RES	Non-Revenue Water, NRW (Leakage)	Total	Notes
Number of Meters		260	3,975	231	4,206		4,466	As of October 2012 read date.
Percentage of Total Meters		6%	89%	5%	94%			
Base Demand	Base Demand (L/s)	13.1	26.1	19.5	45.6	6.14	64.9	Average of source flow records for January, February, March and December, 2012. NRW calculated by comparing meter data to source flow data.
	Percentage of Total Metered Usage	22%	45%	33%	78%			Percentages based on meter consumption information.
	Base Demand Rate (L/ca/day)	201.5						
	Population Equivalents	5,634	11,208	8,344	19,552		25,186	2011 City of White Rock Census plus 85 lots located in Surrey with 2.5 people per lot. Note the Semiahmoo FN accounts for approximately 174 PE of commercial usage.
Seasonal Demand-	Seasonal Demand (L/s)	8.7	74.9	6.8	81.7	0.0	90.4	Additional seasonal demand on maximum demand day (from 2009 source flow records).
	Percentage of Seasonal Demand	10%	83%	8%	90%			
Max. Day	Maximum Day Demand (L/s)	21.8	101.1	26.2	127.3	6.14	155.3	Base demand plus seasonal demand.

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Section 4

Future Demands

4. Future Demands

4.1 Overall Growth Forecast

The City of White Rock released its Official Community Plan (OCP) in 2008. The OCP was based on the 2006 Census population for White Rock of 18,755. The OCP forecasted that the population would increase 190 people per year, to a population of 23,505 in 2031. The 2011 Census indicates a population of 19,339 for the City of White Rock, representing an average growth of 117 people/year.

The 2010 Master Plan Update used the OCP growth prediction, and the 2010 per capita base usage rate (233 L/PE/day) to determine a 2031 MDD of 180 L/s (note seasonal demands brought in separately).

For the purpose of this Master Plan Update, a forecast MDD of 180 L/s will be maintained. Using the 202 L/PE/day base use rate, the forecast MDD corresponds to either of the following growth scenarios:

- 26,649 population in 2031 with a growth rate of 366 people per year from 2011; or
- 26,649 population in 2049 with a growth rate of 190 people per year from 2011.

For convenience, the 180 L/s value is referenced as a year 2049 forecast (consistent with OCP forecast).

The 180 L/s / 26,649 population forecast assumes:

- No additional growth in services beyond the White Rock City Limits;
- ICI base usage continues to be 20% of overall system base demands (as per existing); and
- Seasonal demands stay constant on the basis that overall irrigated green area is not expected to increase and irrigation application rates per acre of green area do not increase.

It is noted that the demand forecast of 180 L/s is only 15% greater than the current estimate of maximum day demand (156 L/s).

4.2 Industrial, Commercial, and Institutional (ICI) Growth

Currently commercial usage accounts for 20% of overall system base demands. No significant industrial land use exists for White Rock. It has been assumed that the ICI usage will continue to form the same percentage of the total system demands.

4.3 City of Surrey and Semiahmoo First Nation Customers

In addition to the City of White Rock residents, EWR also has 85 services to the City of Surrey. It is estimated that these services account for approximately 213 residents. It is assumed that the number of non-White Rock residential customers will not change significantly over the period of the Master Plan.

In addition to the City of White Rock commercial services, EWR also has a commercial service to the Semiahmoo First Nation. It has been assumed that the commercial usage will not change significantly over the period of the Master Plan.

4.4 Additional Demands Due to Growth

Demands were estimated based on the current water use rates and peaking factors and the anticipated growth.

Table 4-1 summarizes the expected increase in water demands.

Given that growth in White Rock is expected to be limited to infill housing, it is assumed that there is no increase in seasonal demands.

Currently NRW flow accounts for 9.5% of overall system base demands. It has been assumed that the NRW flow will continue to form the same percentage of the system base demands for the future forecast scenario.

Table 4-1: Additional Base Demands Due To Growth

	ICI	Single-family Residential	Multi-family Residential	All Residential	Total
Population / PE Growth	2,105	2,192	5,118	7,310	9,415
Base Demand, BD (L/PE/day)	202	202	202	202	202
Additional Winter ADD (L/s)	**4.9**	**5.1**	**11.9**	**17.0**	**21.9**
Existing BD (L/s)	13.1	26.1	19.5	45.6	58.7
Total 2049 BD (L/s)	**18.0**	**31.2**	**31.4**	**62.6**	**80.6**

4.5 Distribution of Additional Demands

Figure 4-1 shows the development permit areas (DPAs) as defined in the OCP.

Commercial growth (ICI demand growth) is restricted to those areas identified in the OCP, specifically:

- Town Centre;
- Lower Town Centre; and
- Neighbourhood Commercial.

The principal area for commercial growth is the Lower Town Centre. ICI growth in other areas is expected to be low, as they are approaching a fully developed state.

As few opportunities for infill housing exist, residential growth has been assumed to be concentrated in new multi-family residential developments. Multi-family growth has been estimated based on 70% of the total predicted residential growth.

The key growth area identified in the OCP for residential growth is the Town Centre Apartment Area. Other areas identified with multi-family residential growth potential include the Upper Town Centre and the Lower Town centre.

Table 4-2 summarizes the demand distribution to each area.

Table 4-2: Distribution of Growth Demands (PE)

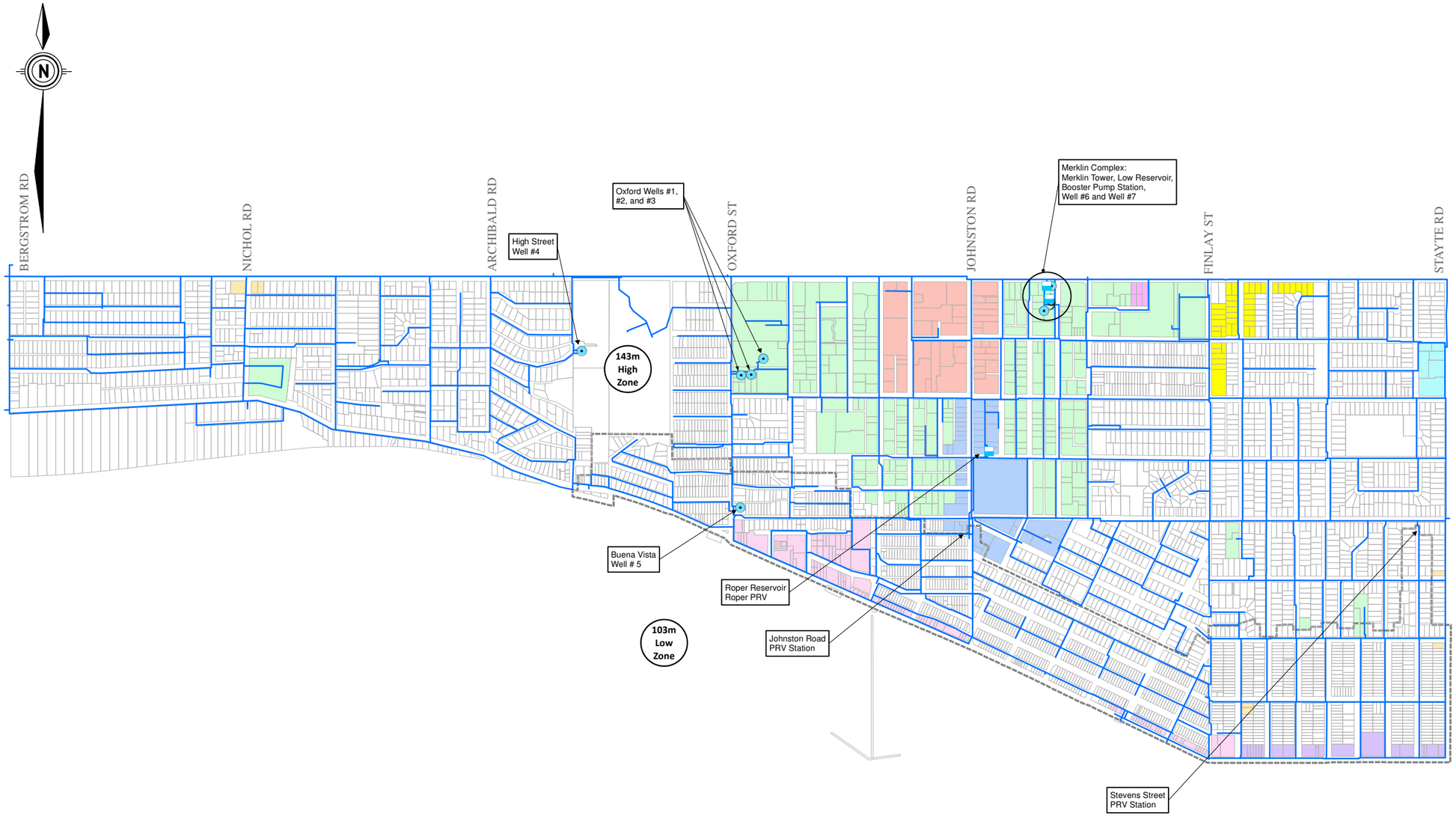
Development Permit Areas	ICI	Single-family Residential	Multi-family Residential
Town Centre	568	2,193*	819
Lower Town Centre	1,453		51
Apartment Area	0		4,248
Stayte Rd. Centre	0		0
East Side Large Lot Infill	0		0
Hospital St.	0		0
Waterfront Business Area	0		0
Waterfront Apartment Area	0		0
Neighbourhood Commercial	84		0
Waterfront Residential Area	0		0
Totals (PE)	2,105	2,193	5,118
Additional BD (L/s) at 202 L/PE/day	**4.9**	**5.1**	**11.9**
*Single-family Residential population growth is assumed to be uniform, city-wide.			

4.6 Summary of Demand Scenarios

Table 4-3 summarizes the demand scenarios used to develop the EWR Master Plan.

Table 4-3: EWR Demands (All Demands in L/s)

	ICI	Single-family Residential	Multi-family Residential	All Residential	Unaccounted for Water	Total Usage
2012 Base Demand (Winter)	13.1	26.1	19.5	45.6	6.1	64.9
2012 Addl. Seasonal Demand	8.7	74.9	6.8	81.7		90.4
2012 MDD	**21.8**	**101.1**	**26.2**	**127.3**	**6.1**	**155.3**
2049 Base Demand (Winter)	18.0	31.3	31.4	62.6	8.4	89.1
2049 Addl. Seasonal Demand	8.7	74.9	6.8	81.7		90.4
2049 MDD	**26.7**	**106.2**	**38.2**	**144.3**	**8.4**	**179.5**



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2013 Water System Master Plan Update

Legend

- PRV
- Well
- Reservoir
- Pump
- Existing Water Mains
- Pressure Zone Boundary
- Apartment Area
- East Side Large Lot Infill Redevelopment Area
- Hospital Street
- Lower Town Centre
- Neighbourhood Commercial
- Stayte Road Centre
- Town Centre
- Waterfront Apartment Area
- Waterfront Business Area (East & West Beach)

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Project No.	Date
102-119	November 2013

City of White Rock Official Community Plan Development Permit Areas

Figure 4-1

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Section 5

Design Criteria

5. Design Criteria

Design criteria are from EPCOR Design and Construction Standards (March 2004), unless otherwise noted.

5.1 Pressure

The required system water pressures are summarized in the following table:

Table 5-1: Pressure Design Criteria

Description	Required Pressure kPa (psi)
Minimum pressure at peak hour demand	300 (43.5)
Minimum pressure coinciding with fire flow and MDD	150 (21.8)

5.2 Required Fire Flow

Table 5-2 shows the minimum required fire flows from the 2003 Master Plan and the 2009 Fire Underwriters Survey [17].

Table 5-2: Fire Flow Design Criteria

Type of Construction/Dwelling	Development Permit Area(s)	Required Fire Flow (L/s)	Storage Requirement (ML)
2003 MASTER PLAN			
High-density commercial & multi-family residential (>50 units/acre)	Town Centre, Hospital St.	225	2.33 (2.9 hr)
Medium-density commercial and multi-family residential (≤ 50 units/acre)	Lower Town Centre, Apartment Area, Waterfront Business Area, Waterfront Apartment Area, Neighbourhood Commercial	150	1.08 (2.0 hr)
Low-density commercial or residential	Stayte Rd. Centre, East Side Large Lot Infill	120	0.86 (2.0 hr)
Single-family Residential		67	0.36 (1.5 hr)
2009 FUS REPORT			
Basic Fire Flow	Benchmark for Complete System	212 L/s (2,800 lgpm)	1.98 ML (2.6 hr)

Values from the 2003 Master Plan were developed based on the OCP guidelines specified for each development permit area and are derived from FUS guidelines.

