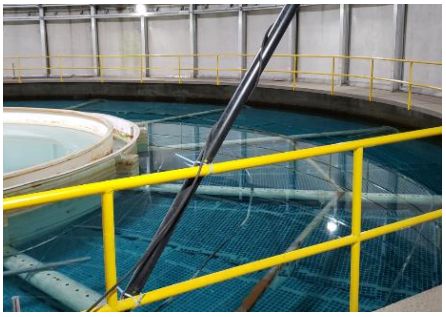
Lakefront Utility Services Inc.

Cobourg Drinking Water System Master Plan

Final Summary Report



415 Baseline Road West, 2nd Floor
Bowmanville, Ontario
Canada L1C 5M2

CIMA+ Project Number: C14-0364

July 2021

REVIEW AND SUBMISSION REGISTER			
Review No.	Reviewed by	Date	Description of the change or submission
1 (e00v02)	DEC	26-Nov-2020	Draft for Client Review
2 (e00v02)	CWS	01-Dec-2020	Editorial and Proofing Review Sections 5, 6 and 7
3 (e01v00)	CWS	19-Feb-2021	Revision for Inclusion of TM-2&3B Content
4 (e01v01)	CWS	15-Mar-2021	Revision of e01 to address stakeholder comments related to TM-2&3B
5 (e01v02)	DEC	12-Apr-2021	Expanded/Updated MCEA Requirement Summary
6 (e01v04)	CWS	09-07-2021	Addition of Public Engagement Details
7 (e01v05)	CWS	20-07-2021	Final Version

Confidentiality and ownership

« Unless CIMA+ s.e.n.c. and its client have agreed otherwise, the intellectual property rights and all documents delivered by CIMA+, whether in hard or electronic copy, are the property of CIMA+, which reserves copyright therein. It is strictly prohibited to use or reproduce such proprietary rights on any support, even in part, without the authorisation of CIMA+. »

Table of Contents

List of Tables

List of Figures

1.0 Introduction

The Cobourg Drinking Water System (DWS) is owned by the Town of Cobourg and operated by Lakefront Utility Services Inc. (LUSI). The Cobourg DWS currently services an estimated residential population of approximately 21,000 persons, including a small population in Hamilton Township.

At full build-out of the current urban (Municipal) boundary Cobourg is expected to have a population of approximately 39,000 persons. A significant portion of Cobourg's future growth is planned to occur in the Cobourg East Community secondary plan area, which is anticipated to provide development opportunities for the time horizon well beyond 20 years given the size of the area and historic growth rates.

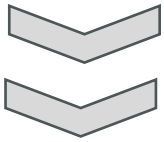
CIMA Canada Inc. (CIMA+) was engaged by Lakefront Utility Services Inc. (LUSI) to prepare a Water Master Plan for the Town of Cobourg's drinking water system. The scope of this Master Plan assignment includes:

+ **Phase 1:** Establishing design requirements for the system to full build-out of the service area.
+ **Phase 2:** Identifying the treatment, pumping, storage and distribution infrastructure necessary to meet the future design requirements.
+ **Phase 3:** Developing a draft Master Plan report to evaluate options for necessary infrastructure upgrades and present a preferred approach for implementing a prioritized set of infrastructure projects to meet the design requirements.
+ **Phase 4:** Stakeholder and public consultation related to the approach presented in the draft Master Plan and finalization of the Master Plan with consideration for public and stakeholder input received.

1.1 Technical Memoranda

In order to develop the Master Plan for the Cobourg DWS a series of five (5) technical memoranda have been prepared as outlined below.

TM-1	Demand Projections, Design Criteria & Preliminary Capacity Evaluations
TM-2	Treated Water Storage Requirements
TM-3	Treated Water Pumping Requirements
TM-2&3B	Evaluation of Potential Storage and Pumping Facility Site Locations
TM-4	Water Treatment Plant Capacity & Preliminary Condition Assessment
TM-5	Distribution System Pressures & Upgrade Requirements



Cobourg Drinking Water System Master Plan	**Draft**
Cobourg Drinking Water System Master Plan	**Final**

1.1.1 Technical Memorandum No. 1

Technical Memorandum No. 1 – Demand Projections, Design Criteria & Preliminary Evaluations (TM-1), submitted in April 2020, provided a general description of the study area and existing drinking water system infrastructure and established service population and water demand projections to full build-out within the Cobourg urban boundary. TM-1 was considered to address Phase 1 of the Master Plan assignment.

1.1.2 Technical Memorandum No. 2 & 3 (Combined)

Technical Memorandum No. 2 & 3 – Treated Water Storage and Pumping Assessment (combined memorandum) (TM-2 & 3), submitted in August 2020, provided a description and review of the existing storage and pumping facilities in the Cobourg Drinking Water System (DWS), identified major deficiencies and operational constraints and outlined preliminary rehabilitation and upgrading requirements and provided a desk-top evaluation of alternatives to satisfy future treated water storage and future treated water pumping requirements. TM-2 & 3 included a detailed evaluation of various pumping and storage strategies and options and outlined the preliminary preferred solution to address the long-term treated water pumping and storage requirements for the Cobourg DWS.

1.1.3 Technical Memorandum No. 2 & 3 B

Technical Memorandum No. 2 & 3 B – Evaluation of Zone 1 Treated Water Storage & Zone 2 Pumping Site Locations, submitted in February 2021, supplements TM-2 & 3 with a more detailed evaluation of potential sites for the combined Zone 1 Elevated Tank and Zone 2 Booster Pumping

Station facilities needed to primarily satisfy short-term treated water storage and pumping needs. TM-2 & 3B included discussion and evaluation of four (4) potential site locations and in conclusion, provided a recommendation for a preferred site. Discussions and recommendations in subsequent technical memoranda (TM-4 and TM-5) proceeded with the assumption of Elevated Tank and Booster Pumping Station location on the recommended site.

1.1.4 Technical Memorandum No. 4

Technical Memorandum No. 4 – Cobourg Water Treatment Plant Assessment (TM-4), submitted in August 2020, provided a general description and review of the existing treatment processes and systems within the Cobourg Water Treatment Plant (WTP), identified major deficiencies, operational constraints and preliminary rehabilitation and upgrading requirements, and evaluated various alternatives to satisfy future processes and system upgrade requirements.

1.1.5 Technical Memorandum No. 5

Technical Memorandum No. 5 – Water Distribution System Assessment (TM-5), submitted in October 2020, provided a general description of the existing distribution system along with an evaluation of security of supply issues, system pressures, system capacity and system expansion requirements to support future growth.

1.2 Purpose of This Document

The purpose of this document is to present information included in the executive summaries of each of the technical memoranda outlined above to provide a consolidated overview of the existing conditions, analysis approach, and recommendations provided in each of the technical memorandum. The information is organized in Sections that are aligned with and follow the sequence of the five (5) memoranda.

Ultimately, following further stakeholder consultation, the Master Plan report will be developed in a similar fashion although with greater integration of the subject matter and less distinction related to the organization of the five (5) original memoranda.

1.3 Existing Drinking Water System

The existing drinking water system consists of water treatment, pumping, storage and distribution infrastructure, which is briefly summarized in the following sub-section and discussed in more detail in the subsequent sections, which relate specifically to each element of the system.

1.3.1 Cobourg Water Treatment Plant

The Cobourg Water Treatment Plant (WTP), located at 6 D'Arcy Street in Cobourg, is a surface water treatment plant drawing raw water from Lake Ontario up to a permitted rate of 31,822 m^3/d. The treatment process at the Cobourg WTP has a rated capacity of 36,368 m^3/d and operates utilizing chemically assisted filtration that includes polymer injection, clarification in a solids up-flow clarifier and filtration through rapid gravity filters with granular activated carbon and silica sand media as well as primary and secondary disinfection using gas chlorination. Treated water is stored at the Cobourg WTP in a concrete in-ground reservoir with two cells having a total volume of ±6,244 m^3.

Elements of the Cobourg WTP are discussed in more detail in Section 4.0.

1.3.2 Pumping Facilities

Treated water is supplied into Pressure Zone 1 (Zone 1) of the distribution system by the high-lift pumping system at the WTP, which consists of five (5) vertical turbine pumps with a maximum capacity of 978 L/s and firm capacity of 751 L/s, which is the available pumping capacity with the largest pump out-of-service.

Water is pumped from Zone 1 into Pressure Zone 2 (Zone 2) of the distribution system by the Ewart Street Booster Pumping Station (BPS), which is located a 9 Ewart Street just east of Division Street. The Ewart Street BPS is equipped with three (3) horizontal centrifugal booster pumps and has a maximum capacity of 228 L/s and firm capacity of 152 L/s with one of the pumps out of service.

Further discussion related to existing pumping infrastructure in the Cobourg DWS is provided in Section 3.0.

1.3.3 Storage Facilities

Additional treated water storage facilities located within the distribution system include the following floating storage facilities:

+ The Zone 1 Elevated Tank located at 665 Victoria Street with a volume of 1,360 m^3 and a top water level of 132.0 m.
+ The Zone 2 Elevated Tank located at 60 Strathy Road with a 3,734 m^3 and a top water level of 158.4 m.

Further discussion related to existing storage infrastructure in the Cobourg DWS is provided in Section 3.0.

1.3.4 Distribution System

The Cobourg water distribution system includes approximately 170.5 kilometers of transmission and distribution watermains (ranging in diameter from 100 mm to 600 mm) and 7,815 individual water services (based on 2019 billing data).

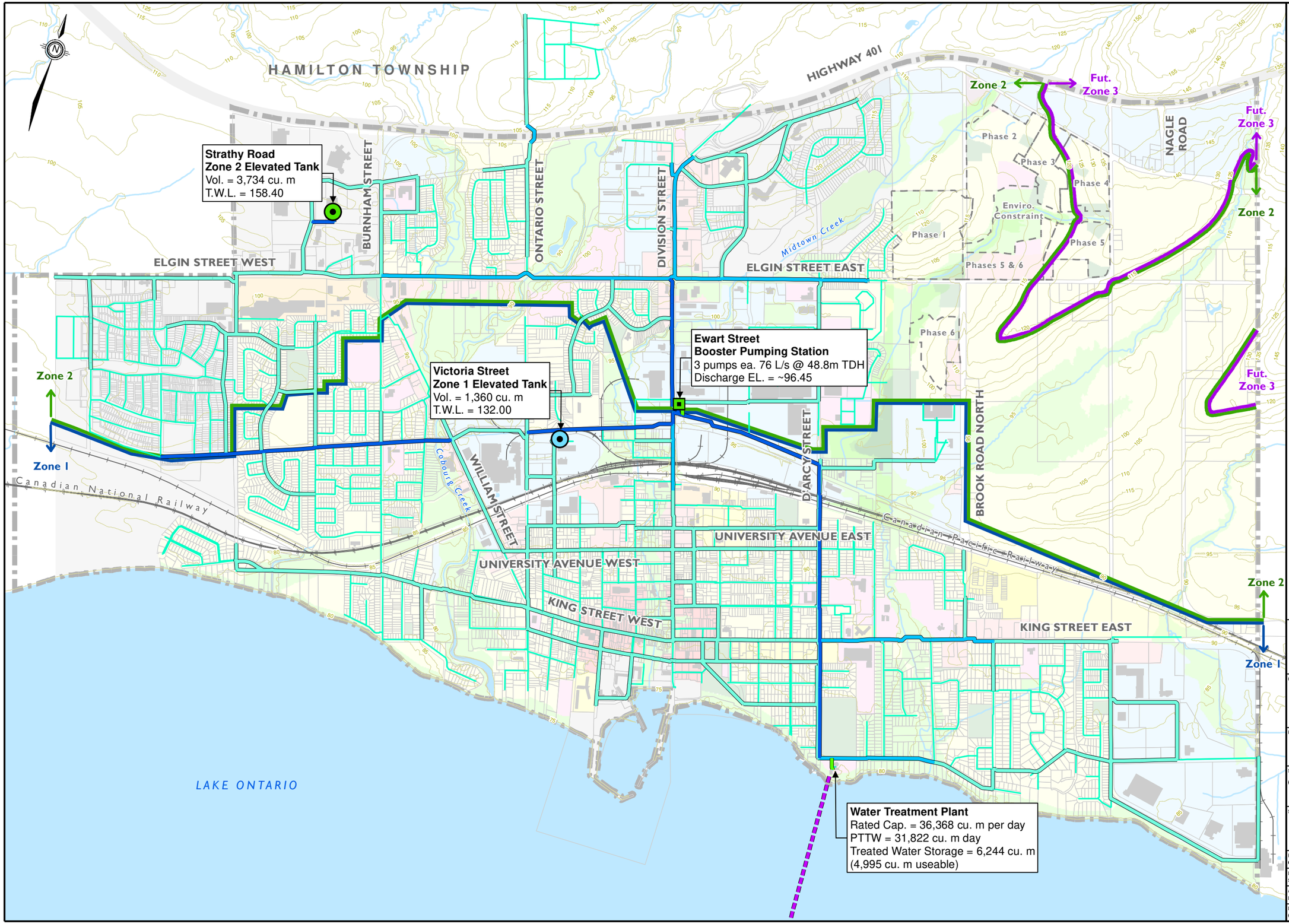
As noted above, the distribution system is currently split into two pressure zones. Zone 1 services lower elevation areas from the lake shore at an elevation of ±75 m to up to an elevation of ±98 m. Zone 2 services higher elevation areas from an elevation of ±85 m up to ±122 m in the Parkview Hills area near Highway 401, also including lands north of Highway 401 in Hamilton Township.

A future pressure zone (Zone 3) is planned to service areas in Cobourg East at elevations above ±122 m up to an elevation of ±146 m.

Figure 1.1 provides a general overall plan of the Cobourg water distribution system and associated facilities including the current boundary between Zone 1 and Zone 2 and the approximated boundary between Zone 2 and future Pressure Zone 3 (Zone 3).

Figure 1.2 provides a general overall schematic of the existing Cobourg DWS.

The existing distribution system is described in detail in **Section 5.0**.



LEGEND

- ELEVATED TANK (ZONE 1)
- ELEVATED TANK (ZONE 2)
- BOOSTER PUMPING STATION (ZONE 2)

EXISTING WATERMAIN

- LESS THAN 300MM
- 300MM
- 400MM
- 450MM
- 600MM
- RAW INTAKE PIPE

LAND USE

- RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- ENVIRONMENTAL CONSTRAINT
- PARK
- MAIN CENTRAL AREA
- SHOPPING NODE
- MIXED USE
- MAJOR INSTITUTIONAL
- EMPLOYMENT
- SECONDARY PLAN AREA

OTHER FEATURES

- PRESSURE ZONE 1/ZONE 2 BOUNDARY
- PRESSURE ZONE 2/FUTURE ZONE 3 BOUNDARY
- CONTOUR (5M INTERVAL)
- BUILDING FOOTPRINT (>= 10,000 SQ. FT.)
- RONDEAU DEVELOPMENT PHASING
- TOWN OF COBOURG MUNICIPAL BOUNDARY

CIMA+

CLIENT: Lakefront Utility Services Inc.