In addition to the Basic Fire Flow target, the FUS Report included 3 fire protection zones for White Rock. However, these zones were less detailed than the 2003 Master Plan. Accordingly, the values from the 2003 Master Plan are carried forward for use in evaluating available fire flows. The basic fire flow requirement of 1.98 ML was used for assessing storage.

It is noted that in some situations, higher fire flows may be required for specific buildings (either existing or proposed) where the building's size or style of construction differs significantly from the normals for that area.

Fire flow requirements are verified with the City of White Rock during the development water servicing review process. The City of White Rock has jurisdiction for identifying required fire protection levels.

5.3 Cost Basis

Costs are estimated based on the 2013 construction year. No allowance has been provided in these figures for escalation in subsequent years. The cost opinions in the report are indicative and have been prepared for long-term budgeting purposes only (i.e. 4-year Plan). Unit prices are based on recent costs for similar facilities; however, no detailed quantity take-offs or equipment selection has been completed.

Some costs for capital tasks are based on estimates from previous reports.

Cost opinions for water main construction are Class "C", based on EWR typical costs, vendor quotes, and typical values for similar projects.

Costs reflect typical scope of work for a distribution main. Water main cost opinions include allowances for:

- Fittings, and isolation valves including thrust restraint;
- Reconnection of existing water services; and
- Road restoration (one lane of the roadway).

Costs for hydrants, and tie-in (includes flushing and disinfection) are included separately for each task.

Cost opinions for facilities upgrades and studies are Class "D" or provisional estimates, as shown on individual capital project justification sheets. Class "D" estimates are preliminary which, due to little or no site information, indicates the approximate magnitude of cost of the proposed project, based on the EWR broad requirements. These cost opinions may be derived from lump sum or unit costs for a similar project.

The following generic allowance was applied to all water main construction projects:

- 20% engineering;
- 10% overhead / administration; and
- 20% contingencies.

For all projects besides water main construction projects, allowances were assigned on a project specific basis (i.e. not the same as the above percentages). Some project cost opinions are the result of work by other consultants.

Costs for water main construction tasks were developed using the unit rates given in Table 5-3.

Table 5-3: Standard Unit Costs

Item	Unit Costs[1]
150 mm Dia. Water Main	$450/m
200 mm Dia. Water Main	$530/m
Hydrant ($/ea)	$5,000/each
Tie-in ($/ea)	$4,200/each
Additional Paving (3.0 m wide road milling after project completion)	$40/m
[1] These unit costs do not include design, administration, contingency, or HST.	

The additional paving cost is a result of a recent (2012) requirement from the City of White Rock that requires the entire affected lane of the road to be resurfaced (rather than the trench width only) when a water main is installed. **The City of White Rock does not currently have a formal policy regarding the paving requirement;** therefore using the information available at this time, a unit cost for additional paving was developed, based on a 3 m width.

In order to assist in planning and budgeting, EWR is attempting to obtain a written policy regarding the paving requirements from the City of White Rock.

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Section 6

Evaluation of Existing System

6. Evaluation of Existing System

6.1 Supply

Current Supply Capacity

The supply capacity of the groundwater wells in the EWR system is summarized in Table 6-1 below. It is noted that the TWQM plan does not include the provision of treatment or disinfection for Well 5. Decommissioning, abandoning, and sealing of Well 5 is recommended.

Table 6-1: Supply Capacity of Groundwater Wells in the EWR Water System

Well Number	Location	Capacity[1] (L/s)	Capacity with Largest Well Out of Service (L/s)
Well 1	Oxford Site – High Pressure Zone	28	
Well 2	Oxford Site – High Pressure Zone	29	
Well 3	Oxford Site – High Pressure Zone	29	
Well 4	High St. – High Pressure Zone	19	
Well 5	Buena Vista Ave. – Low Pressure Zone	31	
Well 6	Merklin Site – High Pressure Zone	22	
Well 7	Merklin Site – High Pressure Zone	41	
Total (all wells)		**199**	**158**
Total with Well 5 Decommissioned		**168**	**127**
Total with Wells 3 and 5 Decommissioned		**139**	**98**
1. Average flow rate, from 2012 monthly flow reports provided by EWR.			

The supply capacity for a water system must exceed the maximum daily demand for the system to avoid water shortages during peak summer demands. In rating the supply capacity, it is normal practice to exclude the largest well to provide a level of safety to deal with maintenance emergencies that may occur during peak demands. In EWR's case, the largest well is Well 7 (41 L/s).

The existing system supply capacity from EWR's well system with the largest well out of service is 158 L/s (199 L/s with all wells in service).

Decommissioning of Well 5 is identified as a requirement of the TWQM plan. The TWQM plan did not include Well 5 due to:

- Well 5 is located in a different pressure zone, and is hydraulically isolated from the other wells;
- Cost considerations with provision of a separate chlorination system (and potentially a future treatment plant); and
- Concerns with the long-term viability of the well.

Recent redevelopment work with Well 3 also indicates that its age may indicate a need for replacement rather than continued redevelopment (see discussion below). Currently Well 3 use is being curtailed to prolong its life.

Table 6-2 compares the supply requirements for the High Pressure Zone, which can be serviced only by Well 1, 2, 3, 4, 6 and 7. The Low Pressure Zone is serviced by Well 5 directly but can also be supplied from the High Pressure Zone through pressure reducing valve (PRV) stations.

Table 6-2: Demand Versus Capacity

Zone	Max. Day Demand (L/s)		Supply Capacity[1] (L/s)	
	2012	2049	Dedicated to Zone	Total Available to Zone
High	126	148	127	127
Low	29	32	31	158
Total	**155**	**180**	**158**	**158**

1. Rated available supply with the largest well out of service.

The year 2012 design demand is 155 L/s, is within the rated supply capacity with the largest well out of service (158 L/s).

While EWR does have an emergency connection to the City of Surrey's water system, the use of these connections has not been included in source capacity calculations. Using these connections is undesirable as they would lead to contamination concerns with respect to the introduction of surface water (and associated microbes) into a groundwater distribution system. Additionally, the connections are un-metered and the current agreement with the City of Surrey is for emergency use only.

Groundwater Well Condition Assessments

KWL and Piteau Associates completed a well source assessment in 2010 [7]. The recommendations from the study include:

- Consider Well 5 for decommissioning;
- Redevelop Well 1 and Well 3 to improve capacity;
- Establish an aquifer protection plan including groundwater monitoring;
- Implement annual analysis of groundwater samples for volatile organic compounds and polycyclic aromatic compounds; and
- Install additional instrumentation to measure well levels continuously.

Well 3 was redeveloped in 2012 by Piteau Associates and Precision Service and Pumps. A report was provided by Piteau Associates [16]. The report indicates that there was no improvement in well performance following redevelopment, and the specific capacity of the well is approximately 25% of the original value. Well 3 is estimated to be 53 years old, and is beyond the typical lifespan for a groundwater well. Given the costs of ongoing attempts to rehabilitate the well, and improvements that may be required to achieve full compliance with the Groundwater Protection Regulation, it was recommended that Well 3 be considered for replacement / decommissioning in the next 5 to 10 years.

Assuming that Well 5 and Well 3 are decommissioned in the future, capacity upgrades of 53 L/s and 82 L/s are required to service existing and forecasted demands respectively.

Given the age and proximity of Well 1 and 2 relative to Well 3, it is possible that these wells should also be considered for eventual replacement.

Additional supply capacity should be located at the Utility Oxford Site in the High Pressure Zone. According to Piteau Associates, siting of additional wells at the Merklin Site is not recommended due to

interference with the current wells (Well 6 and 7) at that site. Installation of the well at other sites is possible but would require additional work to satisfy the disinfection and treatment requirements.

An engineering study is recommended to determine the best strategy for new well development at the Utility Oxford Site to supply the new Oxford Reservoir.

With the addition of a new reservoir at the Utility Oxford Site, the well pumps (Well 1, 2, and 3) will be discharging to a lower HGL. Replacement of the well pumps with pumps suitably sized to the new design condition is recommended. It is expected that this will optimize efficiency and energy consumption. Alternately, wells could be fitted with variable frequency drives, set to reduced operating speeds to meet the lower head required. It is noted that Well 2 already is equipped with a VFD.

Consideration of future treatment requirements for Arsenic and Manganese is considered in the 2012 Stantec report. [20]

Water Conservation

Supply requirements are based on current unit usage rates. It is noted that:

- Average per capita consumption is already low (315 L/ca/day average, including NRW and ICI, compared to Metro Vancouver's usage consumption of 503 L/ca/day); and
- EWR has limited authority to impose water use restrictions[3].

Water conservation opportunities may exist, however, no allowance has been made in the capital plan for the implementation of water conservation measures. If a water conservation study identified practical methods for reducing water demands (demand-side management) significantly, it may be possible to postpone supply-side improvement capital tasks accordingly.

6.2 Storage

The following storage requirements for forecasted demands are reproduced from the 2010 Water System Master Plan Update [13].

Required Balancing Storage:	15.55 MLD (180 L/s) x 16%	= 2.49 ML
Required Fire Storage:	212 L/s for 2.6 hours	= 1.98 ML
Required Emergency Storage:	25% of above storage	= 1.12 ML
Pump Control:		= 0.46 ML
Total Required		**= 6.05 ML**
Available Storage:	Merklin Low Reservoir	= 1.63 ML
	Merklin High Reservoir	= 1.73 ML
	Roper Reservoir (Low Zone)	= 1.14 ML
Total Available		**= 4.50 ML**
Deficiency		**= 1.55 ML**

The storage deficiency is addressed in the TWQM plan as follows:

- The Merklin High Reservoir (1.73 ML) will be decommissioned;

[3] Compared with a municipality, which has the power to enact compulsory water conservation measures as bylaws.

- A new 1.73 ML reservoir will be constructed on the Oxford site; and
- A new 1.55 ML reservoir will be constructed on the Merklin site.

6.3 System Pressure

Figure 6-1 shows peak hour pressures with future maximum day demands. Modelling indicates that there are peak hour pressure deficiencies (pressure is less than 43.5 psi) on Beachview Ave., between Foster St. and Johnston Rd.

6.4 Available Fire Flow

Figure 6-2 shows the available fire flow with future maximum day demands. Modelling indicates that there are fire flow deficiencies at the following locations:

- Marine Dr., between Bergstrom Rd. and Nichol Rd. (50 L/s available, 67 L/s required);
- Saturna Dr., between Archibald Rd. and High St. (62 L/s available, 67 L/s required);
- Martin St., between North Bluff Rd. and Thrift Ave. (180 L/s available, 225 L/s required); and
- Columbia Ln. at Balsam St. (57 L/s available, 67 L/s required).

6.5 Pipe Replacement

Break History

EWR provided an account of all the water main breaks that have occurred from 2000-2012. A map showing the past pipe break locations are shown on Figure 6-3.

Areas with recurring break history of note include:

- 1300 block of Martin St.;
- 13800 block of Coldicutt Ave.;
- Marine Dr. from Vidal St. to Martin St.; and
- Marine Dr. from Bishop Rd. to Magdalen Cres.

Table 6-3 gives a summary of the breaks occurring each year, and based on an average repair cost of $3,200 per break, estimates the annual cost due to water main breaks each year. EWR's observed break rate is 9.5 breaks per year with a total water main length of 77.8 km. This gives the EWR system an observed break rate of 12 breaks per year per 100 km. This compares to average in NWWBI [14] of 7 breaks per year per 100 km and range of 1 to 30 breaks per year per 100 km. The break rate is within the normal range of the industry benchmark.

It is noted that the EWR system is fairly dense (many service connections), hilly (large pressure range), and a mature system (includes older infrastructure). As well, EWR has a good break recording system in place and has a reasonably low non-revenue water (NRW) total indicating breaks /leaks are being found and repaired.

Table 6-3: Summary of Break History 2000-2012

Year	Total Number of Repairs Required	% of Breaks Occurring in CI Piping	Estimated Annual Cost[1]	Notes
2000	6	100%	$19,200	
2001	5	100%	$16,000	
2002	11	100%	$35,200	
2003	11	100%	$35,200	
2004	10	100%	$32,000	
2005	11	73%	$35,200	3 GI breaks, 8 CI breaks
2006	9	N/A	$28,800	Detailed records not available
2007	9	100%	$28,800	
2008	12	83%	$38,400	1 GI break, 1 DI break, 10 CI breaks
2009	12	100%	$38,400	
2010	10	70%	$32,000	3 DI breaks, 7 CI breaks
2011	8	100%	$25,600	
2012	9	78%	$28,800	1 GI break, 1 DI break, 7 CI breaks
Annual Average	**9.5**	**92%**	**$30,400**	

1. Calculated based on average cost of $3,200 per repair.

It is noted that data provided indicates that a yearly fund of approximately $40,000/year plus allowances for property damage should be set aside to allow for break repairs (in operating budget not capital). EWR should continue to monitor break history and record reasons for breaks going forward to potentially identify high-priority mains for replacement and/or condition assessment.

Cast Iron Pipe Condition Assessment

In thirteen years, cast iron piping failures have constituted 92% of the recorded water main breaks in the system breaks. Accordingly, examination of a replacement program or condition assessment program for the cast iron piping is warranted.

Previous work (2010 Water System Master Plan Update) indicated that a global replacement program for all of the cast iron water mains was not warranted on the basis of the observed break rate. The break rate would have to be much higher or average property damage costs very high to justify the cast iron water main replacement program on a financial basis. Note that this analysis considered the break rate remaining stable with time and did not include environmental or socio-economic costs. In fact some exponential increase is typical with CI piping as corrosion / pitting reduces wall thickness.

It may be that replacement of specific water mains that are either high-risk (of causing property damage) and / or poor condition (extensive break history due to age, soils, etc.) may be warranted. However, no information is available at this time to definitively identify these mains.

Certain clusters of break are noted in the break history but it is uncertain whether these are random or linked to the condition of the local main, or other factors (construction methods at the time of install, etc.). In the north-east quadrant, as an example, there has been 39 breaks over a 13 year period on 1.4 km of CI water main (2.2 breaks/year/km).

Another potential justification for replacement of specific mains would be adjacent construction by the City of White Rock (which would reduce road reconstruction costs). Typical road reconstruction costs may form 20% of a water main replacement project. With the current break rates and costs, this alone would not be sufficient reason to replace a typical cast iron water main.

To better manage the cast iron water main asset class, a condition assessment program is recommended. A pilot condition assessment program that includes non-destructive inline inspection using a 'smart pigging' device such as PICA's See Snake is recommended.

A condition assessment program would provide the following benefits:

- Identification of current pipe condition;
- Identification of leaks;
- Pre-emptive point repairs at areas identified with extensive localized wall loss;
- Enables informed decisions on pipe rehabilitation vs. continuing with point repairs for pipes inspected;
- Where pipe rehabilitation is indicated, inspection data provides additional information to determine method of rehabilitation, i.e. lining vs. replacement; and
- Enables extrapolation of results to a larger area.

The following program is recommended in the short term (next 3 years):

- 2 km of cast iron pipe inspection; and
- Estimated cost: $120,000 (for field inspection and summary report for piping inspected includes engineering, and EWR internal costs to support program).

Water Main Asset Management Study

Following the pilot cast iron condition assessment program, a water main asset management study is recommended. The study would review asset classes, maintenance history (breaks, etc.), and condition information (including pilot program results) to determine a sustainable asset management program for the utilities water mains.

Water Main Replacement

Following the condition assessment and asset management programs, it is anticipated that a number of water mains will be recommended for replacement. Based on the previous break history, EWR staff has identified four water mains for potential replacement:

- 1300 Block of Martin St.;
- 13800 Block of Coldicutt Ave.;
- Marine Dr. from Vidal St. to Martin St.; and
- Marine Dr. from Bishop Rd. to Magdalen Cres.

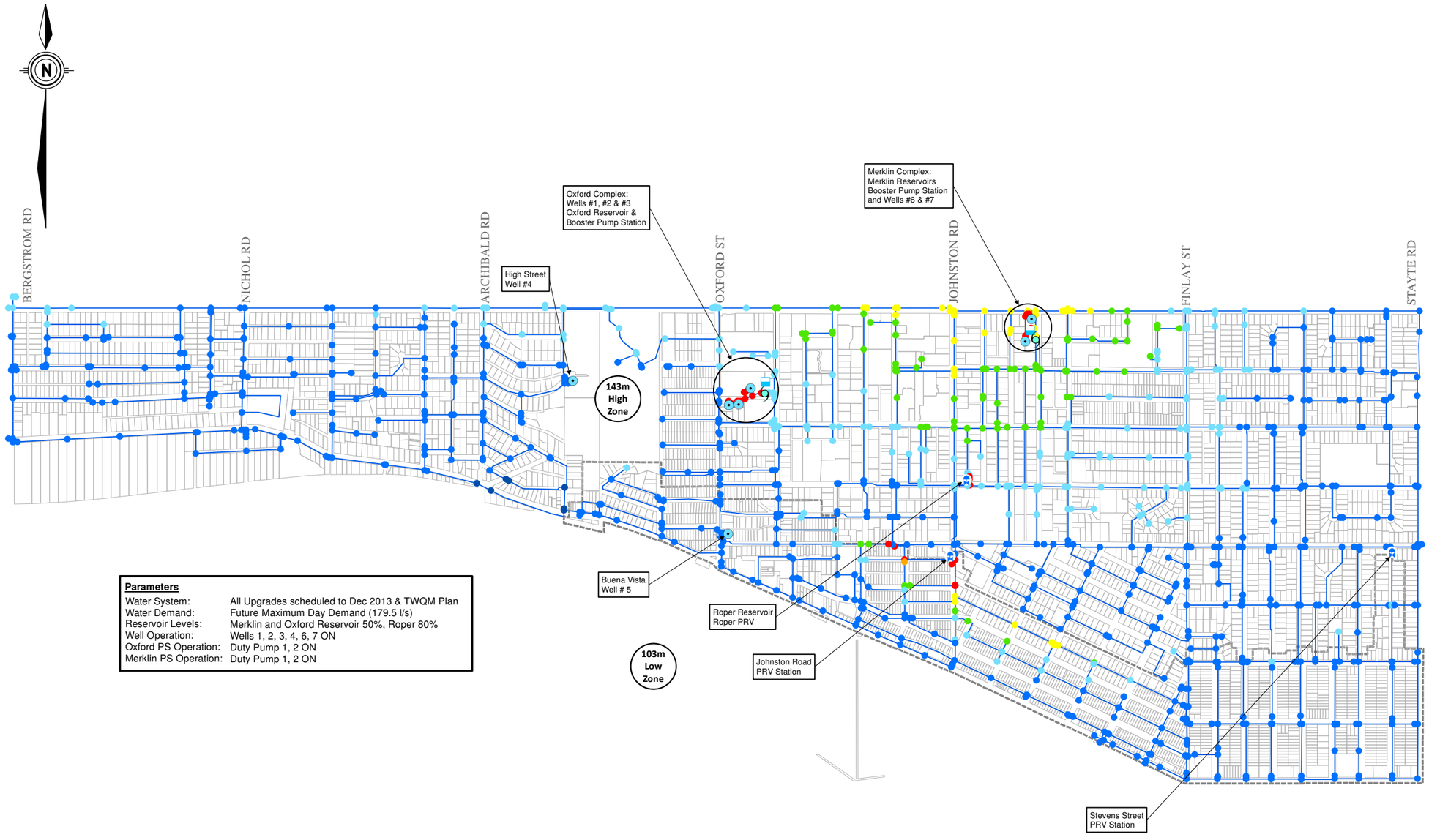
6.6 Meter Replacement

There are 4,466 meters in the EWR system according to the 2012 meter records. It is estimated that about 60% of these meters have been replaced since 1994. The remaining 40% are estimated to be between 20 and 50 years old. Older meters may continue to function but wear will cause them to under

record resulting in loss of revenue. Industry meter quality assurance programs indicate an optimum age to replace a water meter is 30 years [21].

The existing older meters must be read by physical access to the meter chamber or meter box. The readings are manually recorded and later transcribed into the billing system. Replacement meters have electronic touch read capability. Readings can be taken quickly and can be electronically uploaded into the billing software.

Completion of the current cycle of meter replacement over a 10 year period will require 178 meters per year (1,780 meters total). Allowing for 38 meters per year to be replaced through redevelopment, leaves 140 per year to be replaced by the current program. The historic average cost per meter replacement is $650 per meter (including overhead and labour costs, and allowing for a nominal number of large / expensive meter installs).



Parameters

Water System:	All Upgrades scheduled to Dec 2013 & TWQM Plan
Water Demand:	Future Maximum Day Demand (179.5 l/s)
Reservoir Levels:	Merklin and Oxford Reservoir 50%, Roper 80%
Well Operation:	Wells 1, 2, 3, 4, 6, 7 ON
Oxford PS Operation:	Duty Pump 1, 2 ON
Merklin PS Operation:	Duty Pump 1, 2 ON

EPCOR

2013 Water System Master Plan Update

Legend

Peak Hour Pressure (psi)

- < 41
- 41.1 - 43.5
- 43.6 - 50.0
- 50.1 - 60.0
- 60.1 - 80.0
- 80.1 - 150.0
- > 150
- Water Main
- Pressure Zone Boundary

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Project No.	Date
102-119	November 2013

Peak Hour Pressure with Future Demands

Figure 6-1

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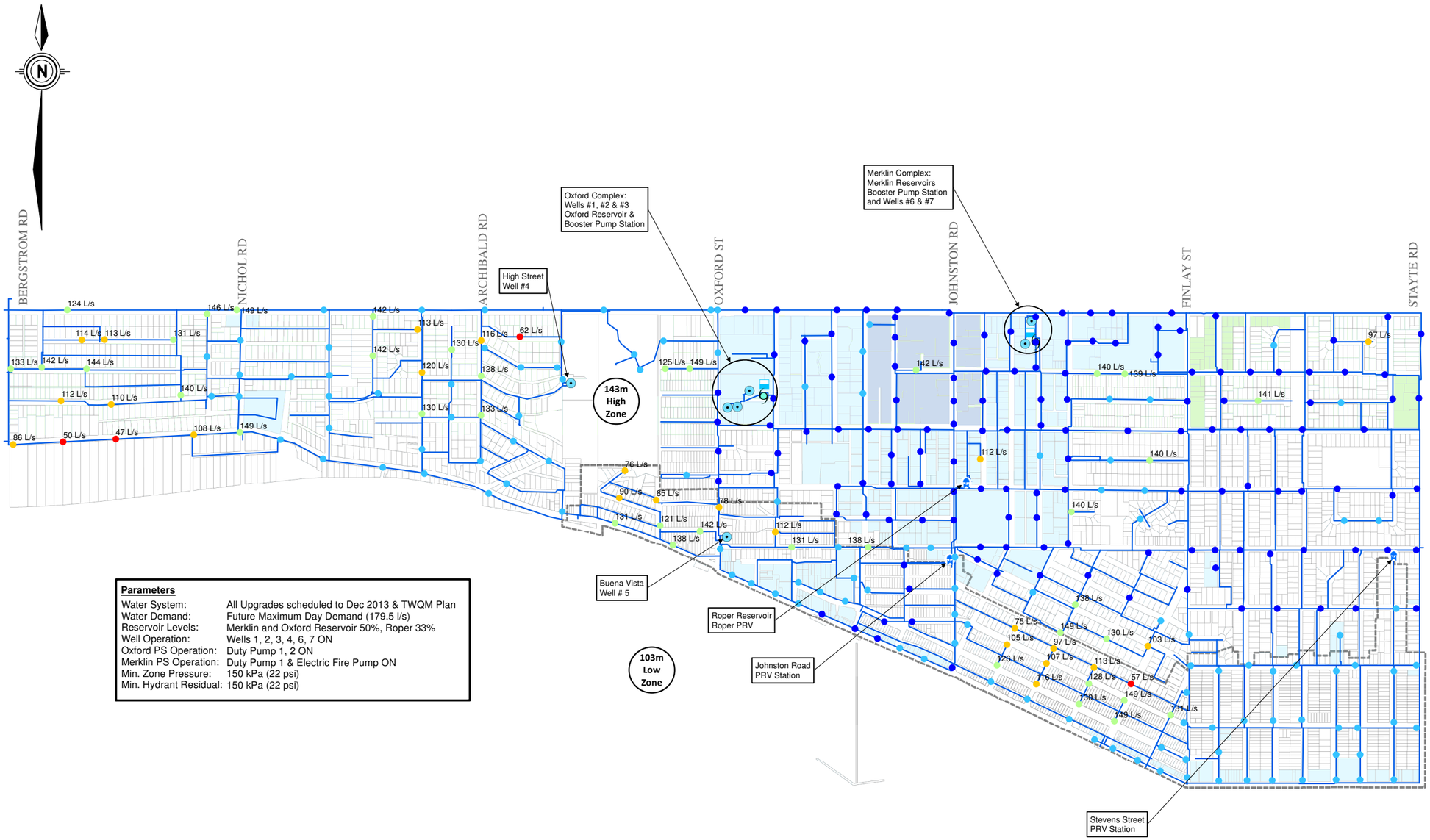

Parameters

Water System:	All Upgrades scheduled to Dec 2013 & TWQM Plan
Water Demand:	Future Maximum Day Demand (179.5 l/s)
Reservoir Levels:	Merklin and Oxford Reservoir 50%, Roper 33%
Well Operation:	Wells 1, 2, 3, 4, 6, 7 ON
Oxford PS Operation:	Duty Pump 1, 2 ON
Merklin PS Operation:	Duty Pump 1 & Electric Fire Pump ON
Min. Zone Pressure:	150 kPa (22 psi)
Min. Hydrant Residual:	150 kPa (22 psi)