PROJECT NAME:
COBOURG DRINKING WATER SYSTEM MASTER PLAN

SHEET TITLE:
OVERALL PLAN OF EXISTING COBOURG WATER DISTRIBUTION SYSTEM

SCALE: 100 50 0 100 200 300 400 500 meters
1:20,000

PROJECT No: C14-0364		CLIENT FILE No: ---
DRAFTER: S. ELLIOTT	DESIGNER ---	FIGURE No: 1.1
APPROVER D. CAMPBELL	APPROVER ---	
DATE: 6/1/2020		

Cobourg Drinking Water System
Schematic: Existing System + Conceptual Zone 3

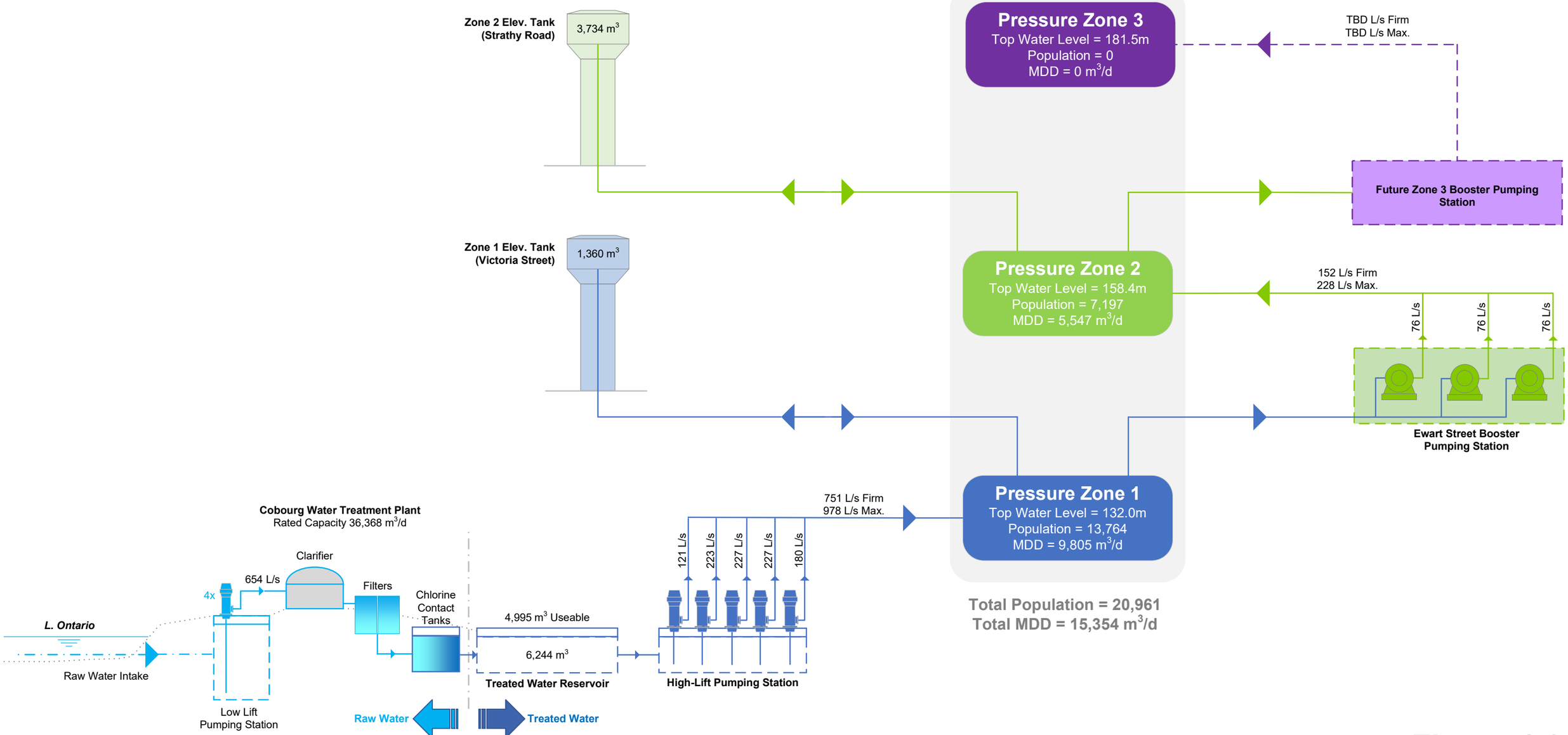


Figure 1.2

2.0 Demand Projections and Design Criteria

2.1 Study Area

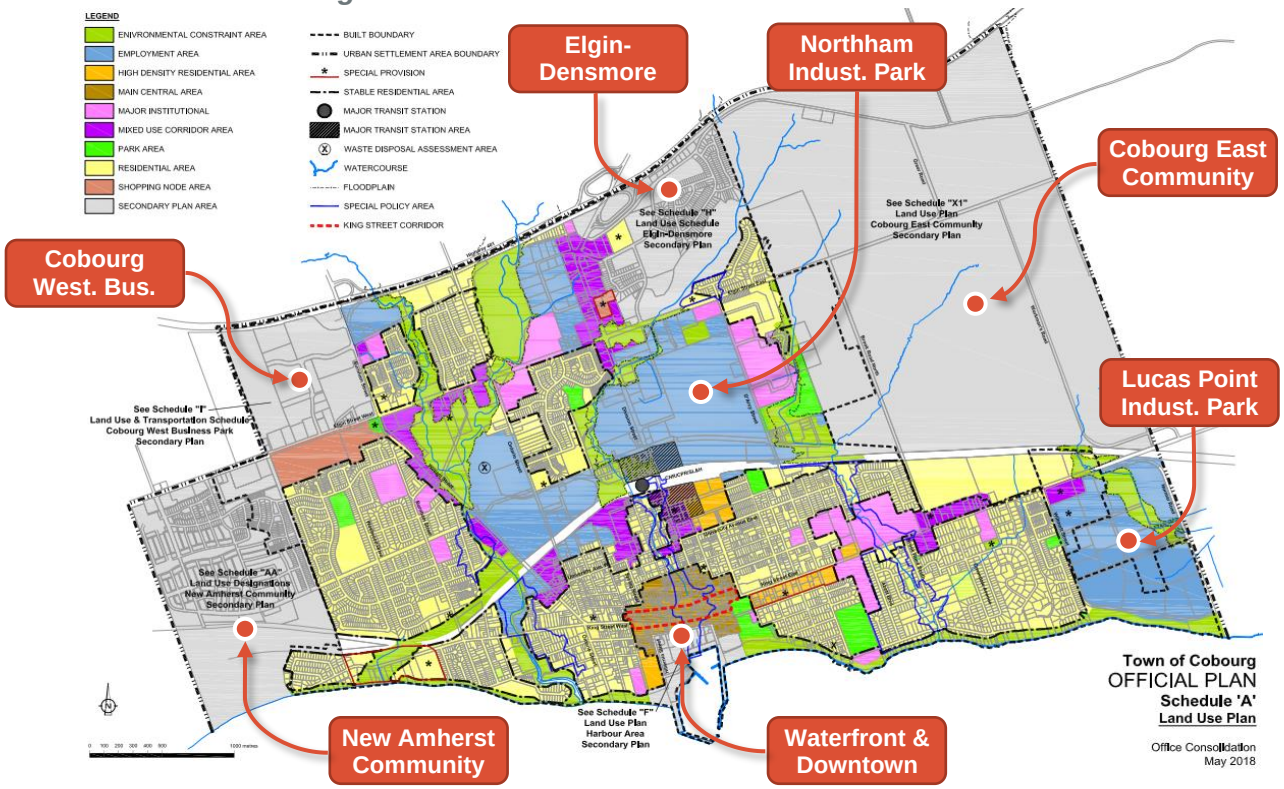
The study area encompasses all lands within the municipal boundary of the Town of Cobourg (Town) totalling approximately 22.36 km^2 (2,236 ha) as well as a small residential area in Hamilton Township (±23 ha), which is currently serviced with water supplied from the Cobourg Drinking Water System (DWS).

At the time of the 2016 national census the population of Cobourg was determined to be 19,440 persons, an increase of 5% from the 2011 national census. The Town's 2016 Development Charges Background Study prepared by Watson & Associates identified employment in Cobourg at the time of the 2011 census to be 10,646 jobs.

Recent population growth in the Town of Cobourg has consisted of significant subdivision development on sites in the Elgin-Densmore and New Amherst Community secondary plan areas in addition to smaller scale greenfield and infill development within existing built-up areas, including significant redevelopment in the Town's waterfront area. Non-residential growth has included development in the Cobourg West Business Park area and the mixed-use corridor along Division Street (north of Elgin Street). There are also two industrial parks in Cobourg including the Town owned Northam Industrial Park and the Lucas Point Industrial Park, both of which include sites to accommodate additional growth.

The location of these development areas is shown below on an annotated version of Town's Official Plan Land Use Schedule in **Figure 2.1**.

Figure 2.1: Annotated Official Plan Land Use Schedule



A significant portion of Cobourg's future growth is planned to occur in the Cobourg East Community secondary plan area, which encompasses 570 ha in the northeast portion of the Town's defined urban boundary. As described in the Secondary Plan for Cobourg East Community, it is anticipated that the Cobourg East Community will provide development opportunities for the time horizon beyond 20 years, given the size of the area and historic growth rates. Ultimately, the Cobourg East Community is intended to be a diverse area that will include varying densities of residential development as well as employment, commercial and mixed-use development. The Secondary Plan for Cobourg East Community (2005) identified a potential future residential population of 16,500 people and employment development that will generate up to 3,600 new jobs.

2.2 Residential Service Population

2.2.1 Current Service Population

The current (2020) residential service population for the Cobourg DWS is estimated to be 20,961 persons. A zone-by-zone breakdown of the current (2020) residential service population estimate is provided in **Table 2.1**.

Table 2.1 Breakdown of Current (2020) Residential Service Population Estimates

Parameter (persons)	Zone 1	Zone 2 [1] Cobourg	Zone 2 [1] Hamilton	Zone 3 [3]	Total
2016 Census Population	13,244	6,196	371	-	19,811
Undercount Adjustment (+2.8%)	370	170	10	-	550
1% Annual Growth (2016 – 2020) [2]	150	450	-	-	600
2020 Residential Service Population	13,764	6,816	381	-	20,961

Notes:
1. Zone 2 includes service areas in Town of Cobourg & Township of Hamilton, Zone 1 & Zone 3 service areas are entirely in Town of Cobourg Urban Boundary.
2. Estimated based on 2016 census data and 1% annual growth to 2020, with 75% of annual growth from 2016 – 2020 assumed to be in Zone 2.
3. Zone 3 is the future pressure zone and is not currently serviced

2.2.2 Future Residential Service Population Projections

The future residential service population for the Cobourg DWS was estimated to be 39,045 persons at full build-out. The following table provides a zone-by-zone breakdown of the future residential service population estimate at full build-out.

Table 2.2 Breakdown of Future (Full Build-Out) Residential Service Population Estimates

Parameter (persons)	Zone 1	Zone 2 Cobourg	Zone 2 Hamilton	Zone 3	Total
2020 Residential Service Population	13,764	6,816	381	-	20,961
In-Progress Residential Development					
Multi-Stage Subdivisions (Cobourg East Development Area) [1]	-	1,620	-	2,048	3,668
Multi-Stage Subdivisions (within existing service area)	1,009	1,905	-	-	2,914
Other Residential Developments	984	926	6	-	1,916
Anticipated Future Residential Developments					
Cobourg East Development Area (excluding in-progress development) [2]	-	8,252	-	434	8,686
Infill & Intensification	450	450	-	-	900
Future Residential Population (persons)	16,207	19,969	387	2,482	39,045

Notes:
1. Estimates based on high-end of unit count range for low density units
2. Estimates based on 45 persons per hectare of residential/mixed use area

Most growth will occur within Zone 2, particularly the portion of Zone 2 that is the Cobourg East area, with Zone 2 eventually growing to have the largest serviced population. The total residential population of Zone 3 will be relatively small in comparison to Zone 1 and Zone 2, although the current land use planning framework does include significant non-residential (i.e. employment) development within Zone 3.

2.3 Historic Water Demands

The following table summarizes recent historical water demands for the Cobourg DWS based on flow data and billing data as provided by LUSI for the three (3) year period from 2017-2019.

Table 2.3 Historic Water Demands for the Cobourg DWS – Based on Flow Data

Parameter	2017	2018	2019	Average
Raw Water Total Annual Taking (m^3) - Flow Data	3,606,484	3,765,329	3,153,633	3,508,482
Raw Water Average Day Taking (m^3/d)	9,881	10,316	8,640	9,612
Raw Water Maximum Day Taking (m^3/d)	12,521	15,004	11,759	-
Treated Water to Distribution (m^3)	3,407,260	3,562,894	2,919,397	3,296,517
Treated Water Average Day Flow (m^3/d)	**9,335**	**9,761**	**7,998**	**9,032**
Treated Water Maximum Day Flow (m^3/d)	11,748	14,315	10,453	-
Maximum Day Peaking Factor	1.3	1.5	1.3	-

Based on the treated water flow data, the average daily demand for the Cobourg DWS over the last three (3) years (2017 through 2019) was approximately 9,000 m^3/d.

The maximum daily demand over this period (2017–2019), observed in July 2018 was 14,135 m^3/d, which represents a maximum day factor of approximately 1.6 based on the average daily demand for the last three years (9,032 m^3/d). This observed maximum daily treated water flow (14,135 m^3/d) represents approximately 45% of the water taking under the current PTTW and approximately 39% of the current rated capacity of the Cobourg WTP.

Historically, non-residential demands (i.e. industrial, commercial, institutional) amount to approximately 35 percent of total system demand at ±3,000 m^3/d on an average day. **Table 2.4** summarizes non-residential demands by zone.

Table 2.4 – Residential Non-Residential Split of Historic Demands

Zone 1 Non-Residential Usage (m^3) - Billing Data	693,397	689,910	686,331	689,879
Zone 1 Average Non-Residential (m^3/d) - Billing	1,900	1,890	1,880	1,890
Zone 2 Non-Residential Usage (m^3) - Billing Data	468,757	439,988	443,528	450,758
Zone 2 Average Non-Residential (m^3/d) - Billing	1,284	1,205	1,215	1,235
Total Non-Residential (m^3) - Billing (All Zones)	1,162,154	1,129,897	1,129,859	1,140,637
Average Non-Residential Usage (m^3/d) - Billing	**3,184**	**3,096**	**3,096**	**3,125**
Estimated Avg. Residential Demand (m^3/d) (1)	**6,151**	**6,665**	**4,902**	**5,907**

Notes:
1. Estimated Average Residential Demand based on Treated Water Average Day Demand (flow data) minus Average Non-Residential Demand (billing data).

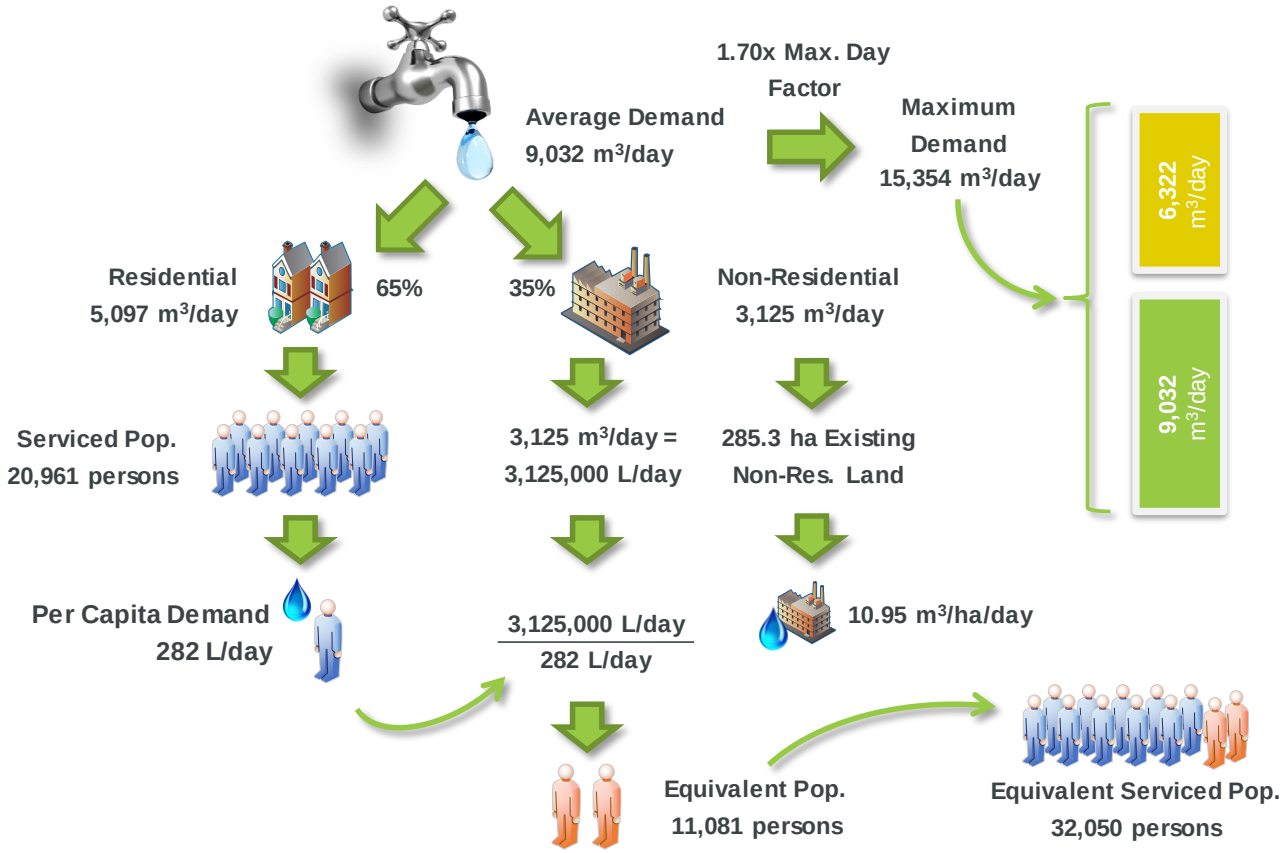
Subtracting the combined average daily usage of all non-residential users (3,125 m^3/d) from the average daily demand for the entire system (9,032 m^3/d) and factoring the remaining average daily usage (5,907 m^3/d) over the current estimated residential service population (20,961 persons) the average daily residential water usage is estimated to be approximately 282 L/c/d.