EPCOR

2013 Water System Master Plan Update

Legend

Available Fire Flow (L/s)

- < 67
- 68 - 120
- 121 - 150
- 151 - 225
- > 225
- Water Main

Fire Flow Required (L/s)

- 67
- 120
- 150
- 225
- Pressure Zone Boundary

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Project No.	Date
102-119	November 2013

Available Fire Flow with Future Demands

Figure 6-2

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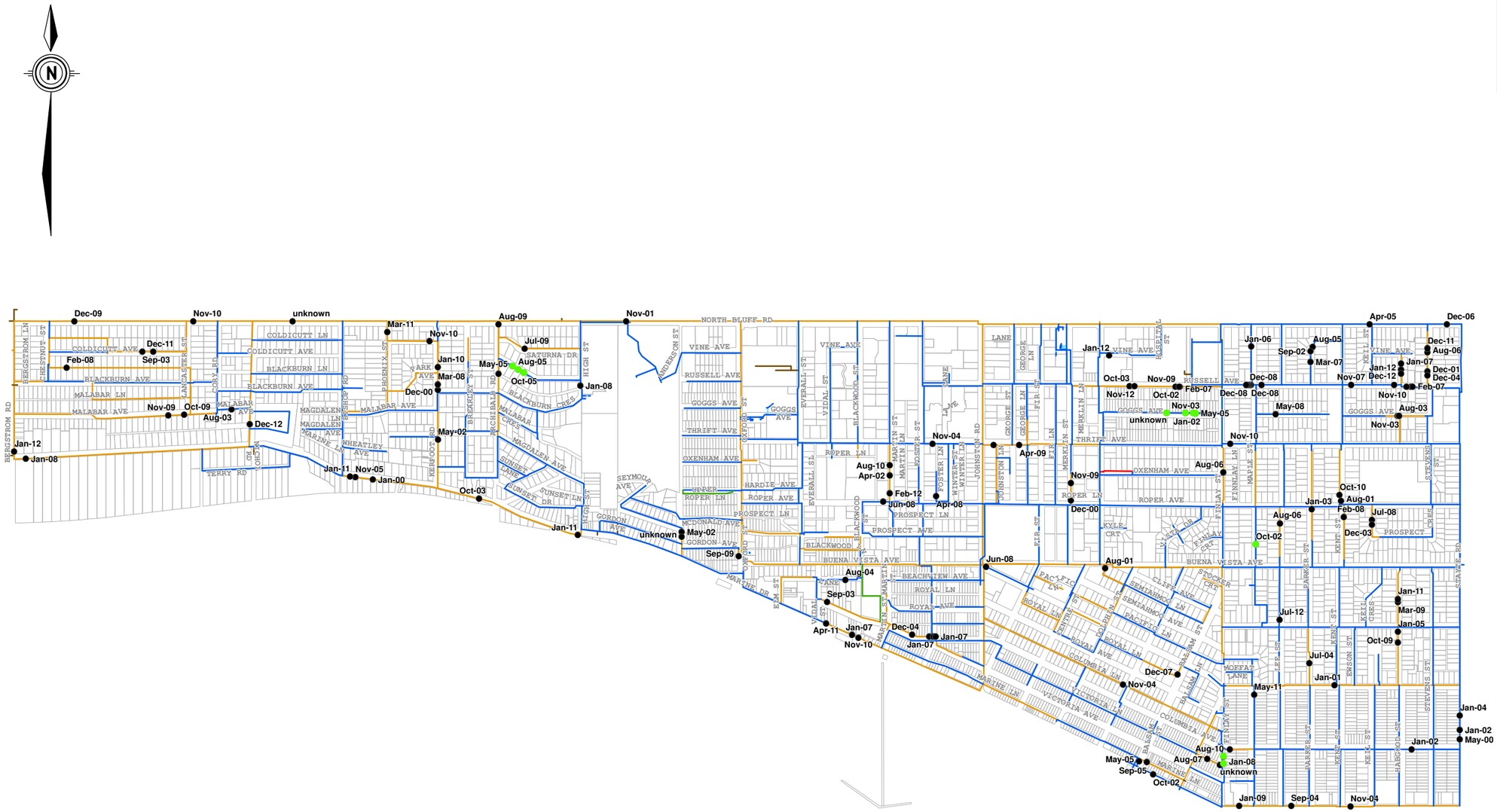

Legend

- Recorded Pipe Breaks (water main replaced since break)
- Recorded Pipe Breaks

Water Main Material

- Cast Iron
- Ductile Iron
- Galvanized Iron
- PVC
- Steel
- Unknown

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Project No.	Date
102-119	November 2013

Water Main Break Locations 2000-2012

Figure 6-3

EPCOR

2013 Water System Master Plan Update

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Section 7

Recommended Capital Tasks

7. Recommended Capital Tasks

7.1 Task Labeling

Capital tasks have been labelled using a three part identifier (ex. E-Hi-1). The first part of the identifier identifies the nature of the primary justification for the task. Justification abbreviations are as follows:

E – Existing fire flow and/or pressure deficiency;

F – Future fire flow and/or pressure deficiency;

O – Operational/reliability concern;

P – System planning/monitoring;

Q – Water quality program; and

S – Supply or storage deficiency (to meet future demands).

The second part of the identifier identifies the zone that the improvement primarily applies to. Zone abbreviations are as follows:

C – Comprehensive program;

Hi – High Pressure Zone; and

Lo – Low Pressure Zone.

The third part of the identifier is a unique label for that task.

7.2 Capital Plan Tasks

Justification sheets have been created for each of the projects. Projects have been prioritized as follows:

- **Recommended Capital Projects (2014 – 2017):** These projects are recommended to be included in the 2014 to 2017 Capital Plan.
- **Annual Programs:** Programs that will be carried out on an annual basis.
- **Capital Projects Deferred (Beyond 2017):** These capital projects are recommended to address system deficiencies. However they are lower priority and are recommended to be deferred beyond 2017.

Work that is part of the Total Water Quality Management plan is not included. Similarly, work scheduled for 2013 completion is not included.

All recommended improvements to be included in Master Plan are presented on Figure 7-1. Capital projects recommended to be included in the 2014 to 2017 rate filing period are summarized in Table 7-1.

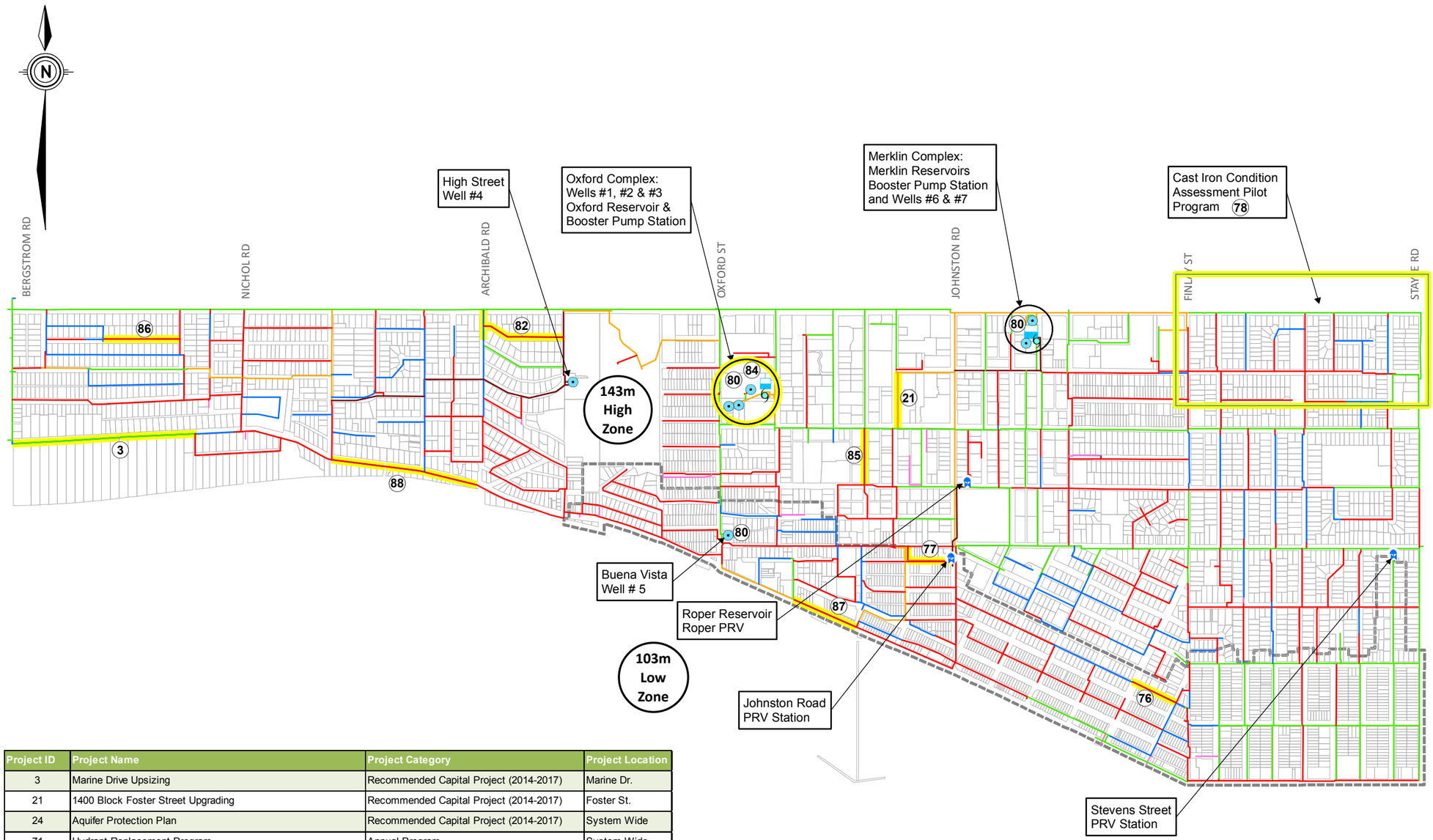
The capital plan does not include ongoing operations and maintenance programs such as:

- Reservoir cleaning and routine maintenance;
- Water main repairs required due to leaks/emergencies; and
- Leak detection program(s).

Table 7-1: Recommended Improvements (2014 to 2017)

Project ID	Project Name	Project Description	Justification	Total Estimated Cost of Capital Project ($)
3	Marine Dr. Upsizing	630 m of 200 mm diameter water main on Marine Dr. between Bergstrom and Terry Rd. (13600-13800 blocks).	Improve fire flows; replace 630 m of 100 mm diameter CI main.	551,000
21	1400 Block Foster St. Water Main Upgrades	Installation of 210 m of 250 mm diameter water main on Foster St. between Russell and Thrift.	Improve fire flows; replace 205 m of 150 mm diameter DI main; improve fire-fighting capabilities.	$222,000
24	Aquifer Protection Plan	Prepare an aquifer protection plan in accordance with the framework provided by the Province of B.C.	Establish a long term groundwater level monitoring program and aquifer protection plan.	60,000
71	Hydrant Replacement Program	Annual program – replace or relocate 5 hydrants per year.	Improve hydrant coverage.	27,000 / year 108,000 total
72	Meter Replacement Program	Annual program – replace 140 water meters per year.	Reduce meter under reading and non-revenue water, increase staff efficiency. Accuracy of service meters assists in water auditing.	91,000 / year 364,000 total
76	15500 Block Columbia Ln. Water Main Upgrades	170 m of 150 mm diameter ductile iron water main on Royal Ave., between Balsam St. and Ash St.	Improve fire flows; replace 170 m of 100 mm diameter cast iron main.	145,000
77	15100 Block Beachview Ave. Pressure Improvements	Install 80 m of 150 mm diameter ductile iron water main on Beachview Ave., between Foster St. and Johnston Rd. Tie in to existing 150 mm diameter main on Beachview, and rezone section (close valves).	Improve water system pressure.	84,000
78	Cast Iron Condition Assessment Pilot & Asset Management Program	Condition assessment of 2 km of cast-iron water main in high break rate area (north east corner of utility including general area bound by Thrift to North Bluff Rd. east of Finlay St.). Develop an asset management strategy for water mains based on the cast iron condition assessment pilot program, pipe material, year of install, break history, system pressures, and replacement costs.	Cast iron breaks constitute 92% of recorded breaks. Further assessment of factors contributing to breaks can inform decisions on pipe rehabilitation and replacement. Provide a basis to prioritize water main replacement and rehabilitation.	160,000
80	Well Redevelopment and Associated Work	Annual program – includes redevelopment of one well per year starting in yr-2015	Re-development restores lost capacity. Allows for inspection, provides opportunity to improve well construction to current standards including well seal, re-grading around the well, and bringing well casing above-grade (if practical).	50,000 / year 150,000 total
81	New Water Service Connections	Annual program - new water services connections for infill housing and redevelopment. Includes water meter and backflow protection.	Water meters installed to EWR standards to ensure meter reading accuracy, efficiency and staff safety. Backflow preventer is installed to EWR standards to protect the water system from cross connections.	At developer's cost

Project ID	Project Name	Project Description	Justification	Total Estimated Cost of Capital Project ($)
82	Saturna Dr. and Archibald Rd. Water Main Upgrades	Installation of 290 m of 150 mm diameter water main on Saturna Dr. and 150 m of 150 mm diameter of water main on Archibald Dr. between Mann Park Cres. and North Bluff Rd.	Improve fire flows. Replace 440 m of 100 mm diameter cast iron main that has a break history.	$378,000
84	Oxford Well 8	Install Well 8 at Oxford site. Decommission of Well 5.	To meet increased water demands and replace lost capacity.	$740,000
85	1300 Block Martin St. Water Main Replacement	Replace 194 m of 150 mm diameter CI water main with DI water main.	To replace water main that has a high break history.	$170,000
86	13800 Block Coldicutt Ave. Water Main Replacement	Replace 252 m of 150 mm diameter CI water main on the 13800 Block of Coldicutt Ave.	To replace water main that has a high break history.	$221,000
87	Marine Dr. (Vidal St. to Martin St.) Water Main Replacement	Replace 236 m of 150 mm diameter CI water main on Marine Dr. from Vidal St. to Martin St.	To replace water main that has a high break history.	$201,000
88	Marine Dr. (Bishop Rd. to Magdalen Cres.) Water Main Replacement	Replace 548 m of 150 mm diameter CI water main on Marine Dr. from Bishop Rd. to Magdalen Cres.	To replace water main that has a high break history.	$485,000
Total				**$4,039,000**



Project ID	Project Name	Project Category	Project Location
3	Marine Drive Upsizing	Recommended Capital Project (2014-2017)	Marine Dr.
21	1400 Block Foster Street Upgrading	Recommended Capital Project (2014-2017)	Foster St.
24	Aquifer Protection Plan	Recommended Capital Project (2014-2017)	System Wide
71	Hydrant Replacement Program	Annual Program	System Wide
72	Meter Replacement Program	Annual Program	System Wide
76	15500 Block Columbia Lane Water Main Upgrades	Recommended Capital Project (2014-2017)	Columbia Ln.
77	15100 Block Beachview Avenue Pressure Improvements	Recommended Capital Project (2014-2017)	Beachview Ave.
78	Cast Iron Condition Assessment Pilot Program & Asset Management Program	Recommended Capital Project (2014-2017)	NE White Rock
80	Well Redevelopment and Associated Work	Annual Program	System Wide
81	New Water Service Connections	Annual Program	System Wide
82	Saturna Drive and Archibald Rd. Water Main Upgrades	Recommended Capital Project (2014-2017)	Saturna Dr.
84	Oxford Well #8	Recommended Capital Project (2014-2017)	Oxford Well Site
85	1300 Block Martin Street Water Main Replacement	Recommended Capital Project (2014-2017)	Martin St.
86	13800 Block Coldicutt Ave Water Main Replacement	Recommended Capital Project (2014-2017)	Coldicutt Ave.
87	Marine Drive (Vidal St. to Martin St.) Water Main Replacement	Recommended Capital Project (2014-2017)	Marine Dr.
88	Marine Drive (Bishop Rd to Magdalen Cres)	Recommended Capital Project (2014-2017)	Marine Dr.

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2013 Water System Master Plan Update

Legend

Water Main Diameter (mm)

- < 100
- 100
- 150
- 200
- 250
- 300
- (76) Recommended 2014 to 2017 Project (Task ID)
- Pressure Zone Boundary

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Project No. 102-119

Date November 2013

Recommended Water System Upgrades

Figure 7-1

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Author: JLau

7.3 Review of Existing Recommendations

Projects from the 2010 Master Plan not subsequently completed have been reviewed and included if merited in the 2013 Master Plan list. Table 7-2 summarizes the recommendations from the 2010 Master Plan.

Table 7-2: Review of Existing Recommendations (from 2010 Master Plan)

Task ID	Project Name	Status					
		Compete	Ongoing	2014-2017 Capital Plan	Deferred Beyond 2017	Addressed in TWQM	Not Recommended
PREVIOUSLY IDENTIFIED PROJECTS							
E-Hi-1	Blackburn Ave. Feeder Main	X					
Q-Hi-2	Chestnut St. Looping	X					
E-Hi-3	Marine Dr. Water Main Upgrades			X			
E-Hi-5	Oxenham Water Main Upgrades		X(1)				
X-Hi-16	George St. Looping	X					
S-Hi-18	Merklin Well 7 Completion	X					
X-Hi-21	1400 Block Foster St. Water Main Upgrades			X			
F-Hi-41	Hospital St. Looping		X(1)				
E-Hi-42	Kerfoot Rd. Looping	X					
Q-Hi-43	Cory Rd. Looping	X					
ANNUAL PROGRAMS							
O-C-47	Galvanized Iron Replacement Program	X					
O-C-71	Hydrant Replacement Program		X	X			
P-C-72	Meter Replacement Program		X	X			
NEW PROJECTS							
S-Lo-52	Well 5 Abandon			X(2)			
S-Hi-53	Well Redevelopment			X			
S-C-54	Continuous Well Level Measurement	X					
Q-C-55	Chlorination System at Merklin Site	X(3)				X	
Q-C-56	Chlorination System at Goggs Site					X	
Q-C-57	Chlorination System at High St. Site					X	
Q-C-58	Chlorination System at Roper Site					X	
O-Hi-61	Power Factor Correction at Oxford Well Site, High St. Well, and Merklin Pump Station	X(3)				X	
O-C-64	1.5 ML Merklin Storage Tank					X	
E-Hi-65	Centre St. Upgrading		X(4)				
Q-Hi-66	Merklin Arsenic Treatment					X	
F-C-36	High St. Well 4 Improvements					X	
O-Hi-60	Merklin High Seismic Upgrading					X	
S-Hi-49	Well 8			X			
O-Hi-70	Balancing Pump #1 and #2 VFD Installation	X					
O-C-74	Billing Software Replacement	X					
STUDIES							
P-C-39	Water Loss Audit & Water Conservation Study / Leak Reduction Programs						X
Q-C-24	Aquifer Protection Plan			X			

Notes:
1) Included in 2013 Capital Program.
2) Included in Well 8 program.
3) Temporary system installed for Well 6 and 7; permanent system is part of TWQM plan.
4) Revised scope (Royal Ave. looping project), scheduled for 2013 construction.

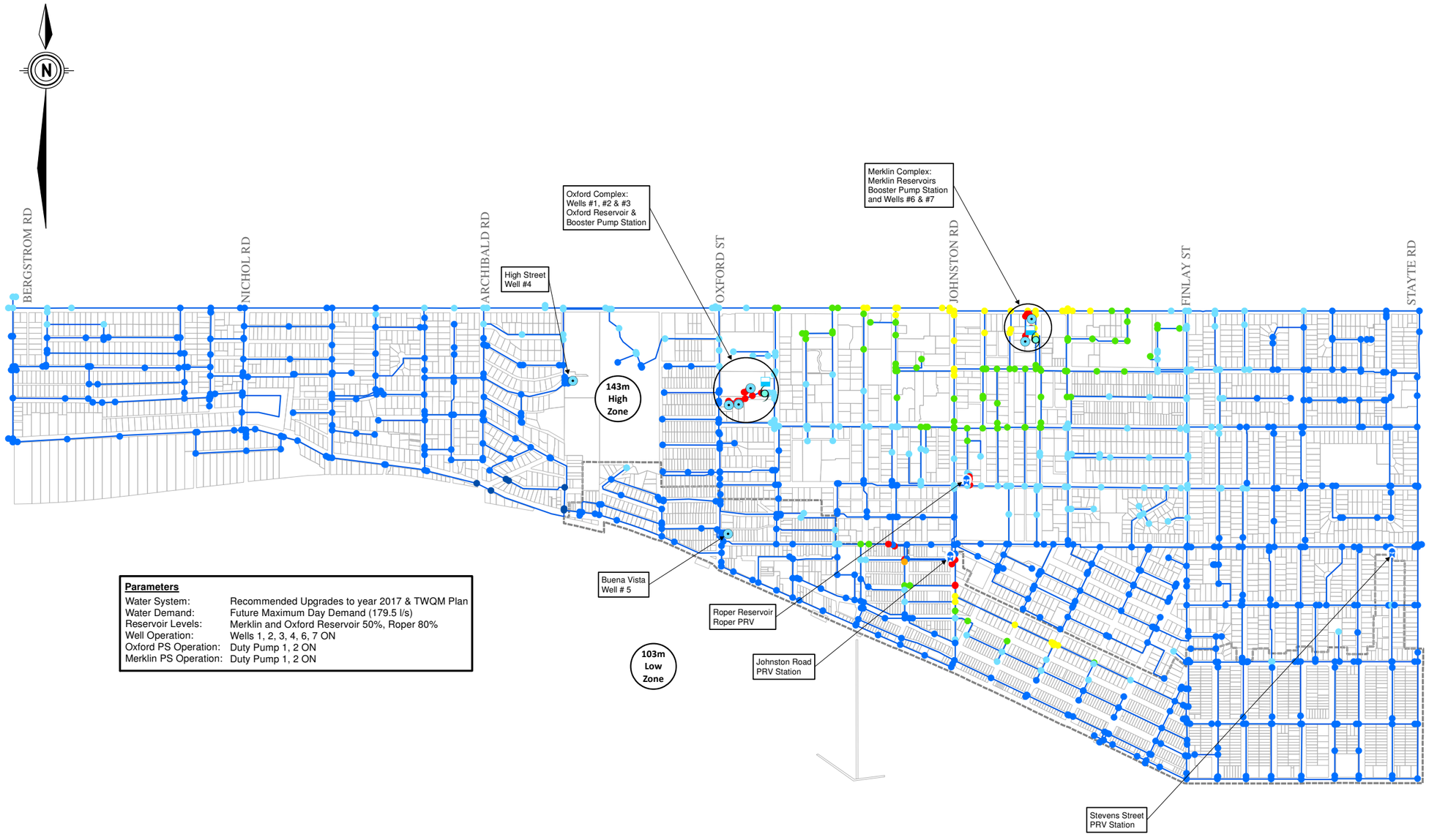
7.4 New Projects

In addition to tasks from previous reports, the following projects have been added to address the following system deficiencies. Note that detailed descriptions are available in the justification sheets in Appendix A.

1. **Improve system performance and reliability:** The following water main upgrades are recommended to improve fire flows and reliability:
   - 15500 Block Columbia Ln. Water Main Upgrades (E-Lo-76);
   - 15100 Block Beachview Ave. Pressure Improvements (E-Lo-77);
   - Saturna Dr. and Archibald Rd. Water Main Upgrades (E-Hi-82); and
   - 1400 Block Martin St. Water Main Upgrades (E-Hi-83).
2. **Condition Assessment, Asset Management and Water Main Replacement:** Given that water main breaks are occurring predominately in cast iron mains, a two faceted project is recommended to assess the condition of the water mains and to provide information for planning purposes with the goal of reducing system leaks and breaks.
   - Cast Iron Condition Assessment Pilot Program & Water Main Asset Management Strategy (O-Hi-78);
   - It is anticipated that this project will provide recommendations for water main replacement projects. Based on previous break history, four potential projects were identified by EWR staff.
     - 1300 Block Martin St. Water Main Replacement (O-Hi-85);
     - 13800 Block Coldicutt Ave. Water Main Replacement (O-Hi-86);
     - Marine Dr. from Vidal St. to Martin St. Water Main Replacement (O-Lo-87); and
     - Marine Dr. from Bishop Rd. to Magdalen Cres. Water Main Replacement (O-Hi-88).
3. **Well Redevelopment:** A regular program of well inspection and redevelopment to manage the existing wells and supply capacity.
   - Well Redevelopment and Associated Work (O-C-80).
4. **Supply capacity:** A new well is recommended over the long term to meet supply capacity demands (existing and future).
   - Oxford Well 8 (F-C-84).

7.5 Model Results with Upgrades

Figure 7-2 shows the pressure at peak hour with the recommended upgrades. Figure 7-3 shows the available fire flow with the recommended upgrades.