Accounting for all residential and non-residential usage (9,032 m^3/d average daily usage), based on an estimated per capita residential consumption rate of 282 L/c/d, the current equivalent service population serviced by the Cobourg DWS is estimated to be approximately 32,050 persons.

2.3.1 Key Design Criteria

Based on the analysis of the historic water demand data **Figure 2.2** illustrates key design criteria established for the evaluation of the Cobourg DWS.

Figure 2.2: Key Design Criteria



Additional key demand related design criteria not illustrated on the figure above include:

+ Future residential service population 39,045 persons (see **Table 2.2**).
+ Peak hour factor 2.7 (based on MECP peak hour factor for populations 25,001 to 50,000) resulting in peak hour demand 24,385 m^3/d.

2.4 Future Water Demand Projections

2.4.1 Residential Demand Projections

Based on the design criteria noted above the following table summarizes estimated future residential demand projections.

Table 2.5 Breakdown of Future (Full Build-Out) Residential Water Demand Projections

Parameter	Zone 1	Zone 2	Zone 3	Total
Current Residential Service Population (persons)	13,764	7,197	-	20,961
Current Average Residential Demand (m^3/d) (1)	3,879	2,028	-	5,907
Future Residential Service Population (persons)	16,207	20,356	2,483	39,046
Future Average Residential Demand (m^3/d) (2)	4,570	5,740	700	11,011
Future Maximum Day Residential Demand (m^3/d) (3)	7,769	9,758	1,190	18,719
Future Peak Hour Residential Demand (m^3/d) (4)	12,339	15,498	1,890	29,730

Notes:
1. Refer to **Table 2.3**
2. Estimates based on per capita residential consumption of 282 L/c/d
3. Estimates based on maximum day peaking factor of 1.7 for all zones
4. Estimates based on peak hour factor of 2.7 for all zones

2.4.2 Non-Residential Demand Projections

Future average non-residential water demands for the Cobourg DWS are estimated to be 5,211 m^3/d at full build-out, based on a non-residential demand increase of 2,086 m^3/d resultant from future development of:

+ An estimated 177.83 hectares of undeveloped employment lands (48.92 ha – Zone 1, 90.91 ha – Zone 2 & 38.0 ha – Zone 3) and an average area unit rate water demand of 10.95 $m^3/d/ha$
+ An estimated 12.69 hectares of undeveloped commercial lands (10.19 ha – Zone 2 & 2.5 ha – Zone 3) and an average area unit rate water demand of 10.95 $m^3/d/ha$

The following table provides a zone by zone breakdown of the future non-residential demands at full build-out.

Table 2.6 Breakdown of Future (Full Build-Out) Non-Residential Water Demands

Parameter	Zone 1	Zone 2	Zone 3	Total
Current Average Non-Residential Demand (m^3/d) (1)	1,890	1,235	-	3,125
Estimated Undeveloped Employment Lands (hectares)	48.92	90.91	38.0	177.83
Average Employment Water Demand - Growth (m^3/d) (2)	536	995	416	1,947
Estimated Undeveloped Commercial Lands (hectares)	-	10.19	2.5	12.69
Average Commercial Water Demand - Growth (m^3/d) (2)	-	112	27	139
Future Average Non-Residential Water Demand (m^3/d)	536	1,107	443	2,086
Future Maximum Day Non-Residential Demand (m^3/d)	911	1,882	753	3,546
Future Peak Hour Non-Residential Demand (m^3/d)	1,447	2,989	1,196	5,632

2.4.3 Combined Residential & Non-Residential Demand Projections

The following table provides a summary of the current and future full build-out overall (residential & non-residential) demand projections for the Cobourg DWS.

Table 2.7 Breakdown of Future (Full Build-Out) Overall Water Demand Projections

Parameter	Zone 1	Zone 2	Zone 3	Total
Future Residential Service Populations (persons)	16,207	20,356	2,483	39,046
Future Average Residential Demands (m^3/d)	4,570	5,740	700	11,011
Future Average Non-Residential Water Demand (m^3/d)	2,426	2,342	443	5,211
Future Estimated Average Day Demand (m^3/d)	6,996	8,083	1,144	16,222
Future Estimated Maximum Day Demand (m^3/d)	11,893	13,740	1,944	27,578
Future Estimated Peak Hour Demand (m^3/d)	18,890	21,823	3,088	43,800

Notes:
1. Maximum day demands based on peaking factor of 1.7 for all zones. Peak hour demands based on peak hour factor of 2.7 for all zones.

3.0 Pumping and Storage

As presented in Section 1.3.2 and 1.3.3, Zone 1 is currently supplied by the high-lift pumping system at the Cobourg WTP which is comprised of five (5) vertical turbine pumps providing a firm rated pumping capacity of 751 L/s (64,886 m^3/d). These pumps supply treated water to the Zone 1 elevated tank at 665 Victoria Street (1,360 m^3) through intermittent operation. Water level in the Victoria Street elevated tank controls system distribution pressures in Zone 1.

Additional treated water storage in Zone 1 is provided by:

- One (1) two-celled treated water storage reservoir at the WTP with a combined total treated water storage volume of ±6,244 m^3
- One (1) high-lift pumping well ±14.8 m x ±4.5 m with ±7.55 m SWD at the WTP

Zone 2 is currently supplied by three (3) identical horizontal centrifugal booster pumps at the Ewart Street BPS which provides a firm rated capacity of 152 L/s (13,133 m^3/d). These pumps supply treated water to the Zone 2 elevated tank at 60 Strathy Road (3,734 m^3) through intermittent operation. Water level in the Strathy Road elevated tank controls system distribution pressures in Zone 2.

For the purposes of these technical memoranda the usable treated water storage volume at the WTP is considered to be 4,995 m^3 which includes 80% of the total volume of the reservoir cells and disregards the volume of the high-lift pumping well and the entire storage volumes for the Zone 1 and Zone 2 elevated tanks are considered as “usable” treated water storage.

Current usable treated water storage in the Cobourg DWS is considered to be 10,089 m^3.

3.1 Pumping Requirements

To provide flexibility for situations where floating storage facilities (water towers) may be out of service for planned maintenance or other unexpected circumstances, it is recommended that the Cobourg DWS be provided with sufficient pumping capacity to pump maximum day demands plus fire flows.

3.1.1 Pressure Zone 1 Pumping Requirements

All water used in the Cobourg DWS must initially be pumped from the high-lift pumping station at the WTP. As such, the high-lift pumping station must be capable of pumping:

- the current maximum day demand of 178 L/s plus a system-wide fire flow requirement of 378 L/s (totaling 556 L/s); and
- ultimate maximum day demand at build-out of 320 L/s plus fire flow of 378 L/s (totaling 698 L/s).

With a firm pumping capacity of 751 L/s the existing high lift pumping system at the WTP is considered to have sufficient capacity to accommodate the above noted system demands under current conditions and at full build-out.

3.1.2 Pressure Zone 2 Pumping Requirements

All water used in Pressure Zone 2 must be pumped into Zone 2 by booster pumping stations. It is anticipated that future Pressure Zone 3 will also be supplied from Zone 2. As such, the total future Zone 2 booster pumping requirements are based on the delivery of sufficient water from Zone 1 to supply both Zone 2 and Zone 3.

Based on the future maximum day demand for Zone 2 and Zone 3 (combined) of 182 L/s plus a Zone 2/3 fire flow requirement of 250 L/s, the future required Zone 2 booster pumping capacity is estimated to be 432 L/s at build-out.

Based on the current firm rated pumping capacity at the Ewart Street BPS of 152 L/s, an expansion of available Zone 2 booster pumping capacity will be required.

3.1.3 Pressure Zone 2 Pumping Options

Given that the projected Zone 2 service population is greater than 10,000 people at full build-out, it is recommended that at least two (2) Zone 2 booster pumping stations be provided to meet future Zone 2 (and Zone 3) demands. This would provide greater security of supply by ensuring some available Zone 2 pumping capacity in the event the Ewart Street BPS was out of service and by reducing reliance on the watermains near the Ewart Street BPS.

Although numerous variations are possible, in order to meet the future Zone 2 and Zone 3 (combined) maximum day demand plus fire flow of 432 L/s a new Zone 2 BPS would require an ultimate firm rated pumping capacity of:

+ 216 L/s with the Ewart Street BPS upgraded to also provide 216 L/s; or
+ 120 L/s with the Ewart Street BPS upgraded to also provide 312 L/s; or
+ 280 L/s with no upgrades to the existing Ewart Street BPS

The preferred approach is to first provide an additional firm rated pumping capacity of 120 L/s at a new Zone 2 BPS that is located at the same site as a new Zone 1 Elevated Tank (further discussed 3.2.3.1). In the longer-term, the existing Ewart Street BPS would then be rehabilitated and upgraded to provide an additional pumping capacity of 312 L/s for an ultimate pumping capacity of 432 L/s.

3.1.3.1 Timing of Zone 2 Pumping Upgrades

The timing of the need for additional pumping capacity will be driven by population growth in Zone 2. In the near term, the Zone 2 elevated tank on Strathy Road can meet the Zone 2 fire flow requirement of 250 L/s for three (3) hours if maintained at a level of at least 73% full. With the Strathy Road elevated tank maintained sufficiently full to provide three (3) hours of fire flow the Ewart Street BPS then needs to be able to pump the current peak hour demand of 102 L/s during a fire event in Zone 2.

Based on utilizing 80% of the current firm rated pumping capacity of the existing Ewart Street BPS, the existing BPS is considered to have the capacity to accommodate Zone 2 growth equivalent to an additional peak hour demand of 19.6 L/s or a total peak hour demand of 121.6 L/s before additional Zone 2 pumping capacity must be provided.

This additional peak hour demand is considered equivalent to an increase in the equivalent service population of 2,225 persons. Based on growth forecasts this threshold is expected to be exceeded within the 10-year time horizon.

3.1.4 Pressure Zone 3 Servicing

The creation of a new (third) pressure zone (Zone 3) will be required to adequately service the area in the northeast corner of the Cobourg urban area that is situated at elevations above ±120 m. The strategy for servicing future Pressure Zone 3 must be considered before future storage requirements for the rest of the distribution system can be confirmed.

At full build-out, Zone 3 is expected to have a residential population of 2,483 persons plus employment development located in the area between existing Danforth Road and Highway 401. Phases 4 & 5 of the proposed "Rondeau" development are also located in future Zone 3. At full build-out, pressure Zone 3 will have an estimated maximum day demand of 22.5 L/s and peak hour demand of 35.8 L/s plus a fire flow requirement of 250 L/s for two (2) hours.

To service Zone 3 a new Zone 3 BPS will be required. The size and operating characteristics (continuous vs. intermittent pumping) of the new Zone 3 BPS depend on whether floating storage is provided in Zone 3. Provision of floating storage in future Zone 3 can only be accomplished through the construction of a new elevated tank (water tower). In-ground reservoirs or standpipes to service Zone 3 would have to be located on higher ground elevations that only exist north of Highway 401, outside of Cobourg in Hamilton Township.

Although providing floating storage for Zone 3 (using an elevated tank) would negate the reliance on continuous pump operation to maintain distribution system pressures, there is significant cost associated with this approach. A lifecycle analysis indicates that over a 30-year operating period the provision of an elevated tank will result in more than $4.0 million of additional capital, maintenance and rehabilitation costs compared to a direct pumping option with continuous pump operation. The operating benefits of an elevated tank are not considered to justify this expense for a residential service population of less than 2,500 persons.

For a direct pumping arrangement into a closed system (i.e. no floating storage) the future Zone 3 BPS will require a firm rated pumping capacity of 272.5 L/s. Although subject to further review of design preferences, it is anticipated that the Zone 3 BPS would be an above grade in-line booster station (similar to the existing Zone 2 Ewart Street BPS) with provisions for up to six (6) horizontal centrifugal pumps with capacities in the 25 L/s to 100 L/s range. This station would presumably be built-out in phases and be funded entirely from development charges.

3.2 Treated Water Storage Requirements

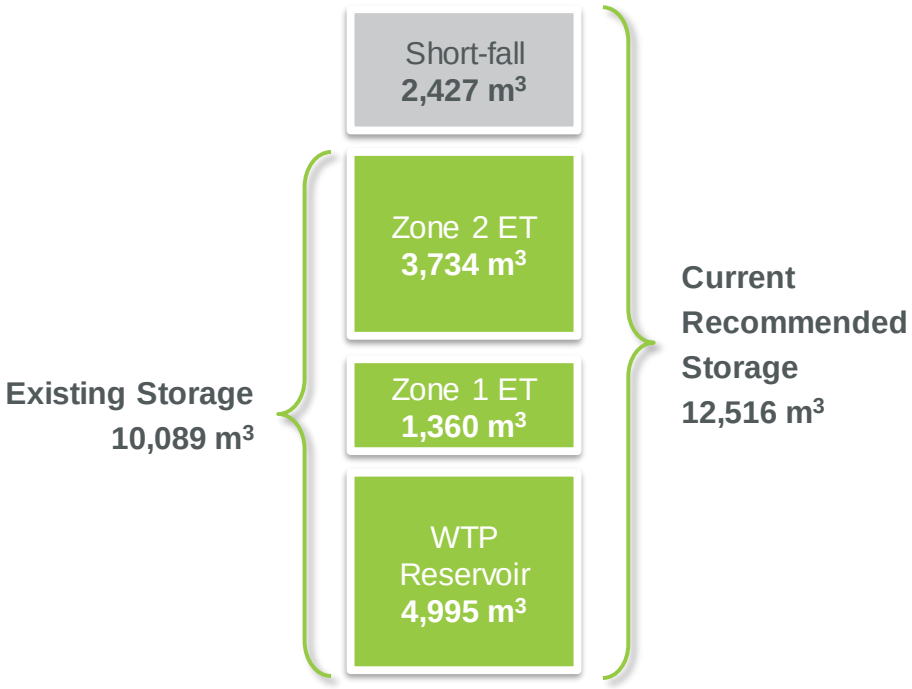
The amount of treated water storage to be provided by a Municipal drinking water system is not specifically regulated and is ultimately at the discretion of the Municipality. A significant short-fall in available treated water storage can jeopardize the ability of the water supply system to maintain distribution pressures and meet system demands, in particular, under fire-fighting conditions. Conversely, a significant overabundance of treated water storage can limit the ability to adequately turnover the water in reservoirs and tanks and contribute to water quality issues due to stagnant water and cause potential freezing issues in elevated tanks and/or standpipes.

3.2.1 Existing Conditions

Under current conditions there is 10,089 m^3 of storage available in the Cobourg DWS both floating (the two elevated tanks) and pumped (the WTP reservoir). This volume is enough to meet maximum day demand and provide a fire flow of 235 L/s for five (5) hours. Based on the current estimated equivalent service population of ±32,050 persons, a current maximum day demand of 15,354 m^3/d and a calculated fire flow requirement of 343 L/s for five (5) hours, the current recommended treated water storage requirement for the Cobourg DWS (all zones combined) is ±12,516 m^3.

As such, the Cobourg DWS is currently considered to have a 2,427 m^3 (±20%) short-fall in available storage capacity, which will increase as the service population increases. Without the provision of additional treated water storage, the existing treated water storage facilities would have a 12,649 m^3 (±46%) capacity short-fall at full build-out. In this regard, there is a need to pursue a strategy that will provide additional storage capacity in the near-term.

Figure 3.1: Current Treated Water Storage



3.2.2 Future Conditions at Build-out

Based on a future estimated equivalent service population of ±57,524 persons at build-out, a future maximum day demand of 27,578 m^3/d and a future fire flow requirement of 378 L/s for six (6) hours the future recommended treated water storage requirement for the Cobourg DWS (all zones combined) is 18,824 m^3 rounded to 19,000 m^3. A break down of future treated water storage requirements is provided in **Table 3.1**.