Parameters

Water System:	Recommended Upgrades to year 2017 & TWQM Plan
Water Demand:	Future Maximum Day Demand (179.5 l/s)
Reservoir Levels:	Merklin and Oxford Reservoir 50%, Roper 80%
Well Operation:	Wells 1, 2, 3, 4, 6, 7 ON
Oxford PS Operation:	Duty Pump 1, 2 ON
Merklin PS Operation:	Duty Pump 1, 2 ON

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2013 Water System Master Plan Update

Legend

Peak Hour Pressure (psi)

- < 41
- 41.1 - 43.5
- 43.6 - 50.0
- 50.1 - 60.0
- 60.1 - 80.0
- 80.1 - 150.0
- > 150
- Water Mains
- Pressure Zone Boundary

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Project No.	Date
102-119	November 2013

Peak Hour Pressure with Future Demands and Recommended Upgrades (to year 2017)

Figure 7-2

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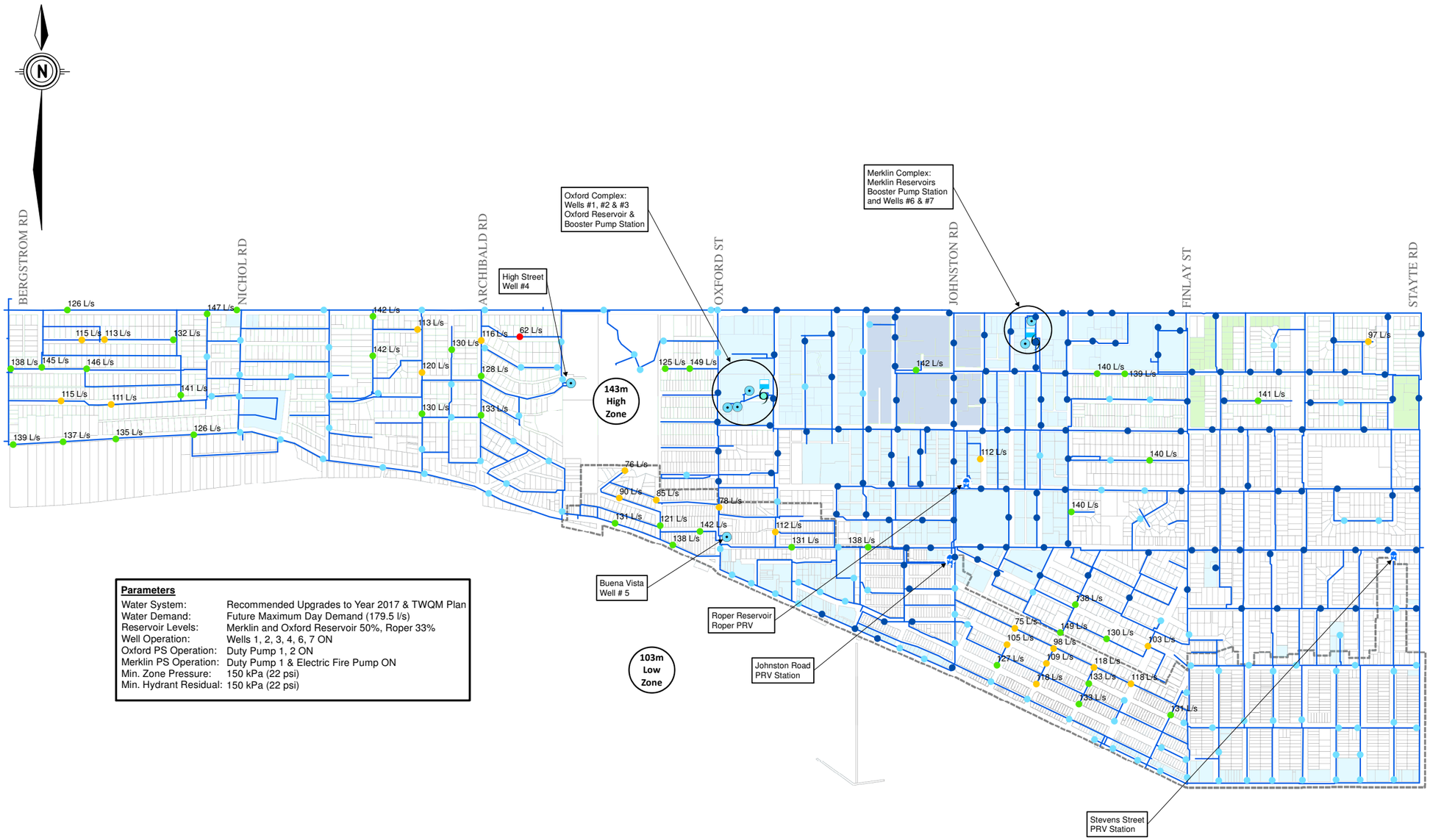
Author: MRevesz



Parameters

Water System:	Recommended Upgrades to Year 2017 & TWQM Plan
Water Demand:	Future Maximum Day Demand (179.5 l/s)
Reservoir Levels:	Merklin and Oxford Reservoir 50%, Roper 33%
Well Operation:	Wells 1, 2, 3, 4, 6, 7 ON
Oxford PS Operation:	Duty Pump 1, 2 ON
Merklin PS Operation:	Duty Pump 1 & Electric Fire Pump ON
Min. Zone Pressure:	150 kPa (22 psi)
Min. Hydrant Residual:	150 kPa (22 psi)

EPCOR

2013 Water System Master Plan Update

Legend

Available Fire Flow (L/s)

- < 67
- 68 - 120
- 121 - 150
- 151 - 225
- > 225
- Water Mains

Fire Flow Required (L/s)

- 67
- 120
- 150
- 225
- Pressure Zone Boundary

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Project No.	Date
102-119	November 2013

Available Fire Flow with Future Demands and Recommended Upgrades (to year 2017)

Figure 7-3

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Author: MRevesz

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Section 8

Conclusions

8. Conclusions

8.1 Summary

The master plan update reviewed the current system performance and developed a recommended upgrading program for 2014 to 2017.

Key observations from the update, compared to the 2010 Master Plan are summarized below:

- Since 2010 EPCOR has completed a Total Water Quality Management Plan (TWQM) that addresses supply, storage and treatment issues from the 2010 Master Plan. EPCOR is moving ahead separately with the TWQM plan and accordingly these items are not re-listed in this plan. However, the analysis completed assumes full implementation of the TWQM plan.
- System demands have decreased since 2010. The 2012 recorded ADD was 71 L/s compared to 85 L/s in 2009.
- Per capita base demands decreased from 233 L/ca/day in 2009 to 202 L/ca/day in 2012 (13% decrease). Reduction in base demands is attributed to increasing use of low-flow fixtures.
- Lower seasonal (irrigation) demands in 2012 (compared to 2009) may be coincidental (due to wet summer, etc.). The unit rate for seasonal demand was not adjusted.
- Demand forecast of 180 L/s was maintained. Due to lower base demand unit rates, the associated forecast population for the demand forecast has increased since the 2010 plan. Population of 26,649 ca are expected to be serviceable with the demand forecast of 180 L/s.
- Well supply capacity is currently adequate but with decommissioning of Well 5 and/or growth, a new well will be required (Oxford Well 8). A routine well redevelopment program is recommended to maintain existing wells.
- In general the White Rock system meets hydraulic design criteria. Isolated deficiencies in some areas result in recommended upgrades at:
  - 13600 – 13800 Marine Dr.;
  - 15500 Block Columbia Ln.; and
  - 15100 Block Beachview Ave.
- As water mains age, the need for a water main asset management increases. A two faceted project is recommended, which includes:
  - A cast-iron condition assessment pilot program; and
  - A water main asset management strategy.
- A review of the service meter assets indicates that an increase to the current replacement program is warranted. Replacement of all the remaining manual read meters (not touch read, all more than 20 years olds) is recommended within ten years.

8.2 Recommended 2014-2017 Program

The recommended 2014-2017 program excluding TWQM plan projects total $4,039,000. The projects are listed in Table 7-1.

8.3 Report Submission

Prepared by:

KERR WOOD LEIDAL ASSOCIATES LTD.

Michelle Revesz, P.Eng.
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Reviewed by:

Nov 25 2013 4:07 PM

Neal Whiteside, M.A.Sc., P.Eng.
Project Manager

Statement of Limitations

This document has been prepared by Kerr Wood Leidal Associates Ltd. (KWL) for the exclusive use and benefit of EPCOR White Rock Water Inc. for the 2013 Water System Master Plan Update. 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.

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Appendix A

Capital Project Justification Sheets

APPENDIX A – CAPITAL PROJECT JUSTIFICATION SHEETS

Contents

Capital Projects

Justification sheets have been created for each of the projects. Projects have been prioritized as follows:

- **Recommended Capital Projects (2014 – 2017)**: These projects are recommended to be included in the 2014 to 2017 Capital Plan.
- **Annual Programs**: Programs that will be carried out on an annual basis.
- **Capital Projects Deferred (Beyond 2017)**: These capital projects are recommended to address system deficiencies. However they are lower priority and are recommended to be deferred beyond 2017.

Work that is part of the Total Water Quality Management plan is not included. Similarly, work scheduled for 2013 completion is not included.

Task Labelling

Capital tasks have been labelled using a three-part identifier (ex. E-Hi-1). The first part of the identifier identifies the nature of the primary justification for the task. Justification abbreviations are as follows:

E – Existing fire flow and/or pressure deficiency

F – Future fire flow and/or pressure deficiency

O – Operational / reliability concern

P – System planning / monitoring

Q – Water quality program

S – Supply or storage deficiency (to meet future demands)

X – New connections for developments

The second part of the identifier identifies the zone that the improvement primarily applies to. Zone abbreviations are as follows:

C – Comprehensive program

Hi – High Pressure Zone

Lo – Low Pressure Zone

The third part of the identifier is a unique label for that task.

Project Category: Recommended Capital Projects (2014-2017)

Primary Justification: Fire Flow Improvement

Project Name: Marine Dr. Water Main Upgrades **Project ID:** E-Hi-3

Project Description:

Installation of 630 meters of 200 mm diameter water main on Marine Dr. between Bergstrom Rd. and Terry Rd. (13600-13800 blocks).

Project Justification:

1. This project will improve available fire flow from 50 L/s to 135 L/s at hydrants #127 and #2.
2. The completion of this project will replace 630 meters of 100 mm diameter cast iron piping with 200 mm diameter ductile iron piping. Recent records (2008 – 2012) show that EWR typically experiences 10 water main breaks per year. The breaks are predominantly occurring on cast iron pipes. Cast iron was used in the construction of water distribution systems from 1900 to 1970 but is no longer considered an acceptable material due to the susceptibility to corrosion leading to water main breaks. The frequency of main breaks will increase as the pipe ages.
3. This section of pipe is high pressure relative to the rest of the system (95 to 110 psi). Due to its location (uphill relative to homes along Marine Dr.), a water main failure could cause significant property damage. In fact a previous break on Marine Dr. did result in significant property damage (January 2008).

Engineering/Financial Evaluation:

The costs are based on historical water main installation costs for EWR, with suitable allowances for administration, engineering and contingencies. The costs include an item to specifically address road restoration to the City of White Rock standards, see section 5.3 of the 2013 Water System Master Plan Update. The 2013 Class 'C' cost opinion for project completion is $551,000.

Consequences of <u>NOT</u> Undertaking the Project:

1. Calculated available fire flow at hydrants #127 and #2 is 50 L/s (below requirement).
2. Cast iron piping is more susceptible to breakage compared to other materials such as ductile iron. Previous breaks have been recorded on this section of main (Jan. 2008). Higher pressures and local topography make risk and consequences of breaks potentially more serious.

Justification Category

1. Safety		2. Customer Requirements	X	3. Reliability	X	4. Life Cycle Costs	
5. Water Quality		6. Environmental		7. Financial		8. Tech./Product Dev.	

Project Category: Recommended Capital Projects (2014-2017)

Primary Justification: Fire Flow Improvements

Project Name: 1400 Blk. Foster St. Water Main Upgrades **Project ID:** X-HI-21

Project Description:

Installation of 210 meters of 250 mm diameter ductile iron water main on Foster St. between Russell Ave. and Thrift Ave.

Project Justification:

1. This project is part of a series of projects (the now-completed Russell Ave. and Merklin St. upgrades) to strengthen the supply and distribution system in the Town Centre area. This series of projects would provide the following:
   - Improve available fire flows significantly to meet fire flow requirements of the Upper Town Centre area (area bounded by North Bluff Rd., Thrift Ave., George St. and Martin St.). Land use for this area has recently been changed to allow higher density requiring increased fire flows.
   - Increase available fire flows to the remainder of the High Zone (outside of the Upper Town Centre).
   - Improve supply capacities between the High Zone storage and the Low Zone.
   - Improve system redundancy between the Oxford wells and the Merklin Reservoir complex. Reduce system velocities and head losses between the Oxford Wells and the Merklin reservoir complex when filling the reservoirs via these wells.
2. In particular this project replaces 205 m of 150 mm dia. ductile iron water main, which currently links the larger dia. mains on Thrift Ave. (200 mm) and Russell Ave. (250 mm).
3. This project is required to improve the fire-fighting capabilities to the southwest corner of the Upper Town center.