Table 3.1 Overview of Future Treated Water Storage Requirements

Description of Scenario	Storage Volume (m^3)			
	Fire	Equalization	Emergency	Total
Future Treated Water Storage Requirements - All Zones Combined with MECP Fire Flow (378 L/s for 6 hours)	**8,165**	**6,894**	**3,765**	**18,824**
Future Treated Water Storage Requirements – Cumulative Zone by Zone with Modified Fire Flows for each Zone (Zone 1 – 300 L/s for 3 hours, Zone 2 – 300 L/s for 3 hours & Zone 3 – 250 L/s for 2 hours)				
Zone 1 Treated Water Storage Requirement	3,240	2,973	1,553	7,767
Zone 2 Treated Water Storage Requirement	3,240	3,435	1,669	8,344
Zone 3 Treated Water Storage Requirement	1,800	486	572	2,858
Cumulative Future Treated Water Storage Required – Modified Fire Flows	**8,280**	**6,894**	**3,794**	**18,968**

With the understanding that no storage will be provided in future Pressure Zone 3 (based on Section 3.1.4) the following factors were considered in determining how the total 19,000 m^3 of storage should be divided between Zone 1 and Zone 2 and floating storage vs. pumped storage:

+ Pressure Zone 1 to be provided with at least 10,135 m^3 of storage (combined pumped storage and floating storage) to allow the treatment processes at the WTP to be shut-down for up to six (6) hours while supplying full build-out maximum day demand and partial fire flow (300 L/s) for three (3) hours.
+ Pressure Zone 1 to be provided with at least 4,989 m^3 of floating storage (as a portion of the 10,135 m^3 noted above) to allow the high-lift pumps at the WTP to be shut-down for up to six (6) hours while supplying full build-out average day demand and partial fire flow (300 L/s) for three (3) hours.
+ Pressure Zone 2 to be provided with at least 5,547 m^3 of floating storage to allow the Zone 2 booster pumping stations to be shut-down for up to six (6) hours, while supplying Zone 2 plus Zone 3 average day demand at full build-out and a partial fire flow of 300 L/s for three (3) hours.

3.2.3 Treated Water Storage Options

The following options were considered and evaluated in determining a preferred approach for meeting the overall treated water storage requirements at full build-out:

+ Option S1 - Rehabilitate and maintain the existing 1,360 m^3 Zone 1 elevated tank to provide partial floating storage for Zone 1 in conjunction with a new Zone 1 floating storage facility.
+ Option S2 - Construct a new Zone 1 elevated treated water storage tank (3,650 m^3 to 5,000 m^3) to provide floating storage for Zone 1 with final size based on whether or not other options/projects are undertaken (e.g. S1, S4 or S5).
+ Option S3 - Construct a new Zone 1 grade level tank or tanks (3,650 m^3 to 5,000 m^3 combined usable storage volume) to provide floating storage for Zone 1 with final size based on whether or not other options/projects are undertaken (e.g. S1, S4 or S5).
+ Option S4 - Construct additional in-ground pumped storage (reservoir expansion north or east of existing chlorine contact tanks) at the water treatment plant (1,200 m^3 to 4,000 m^3).

- Option S5 - Convert existing chlorine contact tankage (±1,350 m^3) at the water treatment plant into treated water storage by installing UV disinfection post-filtration and shift overflow weirs to first pass of existing chlorine contact tanks.
- Option S6 - Construct a new Zone 2 elevated treated water storage tank (2,000 m^3 to 5,000 m^3) to provide floating storage for Zone 2 working in conjunction with existing Zone 2 elevated tank.
- Option S7 - Construct a new Zone 2 at grade tank or tanks (2,000 m^3 to 5,000 m^3 combined usable storage volume) to provide floating storage for Zone 2.
- Option S8 - Construct a new Zone 3 elevated treated water storage tank (1,500 m^3 to 2,000 m3) to provide floating storage for Zone 3.

3.2.3.1 Provision of Zone 1 Floating Storage

Although consideration may be given to rehabilitating the existing Zone 1 elevated tank for additional system storage, the preferred solution to provide the required Zone 1 floating storage is to construct a new 5,000 m^3 Zone 1 elevated tank (Option S2).

The Zone 1 floating storage options are compared in detail with respect to their advantages and disadvantages in Table 5.2 of Technical Memorandum 2 & 3 with respect to the preferred method of providing additional Zone 1 storage. The advantages of a new Zone 1 elevated tank include the following:

- Provides the identified minimum Zone 1 floating storage volume in one (1) facility.
- Provides flexibility with respect to the required ground elevation of the site for floating storage facility in comparison to grade level tanks.
- Several Municipally owned sites are available within Zone 1 itself for a new Zone 1 elevated tank and these sites are generally in areas of industrial/commercial/institutional development.
- Potential to house future Zone 2 booster pumping facilities in the pedestal of a new Zone 1 elevated tank without construction of a separate building provides additional flexibility to meet future pumping needs. This is generally considered to be the preferred approach and is the basis upon which location options are evaluated as outlined below.
- Reduced reliance on pumping in comparison to providing additional pumped Zone 1 storage.
- Ability to proceed with design and construction in the very short-term to meet immediate priority for additional Zone 1 floating storage.

The disadvantages of a new Zone elevated tank include:

- Significant near-term capital costs in the order of $7.15 million (including engineering and contingencies) to construct a 5,000 m^3 elevated tank. A $1.7 million portion of which is anticipated to ultimately be recoverable through development charges.
- Significant ongoing operating costs associated with maintaining coating systems on elevated tanks, although the NPV of the costs is less than the NPV for other floating storage options.
- May displace existing facilities that exist at potential elevated tank sites.

3.2.3.2 Zone 1 Elevated Tank and Zone 2 Booster Pumping Station Location

Five (5) potential site locations for the future Zone 1 Elevated Tank (ET) and Zone 2 Booster Pumping Station (BPS) were identified at various locations within the Cobourg water distribution system.

From a technical perspective, it is preferable that potential sites are located close to Zone 1 trunk watermains that will:

+ Supply water to the new Zone 1 elevated tank when the tank level falls and requires replenishment
+ Provide water to the new Zone 1 distribution from the elevated tank system during periods of high demand or when high lift pumps are stopped.
+ Supply water to the new Zone 2 booster pumping station that will be pumped into Zone 2.

Additionally, it is preferable that the site be located reasonably close to the Zone 1/Zone 2 pressure zone boundary, which will provide for strong connectivity to the Zone 2 distribution system for the new Zone 2 BPS without the need to build extensive Zone 2 watermains exclusively for that purpose and also to obtain a relatively high elevation that will result in reasonable overall height for the new Zone 1 ET.

Site Location Options

Figure 3.2 on the following page illustrates the general location of potential sites for the future Zone 1 Elevated Tank and combined Zone 2 Booster Pumping Station along with other pumping and storage facilities. Potential Zone 1 Elevated Tank and Zone 2 Booster Pumping Station site locations include the following:

+ **Option 1:** Victoria Street ±250 m north of the existing rail corridor (existing Zone 1 Elevated Tank site) – site elevation ±91 m
+ **Option 2:** D'Arcy Street ±300 m north of the existing rail corridor in the vicinity of Kent Street and the Cobourg Community Centre (CCC) – site elevation ±95 m
+ **Option 3:** Brook Road North ±200 m north of the rail corridor on the north side of the Future Kerr Street alignment on the west side of Brook Road) – site elevation ±95 m
+ **Option 4:** Brook Road North ±800 m north of the rail corridor at the rear of the existing LUSI Brook Road North electrical substation property and within Phase 2 (formerly Phase 7) of the planned Villages of Central Park development – site elevation ±98 m
+ **Option 5:** D'Arcy Street ±560 m north of the existing rail corridor and ±230 m east at the rear of Buildings 18 & 19 of the Northam Industrial Park on property owned by the Town of Cobourg.

The sites have ground elevations ranging from ±91 m to ±100 m. This results in a range of elevated tank heights up to 41 m and as short as 32 m.

To summarize the selection of a preferred site location, an evaluation matrix comparing six criteria (**Table 3.2**) and a comparison of initial capital costs (**Table 3.3**) as well as a comprehensive explanation of the advantages and disadvantages of the preferred site location are provided below. TM-2 & 3B should be referred to for complete details of each site that was considered in evaluation of alternative site locations.

HAMILTON TOWNSHIP

HIGHWAY 401

Strathy Road
Zone 2 Elevated Tank
Vol. = 3,734 cu. m
T.W.L. = 158.40

BURNHAM STREET

ONTARIO STREET

DIVISION STREET

Midtown Creek

ELGIN STREET WEST

ELGIN STREET EAST

Zone 2

Fut. Zone 3

Phase 2

Phase 3

Phase 4

Phase 5

Phase 6

Phase 1

Enviro. Constraint

Phases 5 & 6

NAGLE ROAD

Fut. Zone 3

Zone 2

Option 5

Option 4

Option 3

Option 2

Option 1

Ewart Street
Booster Pumping Station
3 pumps ea. 76 L/s @ 48.8m TDH
Discharge EL. = ~96.45

Victoria Street
Zone 1 Elevated Tank
Vol. = 1,360 cu. m
T.W.L. = 132.00

Zone 2

Zone 1

Canadian National Railway

Cobourg Creek

WILLIAM STREET

D'ARCY STREET

BROOK ROAD NORTH

UNIVERSITY AVENUE EAST

UNIVERSITY AVENUE WEST

KING STREET WEST

KING STREET EAST

Canadian Pacific Railway

Zone 2

Zone 1

LAKE ONTARIO

Water Treatment Plant
Rated Cap. = 36,368 cu. m per day
PTTW = 31,822 cu. m day
Treated Water Storage = 6,244 cu. m
(4,995 cu. m useable)

LEGEND

POTENTIAL WATER INFRASTRUCTURE

STORAGE FACILITIES

- INGROUND RESERVOIR (ZONE 1)
- ELEVATED TANK (ZONE 1)
- GRADE LEVEL TANK(S) - GROUND ELEVATION OF +/- 112M (ZONE1)
- ELEVATED TANK - GROUND ELEVATION OF 105-120M (ZONE 2)
- GRADE LEVEL TANK(S) - GROUND ELEVATION OF +/-139M (ZONE 2)
- ELEVATED TANK - GROUND ELEVATION OF 135-145M (ZONE 3)

PUMPING FACILITIES

- BOOSTER PUMPING STATION (ZONE 2)
- BOOSTER PUMPING STATION (ZONE 3)

EXISTING WATER INFRASTRUCTURE

- ELEVATED TANK (ZONE 1)
- ELEVATED TANK (ZONE 2)
- BOOSTER PUMPING STATION (ZONE 2)

WATERMAIN

- LESS THAN 300MM
- 300MM
- 400MM
- 450MM
- 600MM
- RAW INTAKE PIPE

OTHER FEATURES

- PRESSURE ZONE 1/ZONE 2 BOUNDARY
- PRESSURE ZONE 2/FUTURE ZONE 3 BOUNDARY
- CONTOUR (5M INTERVAL)
- BUILDING FOOTPRINT (>= 10,000 SQ. FT.)
- RONDEAU DEVELOPMENT PHASING
- TOWN OF COBOURG MUNICIPAL BOUNDARY

CIMA+

CLIENT: Lakefront Utility Services Inc.

PROJECT NAME:
COBOURG DRINKING WATER SYSTEM MASTER PLAN

SHEET TITLE:
POTENTIAL SITES FOR FUTURE BOOSTER PUMPING STATIONS & STORAGE FACILITIES

SCALE: 100 50 0 100 200 300 400 500 meters
1:20,000

PROJECT No: C14-0364		CLIENT FILE No: ---	
DRAFTER: S. ELLIOTT	DESIGNER ---	FIGURE No:	3.2
APPROVER D. CAMPBELL	APPROVER ---		
DATE: 3/8/2021			

Evaluation of Site Location Options

While two (2) site layout options were evaluated for locating the new Zone 1 ET and Zone 2 BPS at the current Victoria Street Zone 1 ET site (Option 1A and Option 1B) neither proved to be favourable and Option 1 was eliminated from further evaluation conversation. Major reasons for eliminating Option 1 from further consideration include:

+ The site's location approximately 700 m south of the Zone 1/Zone 2 boundary results in lack of BPS discharge options to supply water into Zone 2 from the new BPS and requires a larger quantity of additional Zone 2 watermain construction to connect the site to the distribution system when compared to other Options. Even with additional Zone 2 watermains in place, the connectivity of the Option 1 site to Zone 2 is relatively poor (i.e. a single long Zone 2).
+ The site will require either private property acquisition (adding to impacts and project costs) to facilitate layout Option 1A or removal of the existing Zone 1 ET for layout Option 1B, which is highly technically unfavorable as there would be no floating storage in Zone 1 and Zone 1 would be completely reliant on continuous pumping from the Cobourg WTP for up to two years while the new tank is constructed.

In eliminating Option 1 from consideration, Options 2, 3, 4, and 5 were evaluated in further detail. Of the four (4) remaining options, Option 5 that involves locating the Zone 1 ET and Zone 2 BPS on CCC Campus lands behind (east of) Buildings 18 & 19 of the Northam Industrial Park was determined to be the preferred site location. In general, the Option 5 site location is preferred because it is subject to less negative impacts, uncertainties, and potential challenges than the Option 2, 3 and 4 sites. These uncertainties and challenges are outlined further in TM-2 & 3B.

Table 3.2 provides a comparison of all site options based on six criteria and **Table 3.3** provides a comparison of initial capital costs which helps to inform the comparison of economic factors. A detailed evaluation matrix is provided in **Appendix A** of TM-2 & 3B.

Table 3.2: Comparison of Options

Criteria	Option 1A		Option 1B		Option 2		Option 3		Option 4		Option 5	
Site Availability		*1*		0		3		1		2		4
Compatibility		*4*		4		3		2		2		3
Environmental Factors		*4*		4		1		2		3		4
Technical Factors		*1*		0		2		2		3		2
External Servicing		*1*		1		4		3		2		3
Economic Factors		*0*		0		3		3		2		3
Score	**11**		**9**		**16**		**13**		**14**		**19**	
Overall Rank	**5th**		**6th**		**2nd**		**4th**		**3rd**		**1st**	
Legend	Least Preferred										Most Preferred	
	0 pts		*1 pt*		*2 pts*		*3 pts*		*4 pts*			

Table 3.3: Comparison of Initial Capital Costs

Base Facility Costs	**Option 1A**	**Option 1B**	**Option 2**	**Option 3**	**Option 4**	**Option 5**
Zone 1 Elevated Tank	5,775,000	5,775,000	5,500,000	5,500,000	5,335,000	5,500,000
Zone 2 Booster Pumping Station	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000
Engineering & Contingencies	2,092,500	2,092,500	2,010,000	2,010,000	1,960,500	2,010,000
Sub Total Base Facility Costs	***9,067,500***	***9,067,500***	***8,710,000***	***8,710,000***	***8,495,500***	***8,710,000***
Site Specific Costs	**Option 1A**	**Option 1B**	**Option 2**	**Option 3**	**Option 4**	**Option 5**
Additional Design Studies	150,000	25,000	50,000	150,000	50,000	25,000
Property Acquisition	750,000			750,000		
Soccer Field Replacement			450,000			
Additional Zone 1 Watermain			150,000		1,455,000	345,000
Additional Zone 2 Watermain	1,650,000	1,650,000				
Site Grading Works			300,000			
Parking Lot Reconfiguration						200,000
Zone 1 Elevated Tank Full Removal		200,000				
Sub Total Site Specific Costs	***2,550,000***	***1,875,000***	***950,000***	***900,000***	***1,505,000***	***570,000***
	Option 1A	**Option 1B**	**Option 2**	**Option 3**	**Option 4**	**Option 5**
Total Cost	**11,617,500**	**10,942,500**	**9,660,000**	**9,610,000**	**10,000,500**	**9,280,000**
Extra Over Lowest Cost Option	*2,337,500*	*1,662,500*	*380,000*	*330,000*	*720,500*	-

Overview of the Preferred Site Location Option (Option 5)

While not without its challenges, the following are the advantages of site location Option 5 on the Cobourg Community Centre Campus lands.

+ **Site Availability**: The site is on land already owned by the Town of Cobourg which reduces costs and complexity as negotiations with and purchase of land from an entirely external party is not required.
+ **Compatibility:** The existing developments adjacent to and surrounding the site are institutional which is favourable.
+ **Environmental Factors:** From an environmental perspective, because the site is in a built-up area, fully cleared and maintained as unstructured green space, the potential for negative impacts to natural heritage features and habitat features is relatively low. Ultimately, opportunities may exist to create a naturalized buffer on the eastern side of the site adjacent to the west branch of Brook Creek to enhance existing habitat.
+ **Technical Factors:** From a technical perspective, there are no major challenges for the Option 5 site. Based on a site ground elevation of ±97 m the height of an elevated tank at the Option 2 site would be ±35 m, which is 6 m shorter than the existing Zone 1 elevated tank that is situated at a ground elevation of ±91 m. Additionally, this Option allows the existing Zone 1 elevated tank to be maintained during construction and be either decommissioned or rehabilitated in the future as may be desired.
+ **External Servicing:** The site is relatively well positioned in terms of the availability and proximity to existing Zone 2 trunk watermains. Given that the opportunity exists for east-west trunk watermains ultimately required to support continued growth in Cobourg East to be relocated north following the alignment of Barracks Drive between the site and Brook Road, the site is well positioned to connect the new Zone 2 BPS into the distribution system.