Engineering/Financial Evaluation:

The costs are based on historical water main installation costs for EWR, with suitable allowances for administration, engineering and contingencies. The costs include an item to specifically address road restoration to the City of White Rock standards, see section 5.3 of the 2013 Water System Master Plan Update. The 2010 Class 'C' cost estimate for project completion is $222,000.

Consequences of <u>NOT</u> Undertaking the Project:

Existing 150 mm dia. ductile iron water main remains in service limiting fire flow capacity to the southwest corner of the Upper Town Centre. This will also have some intrinsic negative effects on fire flow servicing and system redundancy beyond the local area.

Justification Category

1. Safety		2. Customer Requirements	X	3. Reliability	X	4. Life Cycle Costs	
5. Water Quality		6. Environmental		7. Financial		8. Tech./Product Dev.	

Project Category: Recommended Capital Projects (2014-2017)

Primary Justification: Improved Protection of Aquifers

Project Name: Aquifer Protection Plan **Project ID:** Q-C-24

Project Description:

Establish a long term groundwater level monitoring program and aquifer protection plan. The Well Protection Toolkit prepared in 2000 by the Province of British Columbia provides a framework for this process, which includes a water system assessment.

Project Justification:

1. Requirements for a water system assessment are defined in the Water Protection Act. Currently an assessment must be completed if required by the Drinking Water Officer.
2. Increased awareness of system operations for EWR and White Rock citizens to promote ongoing stewardship of this valuable resource.
3. Aquifer protection planning outcomes can be incorporated into short-term design and construction of capital projects including: Well Redevelopment project (O-C-80) and TWQM project.

Engineering/Financial Evaluation:

The cost opinion from the 2010 Water Master Plan for project completion was $60,000.

Consequences of NOT Undertaking the Project:

Reduced level of awareness of potential risks that may impact the aquifer (both water quality and quantity).

Justification Category

1. Safety		2. Customer Requirements		3. Reliability		4. Life Cycle Costs	
5. Water Quality	X	6. Environmental		7. Financial		8. Tech./Product Dev.	

Project Category: Recommended Capital Projects (2014-2017)

Primary Justification: Fire Flow Improvement

Project Name: 15500 Block Columbia Ln. Water Main Upgrades **Project ID:** E-Lo-76

Project Description:

Installation of 170 meters of 150 mm diameter water main on Columbia Ln., between Balsam St. and Ash St.

Project Justification:

1. Improves available fire flow from 55 L/s to 118 L/s at hydrant #91.
2. Replaces 170 m of 100 mm diameter cast iron water main. Recent records (2008 – 2012) show that EWR typically experiences 10 water main breaks per year. The breaks are predominantly occurring on cast iron pipes. Cast iron was used in the construction of water distribution systems from 1900 to 1970 but is no longer considered an acceptable material due to the susceptibility to corrosion leading to water main breaks. The frequency of main breaks will increase as the pipe ages.

Engineering/Financial Evaluation:

The costs are based on historical water main installation costs for EWR, with suitable allowances for administration, engineering and contingencies. The costs include an item to specifically address road restoration to the City of White Rock standards, see section 5.3 of the 2013 Water System Master Plan Update. The 2013 Class 'C' cost opinion for project completion is $145,000.

Consequences of <u>NOT</u> Undertaking the Project:

1. Calculated available fire flow at hydrant #091 is 55 L/s (below requirement).
2. Cast Iron piping is more susceptible to breakage compared to other materials such as ductile iron.

Justification Category

1. Safety		2. Customer Requirements	X	3. Reliability	X	4. Life Cycle Costs	
5. Water Quality		6. Environmental		7. Financial		8. Tech./Product Dev.	

Project Category: Recommended Capital Projects (2014-2017)

Primary Justification: Improve Local Pressures

Project Name: 15100 Block Beachview Ave. Pressure Improvements **Project ID:** E-Lo-77

Project Description:

Installation of 80 meters total of 150 mm diameter water main on Foster St. and Johnston Rd., allowing the 15100 block of Beachview Ave. to be serviced from the high pressure zone. The new water main sections will tie in to the existing section of 150 mm diameter water main on Beachview Ave. (currently in the low pressure zone).

Project Justification:

1. Improves system pressure in this area to meet design criteria. Current pressure range in the 15100 block of Beachview Ave. is 38 to 43 psi. When connected into the high zone, the pressure will be 95 to 100 psi.

Engineering/Financial Evaluation:

The costs are based on historical water main installation costs for EWR, with suitable allowances for administration, engineering and contingencies. The costs include an item to specifically address road restoration to the City of White Rock standards, see section 5.3 of the 2013 Water System Master Plan Update. The 2013 Class 'C' cost opinion for project completion is $84,000.

Consequences of <u>NOT</u> Undertaking the Project:

1. Peak hour pressure in this area remains below 40 psi.
2. Impacts ability to service new developments particularly with respect to fire sprinklering.

Justification Category

1. Safety		2. Customer Requirements	**X**	3. Reliability		4. Life Cycle Costs	
5. Water Quality		6. Environmental		7. Financial		8. Tech./Product Dev.	

Project Category: Recommended Capital Projects (2014-2017)

Primary Justification: Reduce Leaks and Breaks

Project Name: Cast Iron Condition Assessment Pilot Program and Water Main Asset Management Strategy **Project ID:** O-Hi-78

Project Description:

Condition assessment of 2 km of cast-iron water main in high break rate area (north east corner of utility including general area bound by Thrift to North Bluff Rd. east of Finlay St.).

Develop a system-wide asset management strategy for water mains based on the cast iron condition assessment pilot program, pipe material, year of install, break history, system pressures, and replacement costs.

Project Justification:

Cast iron piping failures constitute 92% of the recorded water main breaks in the system. Examination of a replacement program or condition assessment program for the cast iron piping is warranted.

Current break rates and repair costs do not indicate the need for a global replacement program for all of the cast iron water mains. Increasing break rates and/or higher damage lead to the need for a global replacement program. Increasing break rates may occur with CI piping as corrosion / pitting reduces wall thickness.

Replacement of specific water mains that are either high-risk (of causing property damage) and / or poor condition (extensive break history due to age, soils, etc.) may be warranted. Better information is required to positively identify these mains.

Certain clusters of break are noted in the break history but it is uncertain whether these are random or linked to the condition of the local main, or other factors (construction methods at the time of install, etc.). As an example in the north-east quadrant there has been 39 breaks over a 13 year period on 1.4 km of CI water main (2.2 breaks/year/km).

To better manage the cast iron water main asset class, a condition assessment program is recommended. A pilot condition assessment program that includes non-destructive inline inspection using a 'smart pigging' device such as PICA's See Snake is recommended.

A condition assessment program would provide the following benefits:

- Identification of current pipe condition;
- Identification of leaks;
- Pre-emptive point repairs at areas identified with extensive localized wall loss;
- Enables informed decisions on pipe rehabilitation vs. continuing with point repairs for pipes inspected;
- Where pipe rehabilitation is indicated, inspection data provides additional information to determine method of rehabilitation, i.e. lining vs. replacement; and
- Enables extrapolation of results to a larger area.

The current water main replacement program was based primarily on replacing mains to provide adequate hydraulic characteristics (fire flows and pressures). Mains were also selected to provide additional redundancy (looping). As these level of service issues areas are addressed and the system ages, the need for an asset management strategy to justify a pipe rehabilitation rate and method (replacement vs. rehabilitation / lining) becomes more pressing. The asset management study would review the cast iron condition assessment pilot program results and consider the need for expansion of this program, as well as using the results to extrapolate possible replacement / repair rates utility wide.
Engineering/Financial Evaluation: Estimated cost $120,000 ($60/m) including costs for inspection, inspection report, engineering and project management. Cost estimate of $35-39/m obtained for inspection only. Additional $ 21-25/m included to allow for program development, engineering, cleaning of mains, internal costs and contingency. Note unit costs are based on reasonable (2 km or more) length of inspected main. Additional $40,000 to complete an asset management strategy extending pilot to entire utility.
Consequences of <u>NOT</u> Undertaking the Project: Additional future costs for water main breaks above economic threshold (for mains in poor condition) and/or premature replacement of mains with significant remaining economic service life (for mains in good condition). Replacement rates and methods not based on structured approach. Projects and replacement rates continue to be selected on an ad-hoc basis.

Justification Category

1. Safety		2. Customer Requirements		3. Reliability	**X**	4. Life Cycle Costs	**X**
5. Water Quality		6. Environmental		7. Financial		8. Tech./Product Dev.	**X**

Project Category: Recommended Capital Projects (2014-2017)

Primary Justification: Fire Flow Improvement

Project Name: Saturna Dr. and Archibald Rd. Water Main Upgrades **Project ID:** E-Hi-82

Project Description:

Installation of 290 meters of 150 mm diameter water main on Saturna Dr., between Archibald Rd. and High St. and 150 m of 150 mm diameter water main on Archibald Rd. between Mann Park Cres. and North Bluff Rd.

Project Justification:

1. Improves available fire flow from 60 L/s to 140 L/s at hydrant #21.
2. Replaces 440 m of 100 mm diameter cast iron water main. Recent records (2008 – 2012) show that EWR typically experiences 10 water main breaks per year. The breaks are predominantly occurring on cast iron pipes. Cast iron was used in the construction of water distribution systems from 1900 to 1970 but is no longer considered an acceptable material due to the susceptibility to corrosion leading to water main breaks. Industry best practice has shown that the frequency of main breaks will increase as the pipe ages.
3. There has been 2 breaks on this section of water main since 2008.

Engineering/Financial Evaluation:

The costs are based on historical water main installation costs for EWR, with suitable allowances for administration, engineering and contingencies. The costs include an item to specifically address road restoration to the City of White Rock standards, see section 5.3 of the 2013 Water System Master Plan Update. The 2013 Class 'C' cost opinion for project completion is $378,000.

Consequences of <u>NOT</u> Undertaking the Project:

1. Calculated available fire flow at Hydrant #21 is 60 L/s (below requirement).
2. Cast Iron piping is more susceptible to breakage compared to other materials such as ductile iron (one local break recorded on this section of water main).

Justification Category

1. Safety		2. Customer Requirements	X	3. Reliability	X	4. Life Cycle Costs	
5. Water Quality		6. Environmental		7. Financial		8. Tech./Product Dev.	

Project Category: Recommended Capital Projects (2014-2017)

Primary Justification: Additional Water Supply Capacity

Project Name: Oxford Well 8 **Project ID:** S-C-84

Project Description:

Install Well 8 at Utilities Oxford site to replace capacity loss as existing wells age and as wells are taken out of service, and to meet future water demands. To minimize the effect on the existing wells, the final siting of the new well will be based on a hydrogeological assessment and recommendations.

Project Justification:

1. Additional water supply capacity is required to meet increased demands and to replace capacity loss as existing wells age (reduction in productivity) and are taken out of service.
2. Decommissioning and abandoning Well 5 is also recommended (over long-term rather than re-development). Well 5 will be maintained over the short-term (until 2017). Decommissioning of Well 5 is recommended due to the inability to incorporate the well into TWQM plan, along with reduced capacity, condition and water quality concerns.
3. Decommissioning of Well 3 is subject to testing conducted beyond 2017.
4. Gross system supply capacity with existing wells (1 through 7 inclusive) is 199 L/s. Without Well 5 (31 L/s) gross capacity would be 168 L/s, compared to current maximum day demand of 156 L/s. Addition of Well 8 (at a nominal capacity of 40 L/s) would meet current and future demands. If Well 3 (29 L/s) is decommissioned, gross capacity will be reduced to 180 L/s (including Well 8), reducing redundancy.

Engineering/Financial Evaluation:

$740,000 excluding GST, including engineering, overhead/administration and contingency. Preliminary cost opinion is based on Well 7 costs (2012) but excluding costs specific to that project (chlorination equipment building, electrical kiosk, and other electrical modifications to the Merklin facility) and adding decommissioning of Well 5.

Consequences of <u>NOT</u> Undertaking the Project:

Unless demand-side measures are very effective or growth is less than anticipated, supply shortfalls on peak demand days are likely resulting in drawdown into fire storage at reservoirs.

Justification Category

1. Safety		2. Customer Requirements	X	3. Reliability		4. Life Cycle Costs	
5. Water Quality		6. Environmental		7. Financial		8. Tech./Product Dev.	

Project Category: Recommended Capital Projects (2014-2017)

Primary Justification: Reduce Water Main Breaks

Project Name: 1300 Block Martin St. Water Main Replacement **Project ID:** O-Hi-85

Project Description:

Replace 194 m of 150 mm diameter cast iron water main on the 1300 block of Martin St. (between Thrift Ave. and Roper Ave.).

Project Justification:

1. Recent records (2008 – 2012) show that EWR typically experiences 10 water main breaks per year. The breaks are predominantly occurring on cast iron pipes. Cast iron was used in the construction of water distribution systems from 1900 to 1970 but is no longer considered an acceptable material due to the susceptibility to corrosion leading to water main breaks. The frequency of main breaks will increase as the pipe ages.
2. Three recent water main breaks (Aug. 2010, Feb. 2012 & Apr. 2012) have occurred on this section of pipe. EWR staff has identified this section of pipe for possible replacement. Upon completion of the Condition Assessment and Asset Management programs, replacement of this section of water main will be confirmed.