  Existing Zone 1 trunk watermains are less available to the site as it is physically located in Zone 2.

  Initially, the new facilities on the site can be serviced by:

  - The provision of ±560 m of new Zone 1 watermain extending west from the site on Barracks Drive, south on D'Arcy Street and connecting to the existing Zone 1 trunk watermain at Kerr Street.
  - The provision of up to ±320 m of new Zone 2 watermain extending west from the site on Barracks Drive and connecting to the existing Zone 2 sub-trunk watermain at 3rd Street.

  In the future, additional redundancy can be provided by connections to both the Zone 1 and Zone 2 networks through provision of the following watermains, which are also necessary to support growth in Cobourg East regardless of the location of the new pumping and storage facilities:

  - New Zone 1 watermain along Future Kerr Street between D'Arcy Street and Brook Road North and a connection under the railway corridor at Brook Road.
  - New Zone 2 watermain easterly along the south limit of existing recreational soccer facilities and in alignment with the south lot line of the future Phase 2 Villages of Central Park development property owned by Rondeau Ltd. where it will continue

north on Brook Road towards Elgin Street and south on Brook Road towards Future Kerr Street.

+ **Economic Factors:** Indicative of the limited external servicing requirements, the fact that additional costs associated with land acquisition are not required, and the site is not impacted by the Brook Creek flood plain, Option 5 is among the lowest cost options.

The main challenges associated with the Option 5 site at the Cobourg Community Centre relate to:

+ **Site Availability**: The site is on land already owned by the Town of Cobourg which reduces costs and complexity, but there will be a need for the Town of Cobourg to revisit and reassess the Cobourg Community Centre Campus Master Plan (Basterfield & Associates, 2014) to determine how it will be impacted by the new Zone 1 ET and Zone 2 BPS. Initially it would appear that the main impacts will be to the configuration of parking facilities included in the CCC Campus Master Plan.
+ **External Servicing:** Due to the Option 5 site location in Zone 2, north of the Zone 1/Zone 2 boundary, it is further removed from existing Zone 1 trunk watermains than other investigated site Options. As a result, to initially put the new Zone 1 ET and Zone 2 BPS online, ±560 m of new Zone 1 trunk watermain is required. While this Zone 1 watermain length requirement is more than all other site Options investigated, with exception to Option 4, the additional length is partially offset by the lack of requirement for additional Zone 2 trunk watermain independent of that which is required to support growth in Cobourg East.

Further to the challenges noted above, **Figure 3.3** below shows the preferred site Option 5 overlaid on an excerpt from the CCC Campus Master Plan document (Basterfield & Associates, 2014). The intent of this figure is to show the location of site Option 5 relative to the proposed future layout of the CCC Campus facilities.

Since development of the CCC Campus Master Plan in 2014 parts of the Cobourg Community Centre lands have been developed. Today, Barracks Drive (an east-west extension of Alexandria Drive) exists immediately north of the Option 5 site and the sports field (shown on the Master Plan immediately north of, and partially occupied by, site Option 5) has been constructed on lands north of Barracks Drive and is in use. Resultant of the works completed with the CCC campus to date, site Option 5 is not anticipated to impact sports facilities; the main impacts of the site will be to planned parking facilities, as noted above.

Figure 3.3 : CCC Campus Master Plan Annotated with Option 5 Site Location

Figure 3.4 provides a preliminary schematic layout of the potential elevated tank site at the preferred location complete with watermain connections as required for both the Zone 1 elevated tank and Zone 2 booster pumping station.

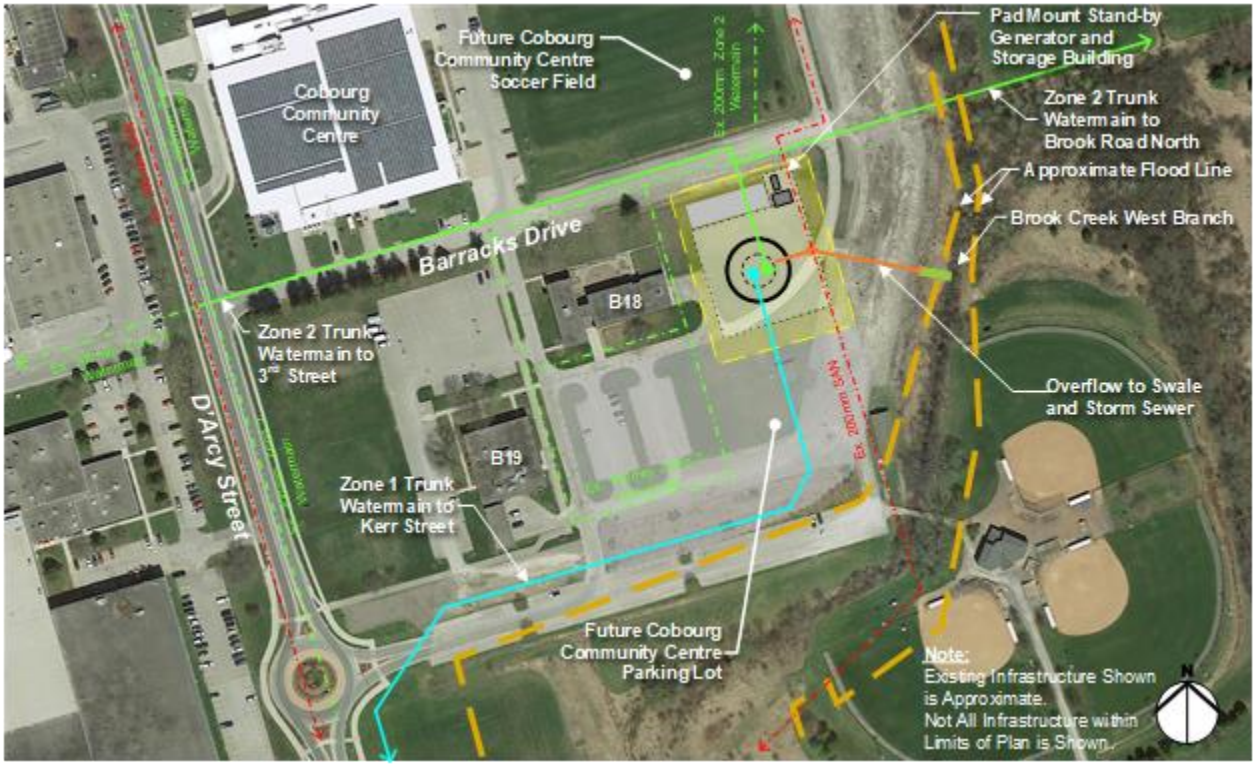


Figure 3.4 : Schematic of Recommended Zone 1 Elevated Tank Site Layout

3.2.3.3 Provision of Zone 2 Floating Storage

Although only an additional 1,813 m^3 of Zone 2 floating storage is required to provide the minimum Zone 2 floating storage volume of 5,547 m^3, it is recommended future Zone 2 floating storage options include 4,000 m3 of additional storage to provide sufficient storage within Zone 2 to accommodate pumping of fire flows to Zone 3 (without additional storage in Zone 3) and provide additional flexibility for situations where the Strathy Road elevated tank is off-line for inspection/rehabilitation in the future.

Based on life-cycle cost estimates, the net present value (NPV) to construct and maintain new at grade tanks for Zone 2 providing a combined usable storage volume of ±4,000 m3 working in conjunction with the existing Zone 2 elevated tank is $4.66 million in comparison to an NPV of $6.66 million to construct a new 4,000 m^3 Zone 2 elevated tank to work in conjunction with the existing Zone 2 elevated tank.

Given the need for additional Zone 2 floating storage is not as immediate as Zone 1, assuming the first of two twin Zone 2 at grade tanks could proceed to design and construction in the next 5 – 10 years, the preferred solution to provide additional Zone 2 floating storage is to construct at twin grade tanks in stages, ultimately providing a combined 4,000 m^3 of additional floating storage for Zone 2 that can also be pumped to Zone 3 (Option S7).

As outlined in Table 5.2 of Technical Memorandum 2 & 3, the advantages of a new Zone 2 at grade tank (or tanks) include the following:

- Provides target Zone 2 floating storage volume in conjunction with existing Zone 2 elevated tank.
- Construction (capital) cost of at grade tanks significantly lower than an elevated tank.
- Significantly lower O&M costs in comparison to elevated tank as glass-fused to steel tanks do not require recoating every 15 – 20 years.
- Use of multiple at grade tanks on same sites allows implementation to be staged with the second tank deferred until Zone 2 and Zone 3 demands dictate the need for construction of additional Zone 2 treated water storage.
- Provides significant operational flexibility and Zone 2 floating storage redundancy (significant risk reduction) when existing Zone 2 elevated tank is taken out of service every 5 – 10 years for short duration (2 - 3 weeks) for cleaning/inspection/maintenance/minor repair and every 15 – 20 years for an extended duration (6 – 8 months) for coating replacement.
- Provides significant increase in Zone 2 (largest pressure zone at full build-out) overall treated water storage as well as available storage for pumping to supply Pressure Zone 3 as a closed system.
- Reduced reliance on the pumping system during high demands (fire-fighting operations) to replenish floating storage within Pressure Zone 2.

As outlined in Table 5.2 of Technical Memorandum 2 & 3, the disadvantages of a new Zone 2 at grade tank (or tanks) include the following:

- Water in lower portion of tank unusable based on providing floating storage for Zone 2 (although still available for pumping to Zone 3).
- Requires site with ground elevation ±139 m to minimize unusable storage – sites available but will be in future Zone 3.
- Property acquisition for tank site required (although assumed to part of development planning approval process at no cost to Town of Cobourg).
- Will require extension of dedicated watermain from Zone 2 to tank site (although assumed to part of development at no cost to Town of Cobourg).
- There may potentially be aesthetic/community branding considerations related to the location of new at grade tanks in the vicinity of Highway 401 within lands that are designated for prestige employment development.

3.2.3.4 Additional Storage

In addition to the Zone 1 and Zone 2 floating storage recommended there is a need for approximately 1,350 m^3 of additional storage to achieve the required volume 19,000 m^3. The most economically feasible options to meet this additional requirement are to

- Rehabilitate the existing 1,360 m^3 Zone 1 elevated tank at a cost of approximately $1,500,000 in the near-term (2-5 years); or
- Construct at least 1,350 m^3 of additional in-ground reservoir storage at the WTP as the total build-out population is approached.

Both options have similar net present values. Rehabilitating the existing elevated tank incurs costs in the short-term but provides greater operational flexibility in Zone 1 by having two sources of floating storage. Providing additional floating storage at the WTP defers costs into the future and provides an opportunity to consider how the 1,350 m3 of additional storage volume might be provided in conjunction with a larger volume that may be required to support growth beyond the forecast for build-out of the current urban boundary.

3.2.4 Summary of Storage Recommendations

In summary the following recommendations are provided with respect to providing sufficient storage to the meet the requirements of the Cobourg DWS at build-out:

- Construct a new Zone 1 5,000 m^3 elevated tank in the near-term (3-5 years) to address existing storage shortfall and provide some additional capacity for growth. The preferred approach is to co-locate the new Zone 1 elevated tank with a new Zone 2 booster pumping station east of D'Arcy Street on the Cobourg Community Centre Campus lands at the rear of Buildings 18 & 19 of the Northam Industrial Park.
- Construct new twin Zone 2 elevated tanks in stages near the future Nagle Road interchange to accommodate future growth in Zone 2 with the first of the two tanks to be constructed at time horizon of 10-15 years.
- Either rehabilitate the existing Zone 1 elevated tank on Victoria Street to provide additional storage that will be required at build-out or decommission the existing Zone 1 elevated tank when continued operation is not feasible and build additional pumped storage at the WTP in the future (20+ years) to provide the total required storage reaches 19,000 m^3.

Figure 3.5 provides an illustration of the recommended future storage facilities to provide the required 19,000 m^3 of storage system-wide.

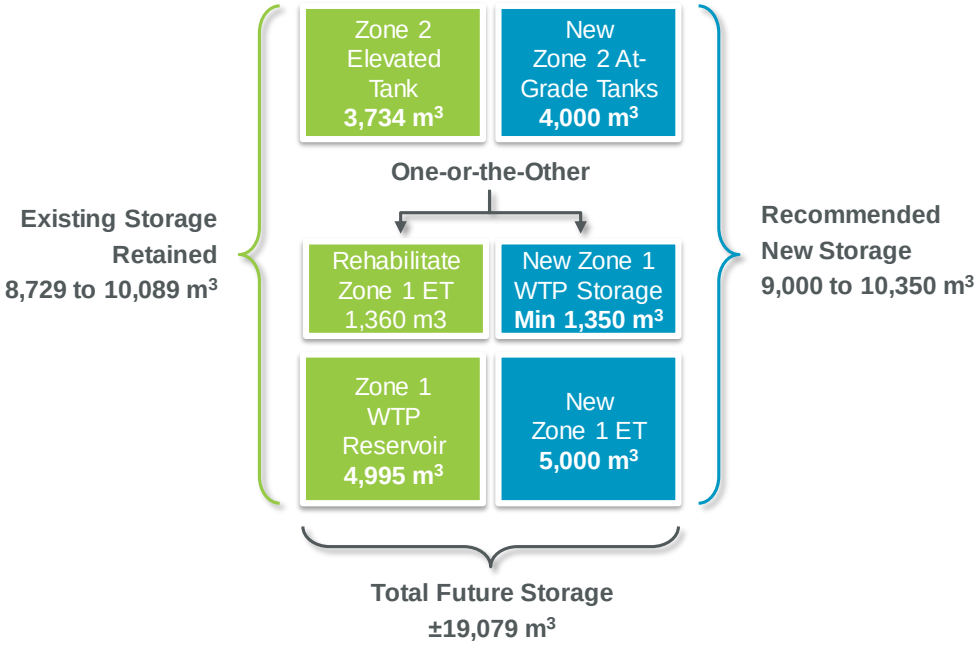


Figure 3.5 : Recommended Future Storage

3.3 Recommended Pumping and Storage Strategy

The preliminary preferred strategy to address the long-term treated water pumping and storage requirements for the Cobourg DWS includes the projects outlined in **Table 3.4** below.

The majority of the projects listed in the table below are necessitated by the need to provide additional system capacity to meet the needs of future growth. In this regard, it is anticipated that most of the long-term projects will be funded either from development charges or implemented directly by developers. In the near-term the provision of additional Zone 1 storage capacity through the construction of a new ±5,000 m^3 Zone 1 elevated tank largely addresses existing deficiencies by:

- Allowing for the decommissioning of the existing Victoria Street Elevated Tank, which is in poor condition.
- Providing sufficient floating storage in Zone 1 to allow for improved operational flexibility at the WTP with respect to shutting down treatment and pumping systems for maintenance.
- Providing additional treated water storage to address the currently identified storage deficit for the existing system as a whole.

For these reasons, the provision of new Zone 1 floating storage is considered to be a project that largely benefits the existing user base. When accounting for the replacement of the existing storage volume at the Victoria Street Elevated Tank roughly 75% of the 5,000 m^3 of new storage to be provided is attributable to existing requirements.

Table 3.4: Recommended Pumping and Storage Strategy Projects

Option	Description	Estimated Cost	Primary Funding	Timing
S2	Construct a ±5,000 m^3 Zone 1 elevated tank to address the current need for additional Zone 1 floating storage with the preliminary preferred tank site being on the Cobourg Community Centre Campus lands east of D'Arcy Street at the rear of Buildings 18 & 19 of the Northam Industrial Park.	6,100,000	75%Water Rates 25% Dev. Charges	2-5 Years
P4	Initially, construct a new Zone 2 BPS with a 120 L/s firm rated capacity that is located on the same site as the new Zone 1 elevated tank, potentially with pumps installed in the pedestal of the Zone 1 elevated tank.	1,200,000	Dev. Charges	2-5 Years
	Ultimately, expand the existing Ewart Street BPS to accommodate additional pumps providing a firm rated capacity of 312 L/s.	1,200,000	Dev. Charges	10+ Years
S7	Provide additional Zone 2 floating storage through the construction of twin at grade tanks, with a combined usable storage capacity of ±4,000 m^3 (Option S7), with the preliminary preferred site in the vicinity of Nagle Road and Danforth Road and the tanks being constructed in phases.	3,750,000	Dev. Charges	10+ Years
Z3	Provide servicing to future Zone 3 as a closed system with a BPS having an ultimate firm rated pumping capacity of ±272.5 L/s.	2,650,000	Dev. Charges	Phased to Development
S4 (Mod.) *	Provide 1,200 m^3 to 2,000 m^3 of additional Zone 1 treated water storage by construction of additional in-ground storage at the WTP.	2,400,000	Dev. Charges	10+ Years
Total		**17,300,000**		
Engineering and Contingency (30%)		**5,190,000**		
Total Including Engineering and Contingency		**22,490,000**		

* Could be replaced by Option S1 with capital cost of $1,500,000 in 2-5 years.

Figure 3.6 provides a summary of the preferred pumping and storage strategy as outlined above and the general project implementation sequence. In addition, the figure illustrates various possible pumping strategies for Zone 2 as well as alternative servicing strategies for Zone 3 along with the timelines for potentially making final decisions regarding those strategies. In this regard, the preferred approach allows for a degree of flexibility in how the strategy is ultimately implemented.

Figure 3.7 and **Figure 3.8** illustrate the system configurations for two versions of the preferred strategy:

- **Preferred Strategy A.1:** a single new Zone 1 elevated tank where a new tank is constructed and the existing Zone 1 Victoria Street elevated tank is decommissioned.
- **Preferred Strategy A.2:** two Zone 1 elevated tanks where a new tank is constructed and the existing Zone 1 Victoria Street elevated tank is rehabilitated and retained.

2 – 5 year Projects

5 – 10 year Projects

10+ year Projects

Zone 3 Projects

Zone 2 Projects

Zone 1 Projects

Preferred/ Recommend Path

Future Options and Flexibility

Development Planning Process to Determine Timing

Build New Zone 3 BPS to Supply Zone 3 as a Closed System with Fire Flow Initially Provided from Zone 2 through a Check Valve and No Development Above an Elevation of ±127.5m

100 L/s Firm

Expand Zone 4 BPS To Ultimate Firm Capacity of 272 L/s Including Fire Pumps for Servicing Above ± 127.5m

272.5 L/s Firm

New Zone 3 Elevated Tank

2,000 m³

S8

Upgrade Ewart Street BPS to Provide 216 L/s Firm Capacity

P3

216 L/s Firm

Build New Zone 2 BPS to Provide 216 L/s Firm Capacity

P3

216 L/s Firm

No

Second of Two New Zone 2 At Grade Tanks

S7

2,000 m³

2,000 m³

First of Two New Zone 2 At Grade Tanks

S7

2,000 m³

2,000 m³

Confirm if Zone 3 Can Continue to Operate as a Closed System

Yes

Provide Pumps in Elevated Tank Pedestal with Firm Rated Capacity of 120L/s

120 L/s Firm

P4

Expand Ewart Street BPS to Provide 312 L/s Firm Capacity

312 L/s Firm

P4

No

Yes

Determine if Zone 2 Pumping Will Be Provided in Pedestal of New Zone 1 Elevated Tank

Determine if Existing Zone 1 Elevated Tank will be Rehabilitated

Yes

New Zone 1 Elevated Tank

5,000 m³

S2

S1

1,360 m³

Rehabilitate Existing Zone 1 Elevated Tank

No

Implement UV Treatment and Convert Chlorine Contact Tanks

Yes

No

1,350 m³

S4

Modified

Build Additional In-Ground Storage Reservoir at WTP

1,350 m³

S5

Covert Chlorine Contact Tanks to Additional to Treated Water Storage

Start

Cobourg Drinking Water System
Storage & Pumping Project Implementation Sequence

Figure 3.6

Cobourg Drinking Water System
Future System Schematic: Preferred Strategy A.1
Single Zone 1 Elevated Tank and Zone 3 Operating as a Closed System

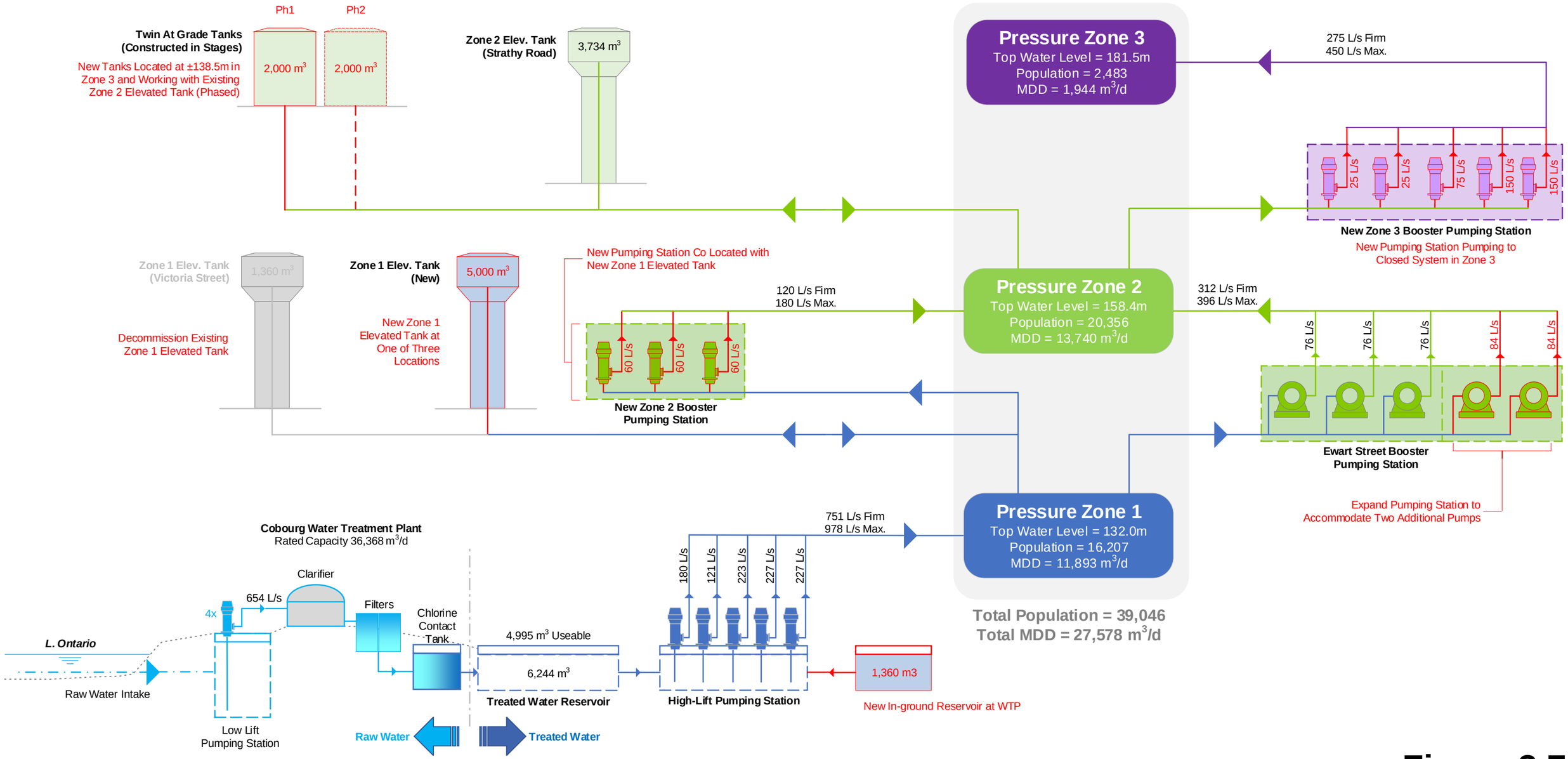


Figure 3.7

Cobourg Drinking Water System
Future System Schematic: Preferred Strategy A.2
Two Zone 1 Elevated Tanks and Zone 3 Operating as a Closed System

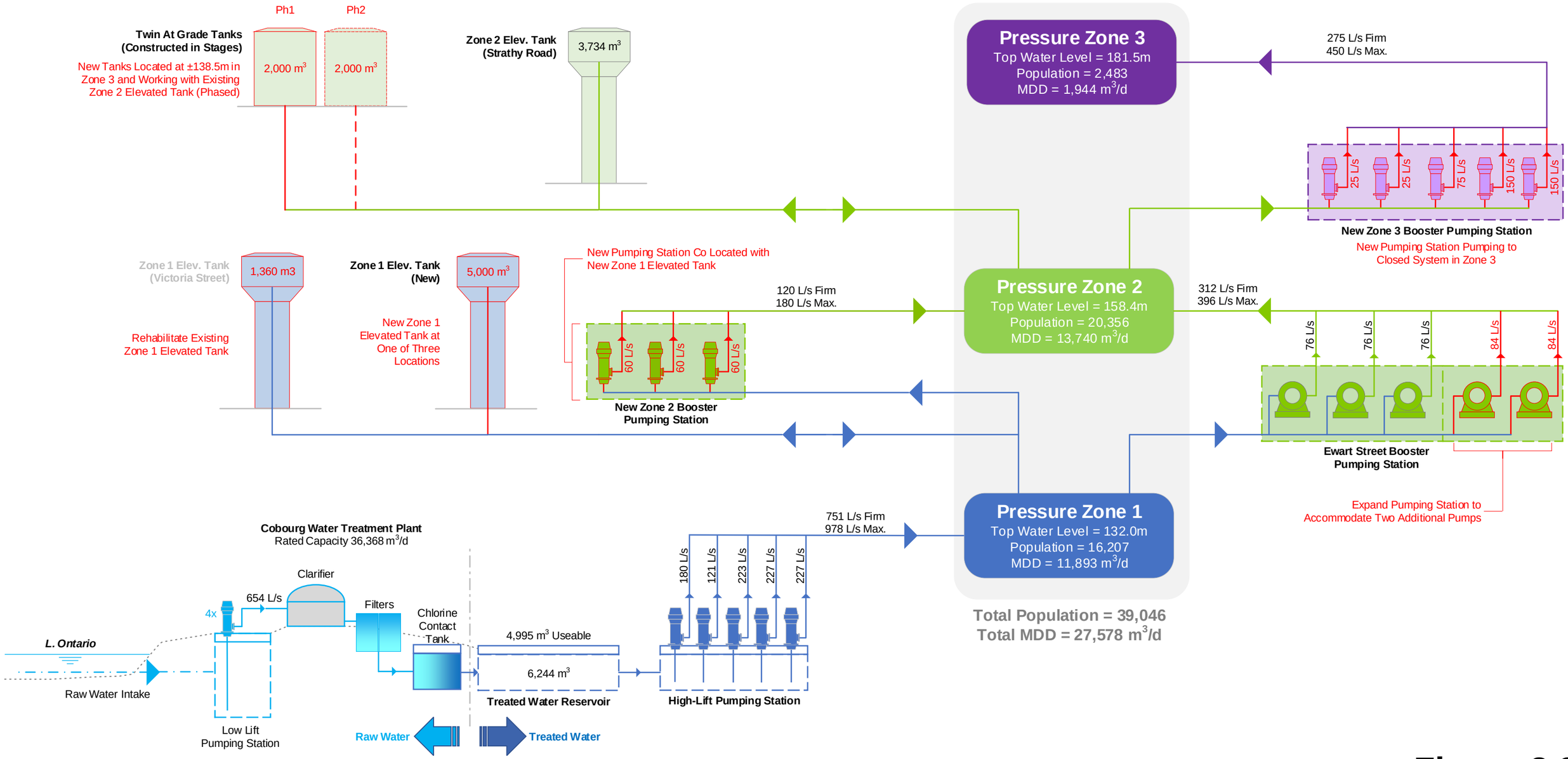


Figure 3.8

4.0 Water Treatment

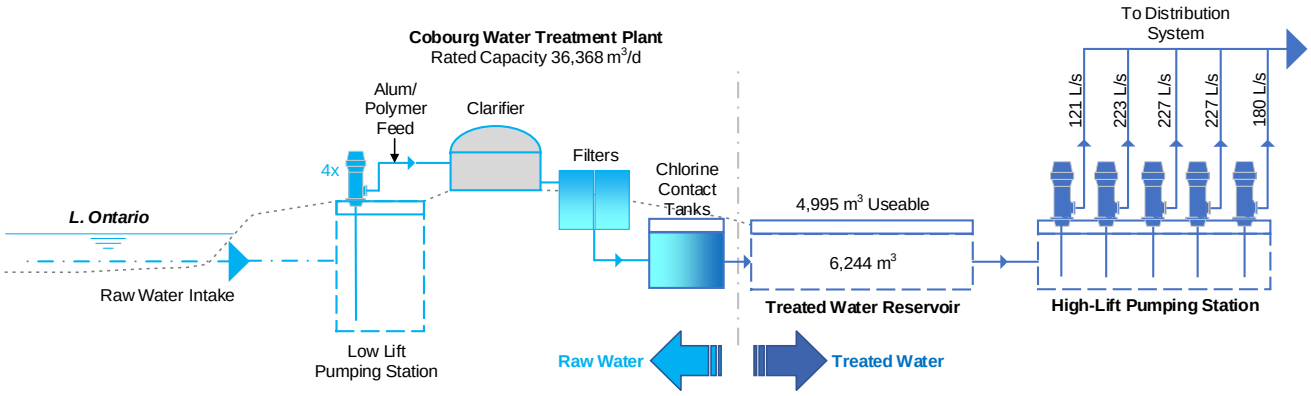
The majority of the Cobourg Water Treatment Plant was constructed in the early 1970s with major upgrades undertaken in 1987 (pump house and chemical building) and 2002 (chlorine contact tanks).

The current Municipal Drinking Water Licence (MDWL) identifies the rated capacity of the Cobourg Water Treatment Plant as 36,368 m^3/d and the current Permit-To-Take-Water (PTTW) indicates the Cobourg DWS is permitted to take a maximum 31,822 m^3/d of raw water from Lake Ontario. The process for treating water at the Cobourg WTP includes the following:

- **Raw Water Intake and Pumping:** The Cobourg WTP draws raw water from Lake Ontario via a 1,050 mm diameter intake pipe that extends ±825 m from shore. Raw water flows into a concrete chamber (the low-lift pumping well) where it is then pumped (by the low-lift pumps) to the clarifier to begin the treatment process.
- Clarification: On route to the clarifier aluminum sulphate (alum) and organic polymer are added to the raw water to assist with sedimentation. In the single circular up-flow clarifier, suspended solids in the raw water settle out as sediment, which is removed from the bottom of the clarifier.
- **Filtration:** Clarified water then flows into two (2) dual media rapid gravity filters with granular activated carbon (GAC) and silica sand filtration media.
- **Disinfection:** Following filtration, chlorine is injected into the filtered water as it flows into the chlorine contact tanks where it resides for a sufficient amount of time to achieve disinfection.
- **Treated Water Storage:** After disinfection, the fully treated water flows from the chlorine contact tanks into two underground reservoirs where residual chlorine levels are monitored and treated water remains until it is pumped into the distribution system by the high-lift pumping station located at the WTP.

Figure 4.1 provides a schematic illustration of treatment processes used at the Cobourg WTP.

Figure 4.1 : Schematic Illustration of Treatment Processes



In addition to the main treatment processes above other processes and systems at the Cobourg WTP include a zebra mussel control system for the intake, a filter back-wash system, a waste handling system for disposing of wastewater and slurry from the clarifier and filters, stand-by power (generator) systems, HVAC systems as well as instrumentation for sampling water and controlling processes.

4.1 Cobourg Water Treatment Plant Capacity

Although the rated capacity of the Cobourg WTP (36,368 m^3/d) is higher than the permitted daily taking under the PTTW (31,822 m^3/d), the higher instantaneous rate of taking permitted by the PTTW (31,177 L/min) essentially would allow the WTP to operate at its rated capacity for up to 21 hours per day.

The current and future maximum day demands at full build-out for the Cobourg DWS are estimated to be:

+ 178 L/s (15,354 m^3/d) current (equal to ±42% of the current WTP rated capacity under the MDWL and ±48% of the current permitted water taking under the PTTW).
+ 320 L/s (27,578 m^3/d) at future build-out (equal to ±76% of the current WTP rated capacity under the MDWL and ±87% of the current permitted water taking under the PTTW).

Current maximum day demand was calculated based on a current average day demand of 9,032 m^3/d (see **Table 2.3**) multiplied by a 1.70 maximum day peaking factor.

Establishing the ability (capacity) of the WTP to deliver water to the distribution system to meet demand (referred to as the Net Delivery Capacity) must consider in-plant demands associated with water used for filter backwashing, clarifier blowdown, chemical make-up water, water quality monitoring and service water as well as an allowance for filter down time during filter backwash and filter-to-waste cycles.

The net delivery capacity of a water treatment plant utilizing a surface water source is generally considered to be no more than 90% of the available production (treatment) capacity. For the purposes of this technical memorandum the Cobourg WTP is considered to have a net delivery capacity of ±32,731 m^3/d (90% of plant rated capacity).