Engineering/Financial Evaluation:

The costs are based on historical water main installation costs for EWR, with suitable allowances for administration, engineering and contingencies. The costs include an item to specifically address road restoration to the City of White Rock standards, see section 5.3 of the 2013 Water System Master Plan Update. The 2013 Class 'C' cost opinion for project completion is $170,000.

Consequences of NOT Undertaking the Project:

Additional water main breaks on this section of main, potentially increasing maintenance costs and reducing level of service.

Justification Category

1. Safety		2. Customer Requirements		3. Reliability	X	4. Life Cycle Costs	X
5. Water Quality		6. Environmental		7. Financial	X	8. Tech./Product Dev.	

Project Category: Recommended Capital Projects (2014-2017)

Primary Justification: Reduce Water Main Breaks

Project Name: 13800 Block Coldicutt Ave. Water Main Replacement **Project ID:** O-Hi-86

Project Description:

Replace 252 m of 150 mm diameter water main on the 13800 block of Coldicutt Ave.

Project Justification:

1. Recent records (2008 – 2012) show that EWR typically experiences 10 water main breaks per year. The breaks are predominantly occurring on cast iron pipes. Cast iron was used in the construction of water distribution systems from 1900 to 1970 but is no longer considered an acceptable material due to the susceptibility to corrosion leading to water main breaks. The frequency of main breaks will increase as the pipe ages.
2. Two recent water main breaks (Sep. 2003 & Dec. 2011), which were costly to repair, occurred on this section of pipe. EWR staff has identified this section of pipe for possible replacement. Upon completion of the Condition Assessment and Asset Management programs, replacement of this section of water main will be confirmed.
3. Project will prepare for eventual elimination of 100 mm dia. water main on private property south of Coldicutt Ave. (consideration for servicing lots on south-side of Coldicutt Ave.).

Engineering/Financial Evaluation:

The costs are based on historical water main installation costs for EWR, with suitable allowances for administration, engineering and contingencies. The costs include an item to specifically address road restoration to the City of White Rock standards, see section 5.3 of the 2013 Water System Master Plan Update. The 2013 Class 'C' cost opinion for project completion is $221,000.

Consequences of <u>NOT</u> Undertaking the Project:

Additional water main breaks on this section of main, potentially increasing maintenance costs and reducing level of service.

Justification Category

1. Safety		2. Customer Requirements		3. Reliability	X	4. Life Cycle Costs	X
5. Water Quality		6. Environmental		7. Financial	X	8. Tech./Product Dev.	

Project Category: Recommended Capital Projects (2014-2017)

Primary Justification: Reduce Water Main Breaks

Project Name: Marine Dr. (Vidal St. to Martin St.) Water Main Replacement **Project ID:** O-Lo-87

Project Description:

Replace 236 m of 150 mm diameter water main on Marine Dr., from Vidal St. to Martin St.

Project Justification:

1. Recent records (2008 – 2012) show that EWR typically experiences 10 water main breaks per year. The breaks are predominantly occurring on cast iron pipes. Cast iron was used in the construction of water distribution systems from 1900 to 1970 but is no longer considered an acceptable material due to the susceptibility to corrosion leading to water main breaks. The frequency of main breaks will increase as the pipe ages.
2. Three water main breaks (Jan. 2007, Nov. 2010 & Apr. 2011) have occurred on this section of pipe. EWR staff has identified this section of pipe for possible replacement. Upon completion of the Condition Assessment and Asset Management programs, replacement of this section of water main will be confirmed.

Engineering/Financial Evaluation:

The costs are based on historical water main installation costs for EWR, with suitable allowances for administration, engineering and contingencies. The costs include an item to specifically address road restoration to the City of White Rock standards, see section 5.3 of the 2013 Water System Master Plan Update. The 2013 Class 'C' cost opinion for project completion is $201,000.

Consequences of NOT Undertaking the Project:

Additional water main breaks on this section of main, potentially increasing maintenance costs and reducing level of service.

Justification Category

1. Safety		2. Customer Requirements		3. Reliability	X	4. Life Cycle Costs	X
5. Water Quality		6. Environmental		7. Financial	X	8. Tech./Product Dev.	

Project Category: Recommended Capital Projects (2014-2017)

Primary Justification: Reduce Water Main Breaks

Project Name: Marine Dr. (Bishop Rd. to Magdalen Cres.) Water Main Replacement **Project ID:** O-Hi-88

Project Description:

Replace 548 m of 150 mm diameter water main on Marine Dr., from Bishop Rd to Magdalen Cres. The diameter of the main will be determined during preliminary design.

Project Justification:

1. Recent records (2008 – 2012) show that EWR typically experiences 10 water main breaks per year. The breaks are predominantly occurring on cast iron pipes. Cast iron was used in the construction of water distribution systems from 1900 to 1970 but is no longer considered an acceptable material due to the susceptibility to corrosion leading to water main breaks. The frequency of main breaks will increase as the pipe ages.
2. EWR staff has identified this section of pipe for possible replacement. Upon completion of the Condition Assessment and Asset Management programs, replacement of this section of water main will be confirmed.

Engineering/Financial Evaluation:

The costs are based on historical water main installation costs for EWR, with suitable allowances for administration, engineering and contingencies. The costs include an item to specifically address road restoration to the City of White Rock standards, see section 5.3 of the 2013 Water System Master Plan Update. The 2013 Class 'C' cost opinion for project completion is $485,000.

Consequences of NOT Undertaking the Project:

Additional water main breaks on this section of main, potentially increasing maintenance costs and reducing level of service.

Justification Category

1. Safety		2. Customer Requirements		3. Reliability	X	4. Life Cycle Costs	X
5. Water Quality		6. Environmental		7. Financial	X	8. Tech./Product Dev.	

Project Category: Annual Programs

Primary Justification: Fire Flow Protection

Project Name: Hydrant Replacement Program **Project ID:** O-C-71

Project Description:
Replacement and/or relocation of 5 hydrants per year.
Project Justification:
Hydrants have been provided by the water utility as required by the City of White Rock for fire protection. Hydrant maintenance is funded by the City via Schedule 'F' of the existing Water Tariff. The hydrant replacement program provides: 1. Improved fire hydrant coverage. 2. Improved flow capacity by replacing old hydrants with newer models.
Engineering/Financial Evaluation:
Cost estimate of $5,400 per hydrant, for a total of $27,000 annually (2013 dollars); based on previous experience.
Consequences of <u>NOT</u> Undertaking the Project:
Available fire protection may be compromised.
Notes: Project information provided by EWR.

Justification Category

1. Safety		2. Customer Requirements	**X**	3. Reliability		4. Life Cycle Costs	
5. Water Quality		6. Environmental		7. Financial		8. Tech./Product Dev.	

Project Category: Annual Programs

Primary Justification: Service Meter Accuracy

Project Name: Meter Replacement Program **Project ID:** P-C-72

Project Description:

There are 4,466 meters in the EWR system according to the 2012 meter records provided by EWR. It is estimated that about 60% of these meters have been replaced since 1994. The remaining 40% are estimated to be between 20 and 50 years old.

Older meters may continue to function but wear will cause them to under record resulting in loss of revenue. Industry meter quality assurance programs indicate an optimum age to replace a water meter is 30 years.

The existing meters must be read manually, by physical access to the meter chamber. The readings are manually recorded and later transcribed into the billing system.

Replacement meters have electronic touch read capability. Readings can be taken quickly without physical access to the meter chamber. The readings can be then electronically uploaded into the billing software.

Identification of the meters to be replaced new each year rests with the EWR Operations staff in White Rock.

Based on completion of current cycle of meter replacement over a 10 year period will require 178 meters per year (1,780 meters total). Allowing 38 meters per year to be replaced through redevelopment leaves 140 per year to be replaced by the current program. Historic average cost per meter replacement is $650 per meter (including overhead and labour costs, and allowing for a nominal number of large / expensive meter installs).

Once meters have been identified for replacement or upgrading, the field work is planned. Meters are purchased locally and the models selected conform to the EWR standards.

Project Justification:

1. Reduce meter under reading and non-revenue water.
2. Increase staff efficiency by reducing manual meter reading, recording and transcribing.
3. Accuracy of service meters assists in water auditing.

Engineering/Financial Evaluation:

The recommended program cost is $91,000 annually (2013 dollars) to replace 140 meters per year.

Consequences of NOT Undertaking the Project:
1. Without accurate water meters, water usage cannot be accurately determined and billing is not equitable. 2. Possible loss of revenue due to under reading meters may occur. 3. Increased operating costs due to manual access, reading, recording and transcribing will occur. 4. Reduced level of service due to infrequent readings, and errors introduced by manual reading, recording and transcribing will affect customer service expectations.
Notes: Project information provided by EWR.

Justification Category

1. Safety		2. Customer Requirements		3. Reliability		4. Life Cycle Costs	**X**
5. Water Quality		6. Environmental		7. Financial	**X**	8. Tech./Product Dev.	

Project Category: Annual Programs

Primary Justification: Maintain Supply Capacity

Project Name: Well Redevelopment and Associated Work **Project ID:** O-C-80

Project Description:

A regular program of well redevelopment to maintain the existing wells. Re-development of one well per year is recommended (five-year cycle). Program to start in yr-2015). Based on previous well redevelopments tentative redevelopment schedule: 2015 – Well 4, 2016 - Well 2, 2017 – Well 1.

Project Justification:

1. Re-development restores lost capacity.
2. Allows for inspection of down hole components such as well pump, motor, check valve, and instrumentation and replacement or rebuild on a structured basis.
3. Provides opportunity to improve well construction to current standards including well seal, re-grading around the well, and bringing well casing above-grade (if practical).

Engineering/Financial Evaluation:

The cost opinion, based on previous well redevelopments, is $50,000 per well (yearly). Total cost $150,000.

Consequences of NOT Undertaking the Project:

1. Well capacity will de-grade, lack of regular re-development schedule may result in permanent losses in capacity and the need for drilling new wells to compensate for lost capacity.
2. Down-hole components not maintained on a pro-active basis, increased potential for failures requiring emergency repair and associated reduced reliability of supply.
3. Based on the aquifer protection plan, improvements to surface seals, instrumentation, and other related measures are required for aquifer protection. Allowances for these items are included in this project.

Justification Category

1. Safety		2. Customer Requirements		3. Reliability	X	4. Life Cycle Costs	X
5. Water Quality		6. Environmental		7. Financial		8. Tech./Product Dev.	

Project Category: Annual Programs

Primary Justification: New Connections for Developments

Project Name: New Water Service Connections **Project ID:** X-C-81

Project Description:
New water services connections for infill housing and redevelopment. Includes water meter and backflow protection. New water services are installed by EWR at developer's cost.
Project Justification:
1. Provides water service to infill housing and redevelopment. 2. Water meter is installed to EWR standards to ensure meter reading accuracy, efficiency and staff safety. 3. Backflow preventer is installed to EWR standards to protect the water system from potential cross connections.
Engineering/Financial Evaluation:
New water service connections are installed by EWR at the developers cost.
Consequences of <u>NOT</u> Undertaking the Project:
Services not installed to EWR standard may increase operations costs with maintenance of non-uniform services.

Justification Category

1. Safety		2. Customer Requirements	**X**	3. Reliability		4. Life Cycle Costs	
5. Water Quality		6. Environmental		7. Financial		8. Tech./Product Dev.	

Project Category: Capital Projects Deferred (Beyond 2017)

Primary Justification: Fire Flow Improvement

Project Name: 1400 Block Martin St. Water Main Upgrades **Project ID:** E-Hi-83

Project Description:
Installation of 410 meters of 200 mm diameter water main on Martin St., between North Bluff Rd. and Thrift Ave.
Project Justification:
Improves available fire flow from 180 L/s and 200 L/s to 250 L/s at hydrants #129 and #293, by replacing 410 meters of 150 mm diameter ductile iron water main.
Engineering/Financial Evaluation:
The costs are based on historical water main installation costs for EWR, with suitable allowances for administration, engineering and contingencies. The costs include an item to specifically address road restoration to the City of White Rock standards, see section 5.3 of the 2013 Water System Master Plan Update. The 2013 Class 'C' cost opinion for project completion is $378,000.
Consequences of <u>NOT</u> Undertaking the Project:
The calculated available fire flow at hydrant #129 and #293 is 180 L/s and 200 L/s, respectively (below requirement for the Town Centre Area).

Justification Category

1. Safety		2. Customer Requirements	**X**	3. Reliability		4. Life Cycle Costs	
5. Water Quality		6. Environmental		7. Financial		8. Tech./Product Dev.	