Based on this premise the Cobourg WTP is currently operating at/near ±47% of its net delivery capacity and is anticipated operate at ±84% of net delivery capacity at full build-out.

Although system demands and growth projections should be re-evaluated on a regular basis, based on the growth and demand projections to full build-out as outlined herein, there does not appear to be a need to increase the rated capacity of the Cobourg WTP or increase the permitted water taking at this time.

4.2 Recommended Repairs, Improvements and Upgrades

While the rated capacity of the Cobourg WTP does not need to be expanded to meet water demand at full build-out a number of projects are required to ensure that the WTP can continue to meet current demands and operate effectively to meet future demands at levels that approach 90% of its rated capacity. These projects include:

+ Repair and replacement of existing equipment and systems as they approach the end of their useful life;
+ Improvements to equipment and processes to meet changing environmental and regulatory conditions; as well as
+ Upgrades and expansions to ensure that there is sufficient redundancy for the WTP to operate effectively to meet higher demands.

4.3 Clarifier Rehabilitation or Replacement

Given its age and the fact that the operation of the WTP is dependent on the single existing clarifier its rehabilitation or replacement will be the largest undertaking required at the Cobourg WTP.

Rehabilitation or replacement of the existing clarifier will be a major undertaking that will temporarily impact the operation and rated capacity of the Cobourg WTP and will impact other processes including filtration and disinfection on either a temporary or permanent basis. The flexibility to implement various options will decline as demand increases and similarly, the risk of not having any redundancy in the clarification process will increase as demand grows. In this regard, it is important to begin planning for rehabilitation or replacement of the existing clarifier.

4.3.1 Rehabilitation or Replacement Options

Several options with costs ranging between $6.5 million and $10.2 million (excluding contingencies) can be considered:

- **Option C1:** Rehabilitate (maintain) the existing single upflow solids contact clarifier and modify plant operation to use direct filtration when the clarifier is out of service for maintenance and rehabilitation using enhanced chlorine disinfection to compensate for lost treatment credits associated with temporary removal of the clarification process - “Rehabilitate Existing Clarifier Option”.
- **Option C2:** Rehabilitate (maintain) the existing single upflow solids contact clarifier, install UV disinfection and modify plant operation to use direct filtration when the clarifier is out of service for maintenance and rehabilitation using a combination of UV and chlorine disinfection to compensate for lost treatment credits associated with temporary removal of the clarification process - “Rehabilitate Existing Clarifier & Add UV Disinfection Option”.
- **Option C3:** Install UV disinfection, decommission the existing clarifier and utilize direct filtration on a permanent basis with additional filter trains installed in the existing clarifier structure/building - “Add UV Disinfection, Decommission Existing Clarifier & Install Additional Filter Capacity for Direct Filtration Option”
- **Option C4:** Construct a second upflow solids contact clarifier (or similar clarifier unit) north of the existing chlorine contact tanks (within new building/structure) to work in conjunction with the existing rehabilitated upflow solids contact clarifier (with flow splitting) to provide partial redundancy for the clarification process - “Add Second Upflow Solids Contact Clarifier Option”.
- **Option C5:** Construct a new multi-train Dissolved Air Floatation clarification system (or similar clarifier units), north of the existing chlorine contact tanks (within new building/structure) and decommission and demolish the existing clarifier - “New Clarification Process at New Location Option”.
- **Option C6:** Decommission the existing clarifier and install a new multi-train Dissolved Air Floatation clarification system (or similar clarifier units), (within existing clarifier building/structure) with temporary use of direct filtration and enhanced chlorination during construction of the new clarification process - “New Clarification Process Within Existing Clarifier Structure Option”.

4.3.2 Preferred Clarifier Option

Options C3, C5 and C6 are all considered to be viable options. At this time, Option C5, construction of a new clarification process at a new location on the WTP site, is considered the preferred option. Option C5 has an estimated cost of $9.1 million (excluding contingencies) and minimizes risk/uncertainty associated with the reuse of the existing clarifier building while maximizing flexibility for the configuration and type of clarification processes to be implemented.

While detailed evaluation of available processes or technologies is considered beyond the scope of a master planning exercise, it is anticipated that a Dissolved Air Floatation (DAF) clarification system (or similar) installed north of the existing chlorine contact tanks will be the most suitable approach. To provide flexibility for maintenance/repair related downtime it is recommended that the new clarification process included 4-5 individual treatment trains such that the overall capacity is not significantly reduced when a single train is out-of-service for planned or unplanned maintenance. With the existing clarifier eventually removed a third filter train can then be added on the north side of the existing filtration at the former clarifier location as illustrated in **Figure 4.2**. The addition of third filter train will provide greater flexibility and redundancy for the maintenance and operation of the filtration system as demand increases and approaches rated capacity.

Figure 4.2 : New Clarification Process at New Location

4.4 Other Repairs, Improvements and Upgrades

In addition to major works associated with replacement of the existing clarifier and provision of a third filter train other identified major short-term (0 - 4 years) and long-term (5 - 10 years) expenditures or upgrades to the Cobourg WTP (not including the treated water storage options summarized in Section 3.3) are summarized in the following tables.

Table 4.1: Recommended Short-Term (0 – 4 year) Upgrades

Short-Term Upgrades (0-4 years)	**Preliminary Cost Estimate (2020)**
Intake pipe cleaning and inspection, replacement of raw water sample line and chlorine solution line and minor repairs to timber portion of intake crib.	$100,000
Repair leaking pumphouse roof.	By Others
Provide separate alum suction line and move feed pumps to containment area.	$10,000
Structural repairs to clarifier structure and clarifier valve room.	Potentially Part of Clarifier Upgrade or Replacement
Replacement of piping in clarifier valve room.	
Control modification to allow direct filtration.	
Provision of railings on retaining walls at clarifier.	
Provision of kick plates on railing system around clarifier perimeter walkway.	
Provision of railing system on retaining walls at shoreline.	$10,000
GAC filter media replacement (every ± 5 years).	$400,000
Enhanced ventilation & dehumidification in backwash pump room.	$50,000
Replacement and/or repair of corroded sections of backwash piping.	$150,000
Replacement of wastewater transfer pumps and provision of flowmeter on discharge piping.	$75,000
Upgrades to the wastewater discharge system (on-site SPS) from WTP site including provision of flowmeter on forcemain.	$500,000
Chlorine storage room and monorail and hoist replacement.	$50,000
Replace surge valve on high-lift discharge.	$30,000
Relocate chlorine residual sampling points.	$25,000
Replace WTP SCADA computers.	$25,000
Replace SCADAPack 32 PLC's at Ewart Street BPS.	$75,000
Replace SCADAPack 32 PLC at Zone 2 Elevated Tank.	$50,000
Sub-Total Preliminary Short-Term Upgrades (excluding HST)*	**$1,550,000**
Contingency Allowance (30%)*	**$465,000**
Total Preliminary Short-Term Upgrades (excluding HST)*	**$2,015,000**

*Excludes clarifier upgrades

Table 4.2 : Recommended Long-Term (5 – 10 year) Upgrades

Long-Term Upgrades (5-10 years)	Preliminary Cost Estimate (2020)
Low-Lift pump discharge valve replacement every ±20 years (as needed).	$100,000
Low-Lift pump refurbishment every ±10 years (as needed).	$120,000
Alum tank replacement – 2 tanks (as needed).	$200,000
Turbidimeter replacement every ±10 years (as needed).	$60,000
Provision of redundant clarifier based on Option C5 (Refer to Section 4.0).	$9,100,000
Provision of third filter for security of supply when one of existing filters is out of service (potentially part of clarifier replacement).	
Replacement of supernatant discharge pumps.	$20,000
Equip high-lift pumps HLP#1 and HLP#2 with VFD's (including provision of inverter duty motor for HLP#2).	$100,000
High-Lift pump discharge butterfly valve and booster pump control valve replacement every ±20 years (as needed).	$200,000
High-Lift pump refurbishment HLP#1 – HLP#4 every ±10 years (as needed).	$120,000
Flowmeter & Level Transmitter Replacement every ±10 years (as needed).	$200,000
Sub-Total Preliminary Long-Term Upgrades (excluding HST)	**$10,220,000**
Contingency Allowance (30%)	**$3,066,000**
Total Preliminary Long-Term Upgrades (excluding HST)	**$13,286,000**

Table 4.3 : Recommended Long-Term (10 – 50 year) Upgrades

Future Upgrades (10+ Years)	Preliminary Cost Estimate (2020)
Replacement of intake crib/structure (as needed).	$750,000
Construction of a dividing wall within the high-lift pumping well and provision of second supply connection from the in-ground reservoir (when high-lift pumping well requires rehabilitation).	$500,000
SCADA replacement upgrade at WTP (as needed).	$300,000
Sub-Total Preliminary Future (10+ years) Upgrades (excluding HST)	**$1,550,000**
Contingency Allowance (30%)	**$465,000**
Total Preliminary Long-Term Upgrades (excluding HST)	**$2,015,000**

5.0 Water Distribution System

The existing Cobourg Drinking Water System, as described in Section 1.3, is a combination of treatment, pumping, storage and distribution infrastructure. Sections 3.0 and 4.0 above provide a summary of recommendations for improvements to existing pumping and storage and treatment infrastructure respectively.

Further to the above analyses and recommendations, the existing distribution infrastructure was evaluated to:

+ Determine upgrades that are necessary to increase security of supply by improving the current Cobourg DWS distribution system's level of redundancy at key locations.
+ Identify areas where problematic high or low pressures may exist and provide recommendations to mitigate pressure issues under both current and future conditions.
+ Evaluate and provide recommendations for the provision of new trunk and sub-trunk watermains in the existing Cobourg DWS distribution system to accommodate future growth in the Town of Cobourg in conjunction with the preferred pumping and storage strategy.

5.1.1 Existing Zone 1 Trunk and Sub-Trunk Watermains

Existing key distribution infrastructure servicing Zone 1 includes:

+ A north-south 450 mm dia. trunk watermain that runs north along D'Arcy Street from the Cobourg WTP toward the Future Kerr Street corridor, formerly the alignment of the Canadian Northern Railway (CNoR). This watermain 450 mm dia. trunk watermain is paralleled by a 300 mm dia. sub-trunk watermain that connects to other watermains along D'Arcy Street.
+ An east-west 450mm dia. trunk watermain west of D'Arcy Street that extends along the Future Kerr Street corridor to the west Cobourg boundary (locally reduced in size to 300mm dia. between Ontario Street and William Street).
+ A combination of 400mm dia. and 300mm dia. trunk watermains east of D'Arcy Street following the alignments of Lakeshore Road and King Street East with both watermains ultimately terminating at the Lucas Point Industrial Park on Wilmott Street.
+ A significant network of 300mm dia. sub-trunk watermains in the downtown and surrounding area. The sub-trunk network is considerably less developed in the area west of Cobourg Creek.

5.1.2 Existing Zone 2 Trunk and Sub-Trunk Watermains

Existing key distribution infrastructure servicing Zone 2 includes:

+ Primary 450mm dia. trunk watermain on Division Street, which runs north from the Ewart Street Booster Pumping Station (BPS) to Elgin Street where it connects to a 400mm dia. watermain running east-west from Conger Avenue to the west Cobourg boundary. The 400mm dia. main is locally reduced in size (300mm dia.) between Burnham Street and the west Cobourg boundary.
+ Numerous 300 mm dia. sub-trunk watermains mainly established in the north-south direction extending from the Elgin Street trunk watermain, inclusive of a key 300mm dia.

sub-trunk loop that provides a redundant connection between the trunk watermain and the Zone 2 Strathy Road Elevated Tank.

5.2 Security of Supply

In general, the existing Cobourg water distribution system provides considerable redundancy with alternatives for conveying treated water to most locations in situations where a trunk or sub-trunk watermain may be out of service. However, there are some portions of the system that lack redundancy, which creates potential risks related to security of supply that could impact large portions of the distribution system. Areas of security of supply concern are illustrated on **Figure 5.1** and include:

+ **Zone 2 Pumping Facilities:** Currently the Ewart Street Booster Pumping Station (BPS) is the only means of treated water supply for Zone 2. If the station is offline due to unforeseen events, Zone 2 would have to be supplied entirely from available water at the Strathy Road Elevated Tank, with no ability to replenish the tank until the issue is resolved.

  Provision of additional pumping capacity, at a new pumping facility at a second location, is recommend to support continued growth in Zone 2 as outlined in Section 3.1.3 and will address this issue.

+ **East-West Connectivity in Pressure Zone 2:** The 400mm dia. trunk watermain running east-west on Elgin Street is the only connection to supply flow from the Ewart Street BPS to the majority of Zone 2, including the Strathy Road Elevated Tank. If this watermain is taken out of service, there is no alternative connectivity to the portion of Zone 2 west of Cobourg Creek. In such a situation the supply to the eastern portion of Zone 2 would have to be through continuous operation of the Ewart Street BPS and the western portion of Zone 2 from the available storage in the Strathy Road Elevated Tank, with no ability to replenish the tank until the issue is resolved.

  Provision of new 300mm dia. watermain crossings of the east and west branches of Cobourg Creek to interconnect the partially complete sub-trunk loop along DePalma Drive, White Street and Densmore Road would provide additional east-west connectivity in Zone 2.

+ **Pebble Beach Area:** The Pebble Beach residential area (Pebble Beach Drive, Glen Watford Road and Ravensdale Road) is serviced by a single 300 mm dia. watermain extending ±650 m along King Street West. No alternative source of supply exists to service the Pebble Beach area should a disruption on the 300mm dia. watermain occur.

  Provision of a watermain connection from Tracey Road to Daintry Crescent within the Tracey Road/Rogers Road right-of-way inclusive of a watermain crossing under the CNR and CPR corridors would provide an alternative source of supply to this area. Alternatively, temporary by-pass connections would provide enough capacity to meet domestic demands for the time required to repair a watermain break.

+ **North of Highway 401 in Hamilton Township:** The population north of Highway 401 in Hamilton Township is serviced by a single 300mm dia. watermain on Ontario Street with a 400mm dia. oversized watermain crossing under the Highway 401 corridor. Any service disruption within the Highway 401 corridor can be anticipated to have long timelines associated with required repair/replacement.

  This issue should be mitigated through careful consideration of the portion of watermain crossing Highway 401 in the asset management plans of all stakeholders including, taking the

appropriate measures for monitoring the watermain condition and planning the ultimate replacement of the watermain well before the end of its useful service life.

Single Watermain Connection Under Highway 401 to Hamilton Township

Monitor Condition of Highway 401 Connection and Pro-Actively Plan for Replacement

HAMILTON TOWNSHIP

HIGHWAY 401

Complete White Street Sub-Trunk Watermain Connection Under West Branch of Cobourg Creek

Strathy Road
Zone 2 Elevated Tank
Vol. = 3,734 cu. m
T.W.L. = 158.40

BURNHAM STREET

ONTARIO STREET

Complete White Street Sub-Trunk Watermain Connection Under East Branch of Cobourg Creek

ELGIN STREET WEST

ELGIN STREET EAST

Zone 2

Fut. Zone 3

Phase 2

Phase 3

Phase 4

Phase 5

Phase 6

Phase 1

Enviro. Constraint

Phases 5 & 6

NAGLE ROAD

Fut. Zone 3

Zone 2

Fut. Zone 3

Only Zone 2 Crossing of East and West Branches of Cobourg Creek

Victoria Street
Zone 1 Elevated Tank
Vol. = 1,360 cu. m
T.W.L. = 132.00

Ewart Street
Booster Pumping Station
3 pumps ea. 76 L/s @ 48.8m TDH
Discharge EL. = ~96.45

Zone 2

Zone 1

Interconnection Under CNR and CPR to Daintry Crescent

Single Existing Zone 2 Pumping Station

WILLIAM STREET

Cobourg Creek

D'ARCY STREET

BROOKE ROAD NORTH

Provision of Second Zone 2 Pumping Station

UNIVERSITY AVENUE EAST

UNIVERSITY AVENUE WEST

KING STREET WEST

KING STREET EAST

Zone 2

Zone 1

650m of Single 300mm Watermain Feeding Pebble Beach Area

LAKE ONTARIO

Water Treatment Plant
Rated Cap. = 36,368 cu. m per day
PTTW = 31,822 cu. m day
Treated Water Storage = 6,244 cu. m
(4,995 cu. m useable)

Legend

- Security of Supply Concern
- Recommended Improvement

LEGEND

- ELEVATED TANK (ZONE 1)
- ELEVATED TANK (ZONE 2)
- BOOSTER PUMPING STATION (ZONE 2)

EXISTING WATERMAIN

- LESS THAN 300MM
- 300MM
- 400MM
- 450MM
- 600MM
- RAW INTAKE PIPE

LAND USE

- RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- ENVIRONMENTAL CONSTRAINT
- PARK
- MAIN CENTRAL AREA
- SHOPPING NODE
- MIXED USE
- MAJOR INSTITUTIONAL
- EMPLOYMENT
- SECONDARY PLAN AREA

OTHER FEATURES

- PRESSURE ZONE 1/ZONE 2 BOUNDARY
- PRESSURE ZONE 2/FUTURE ZONE 3 BOUNDARY
- CONTOUR (5M INTERVAL)
- BUILDING FOOTPRINT (>= 10,000 SQ. FT.)
- RONDEAU DEVELOPMENT PHASING
- TOWN OF COBOURG MUNICIPAL BOUNDARY

CIMA+

CLIENT: Lakefront Utility Services Inc.

PROJECT NAME:
COBOURG DRINKING WATER SYSTEM MASTER PLAN

SHEET TITLE:
OVERALL PLAN OF EXISTING COBOURG WATER DISTRIBUTION SYSTEM

SCALE: 100 50 0 100 200 300 400 500 meters
1:20,000

PROJECT No: C14-0364		CLIENT FILE No: ---
DRAFTER: S. ELLIOTT	DESIGNER ---	FIGURE No: 5.1
APPROVER D. CAMPBELL	APPROVER ---	
DATE: 6/1/2020		

5.3 Distribution System Pressures

Ideally, system pressures should range from 350 kPa to 480 kPa (50 psi to 70 psi) and not be less than 275 kPa (40 psi) under peak hour demands or higher than 700 kPa (100 psi) under low demands. Additionally, the Ontario Building Code requires pressures to be limited to 550 kPa (80 psi) in occupied part of buildings.

Pressure zones are configured with the objective of providing pressures that are within established guidelines. Under normal operating conditions pressures across the distribution system are mainly influenced by the elevation of a location relative to the Hydraulic Grade Line (HGL) for each zone. Lower elevations will have higher pressures and higher elevations will have lower pressures.

The Cobourg DWS currently services elevations ranging from ±75 m to ±122 m and is organized into two pressure zones (Zones 1 & 2) with plans for a future third pressure zone (Zone 3).

- Zone 1 services elevations between ±75 m and ±98 m with a maximum HGL of 132 m (top water level in the Victoria Street Elevated Tank).
- Zone 2 services elevations between ±85 m and ±122 m with a maximum HGL for 158.4 m (top water level in the Strathy Road Elevated Tank).
- Zone 3 will service elevations ranging from ±120 m to ±146 m with a planned HGL of 181.5 m.

A hydraulic profile of the Cobourg DWS is provided in **Figure 5.2**.

Water demand across the system also results in hydraulic losses in the distribution system and influences the HGL by lowering tank levels and requiring pumps to be started. These dynamic factors also influence pressures.

To evaluate pressures within the existing Cobourg water distribution system against MECP (formerly MOE) guidelines four (4) steady state modelling scenarios were run using a hydraulic model developed with the InfoWater software package developed by INNOVYZE. For each scenario pressures are calculated at each junction within the system. The four (4) modelling scenarios are:

- **Average Day Demand (ADD):** The base scenario from which other scenarios are derived where water demand is based on averages derived from historic water billing/pumping records.
- **Minimum Hour Demand (MHD):** Representative of conditions during overnight hours when demands are lowest and tanks are full and no pumps are running. Demand is based on ADD multiplied by a factor of 0.60.
- **Maximum Day Demand (MDD):** Representative of conditions on a high demand day when tank levels are lower and individual pumps may be running to refill tanks. Demand is based on ADD multiplied by a factor of 1.70.
- **Peak Hour Demand (PHD):** Representative of peak hour conditions on a high demand day when tank levels are lower and multiple pumps may be running to refill tanks. Demand is based on ADD multiplied by a factor of 2.70.

Cobourg Drinking Water System
Hydraulic Profile: Existing System + Conceptual Zone 3

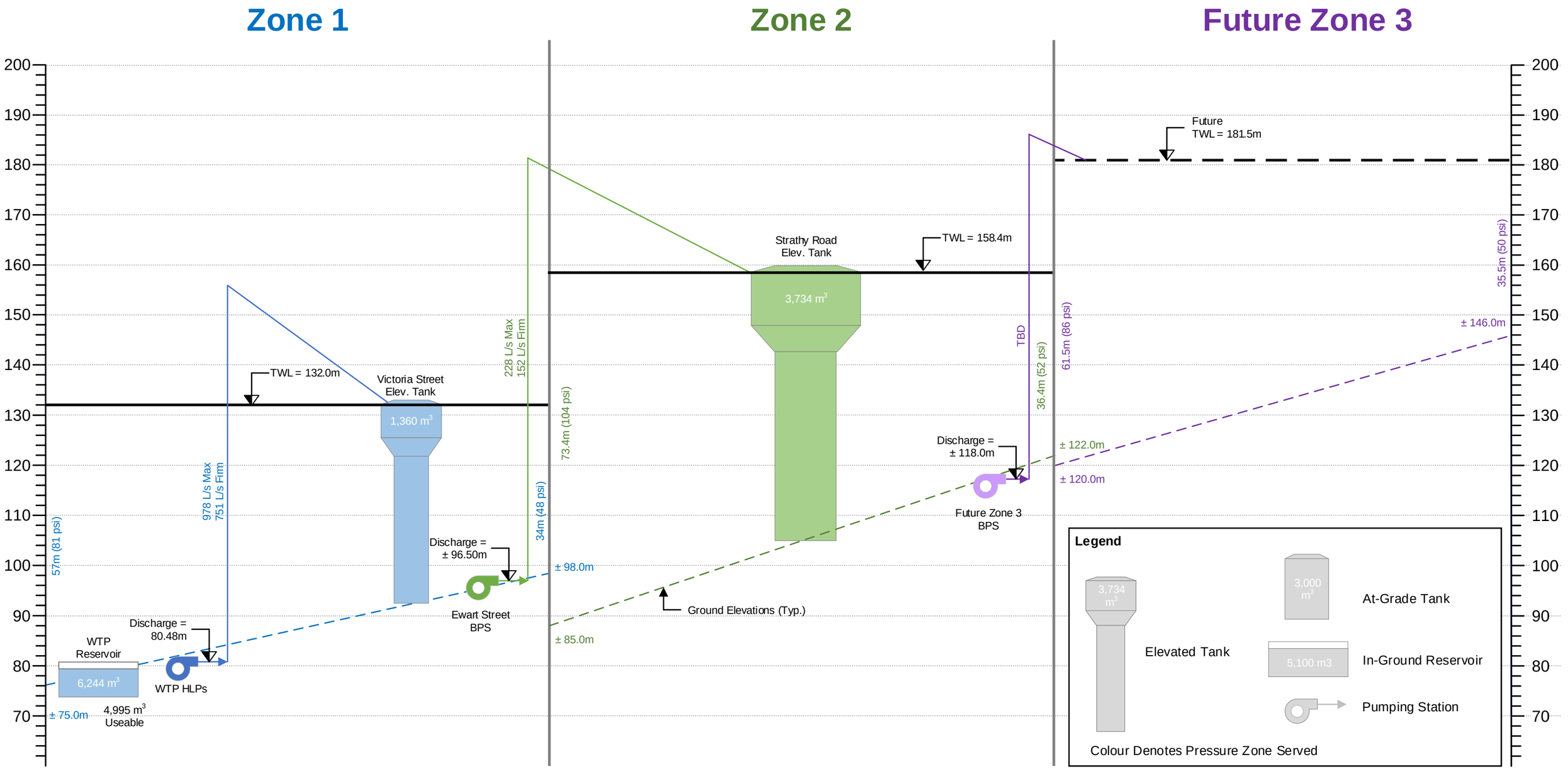


Figure 5.2

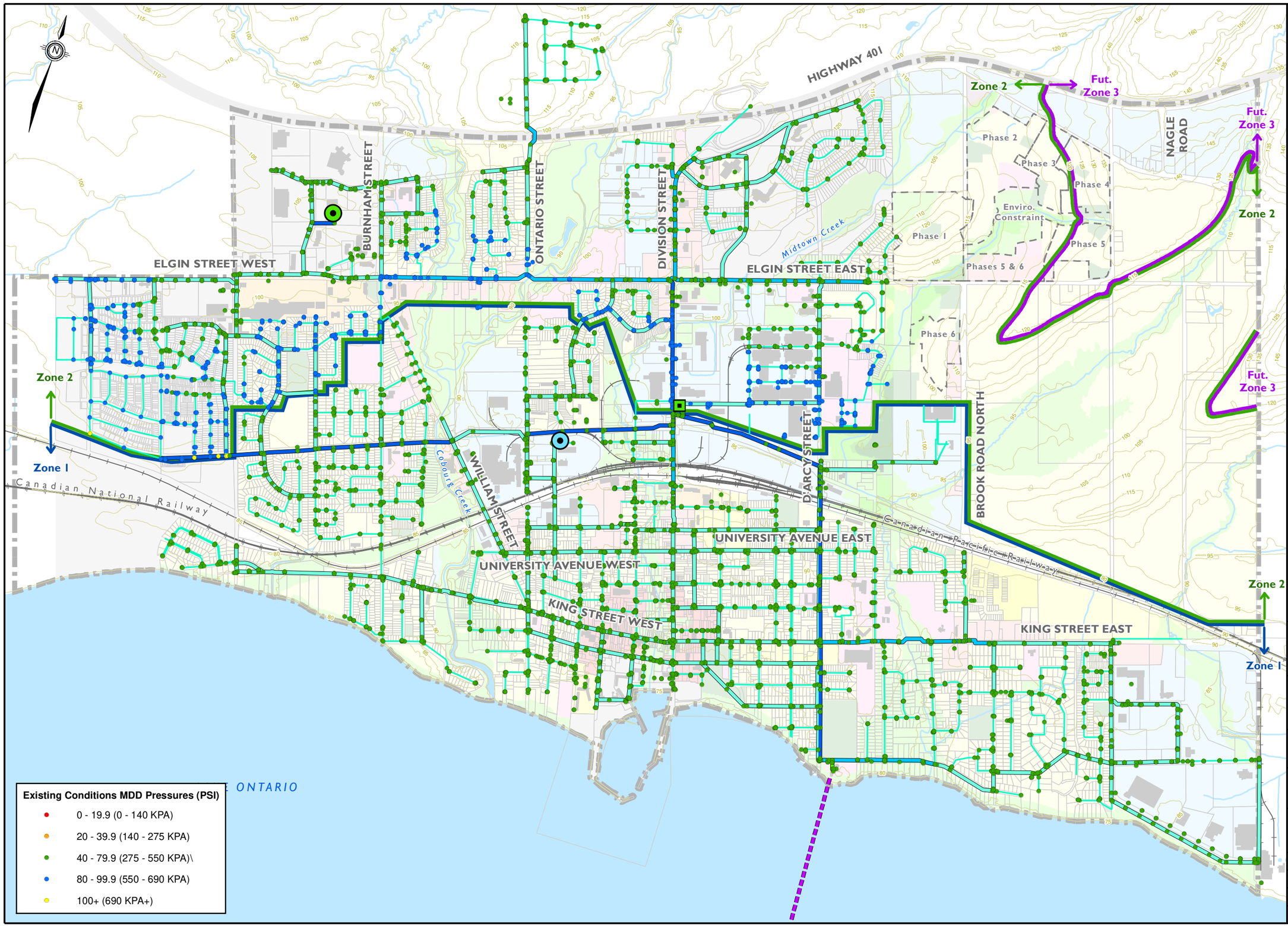
Table 5.1 summarizes the minimum and maximum pressures that occur in each pressure zone for each steady state modelling scenario.

Table 5.1: Steady State Scenario Pressures – Existing Conditions

Scenario >	No Pumping				With Pumping	
	MHD	ADD	MDD	PHD	MDD	PHD
Pressure at Zone 1 High Point (±98 m)	47 psi	41 psi	41 psi	37 psi	47 psi	47 psi
Pressure at Zone 1 Low Point (±75 m)	80 psi	74 psi	74 psi	70 psi	78 psi	78 psi
Pressure at Zone 2 High Point (±122 m)	52 psi	48 psi	47 psi	42 psi	51 psi	57 psi
Pressure at Zone 2 Low Point (±85 m)	105 psi	101 psi	101 psi	98 psi	102 psi	99 psi
Zone 1 Elevated Tank Flow	42 L/s (Draining)	70 L/s (Draining)	119 L/s (Draining)	188 L/s (Draining)	42.99 L/s (Filling)	38 L/s (Filling)
Zone 2 Elevated Tank Flow	25 L/s (Draining)	42 L/s (Draining)	72 L/s (Draining)	114 L/s (Draining)	33.26 L/s (Filling)	77.46 L/s (Filling)

High pressures in Zone 1 are within acceptable ranges, with the highest Zone 1 pressure not exceeding 80 psi. Pressures below the MECP recommended lower limit (40 psi) occur at the high point of Zone 1 under PHD conditions. Provision of a future connection to the Zone 2 distribution system through growth related construction of watermains on Brook Road North will address this deficiency.

Localized areas of Zone 2 have pressures exceeding the maximum MECP recommended operating pressure for watermains (100 psi). This occurs primarily in the southwest portion of Zone 2 between Kerr Street and Ernst Allen Boulevard. Furthermore, most Zone 2 pressures exceed the MECP recommended normal operating pressure range for water distribution systems of 70 psi with pressures in excess of 80 psi. The pressures are considered acceptable (although not ideal), but to achieve the OBC requirement for maximum pressures entering occupied spaces, it is recommended that Pressure Reducing Valves (PRVs) be required/provided on individual water services for any new development in Zone 2 where potential exists for pressures above 80 psi to occur in occupied spaces.



Existing Conditions MDD Pressures (PSI)

- 0 - 19.9 (0 - 140 KPA)
- 20 - 39.9 (140 - 275 KPA)
- 40 - 79.9 (275 - 550 KPA)\
- 80 - 99.9 (550 - 690 KPA)
- 100+ (690 KPA+)

LEGEND

- ELEVATED TANK (ZONE 1)
- ELEVATED TANK (ZONE 2)
- BOOSTER PUMPING STATION (ZONE 2)

EXISTING WATERMAIN

- LESS THAN 300MM
- 300MM
- 400MM
- 450MM
- 600MM
- RAW INTAKE PIPE

LAND USE

- RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- ENVIRONMENTAL CONSTRAINT
- PARK
- MAIN CENTRAL AREA
- SHOPPING NODE
- MIXED USE
- MAJOR INSTITUTIONAL
- EMPLOYMENT
- SECONDARY PLAN AREA

OTHER FEATURES

- PRESSURE ZONE 1/ZONE 2 BOUNDARY
- PRESSURE ZONE 2/FUTURE ZONE 3 BOUNDARY
- CONTOUR (5M INTERVAL)
- BUILDING FOOTPRINT (>= 10,000 SQ. FT.)
- RONDEAU DEVELOPMENT PHASING
- TOWN OF COBOURG MUNICIPAL BOUNDARY

CIMA+

CLIENT: Lakefront Utility Services Inc.

PROJECT NAME: **COBOURG DRINKING WATER SYSTEM MASTER PLAN**

SHEET TITLE: **PRESSURES UNDER MDD SCENARIO EXISTING CONDITONS**

SCALE: 100 50 0 100 200 300 400 500 meters 1:20,000

PROJECT No: C14-0364		CLIENT FILE No: ---
DRAFTER: S. ELLIOTT	DESIGNER ---	FIGURE No: **5.3**
APPROVER D. CAMPBELL	APPROVER ---	
DATE: 10/20/2020		

5.4 Distribution System Capacity

The hydraulic capacity of the watermains in distribution systems that are designed to provide fire flow (as the Cobourg system is) are typically not significantly strained by normal demands, even peak hour demands. Therefore, the hydraulic capacity of the system under a fire flow scenario is what should be considered when evaluating distribution system capacity to determine if watermains are appropriately sized.

Fire flow capacity is typically evaluated using a scenario referred to as Maximum Day Demand plus Fire Flow (MDD+FF). An MDD+FF scenario is created within the hydraulic model to determine available fire flow under conditions where:

+ System demand levels are set at maximum day demand;
+ Tank and standpipe levels are lowered to normal low water levels at which pumps would normally be started to replenish tank levels;
+ All pumping up to firm capacity is made available (i.e. the largest pump at each pumping facility is unavailable, but all others are available).

The hydraulic model can then be used to iteratively test a range of flows at each junction until the flow is sufficient to cause residual pressure at that junction or another junction elsewhere in the distribution system (the critical junction) to drop below 140 kPa (20 psi). This process is repeated for all junctions within the model to determine the best available fire flow that can be supplied at each junction when it alone is providing a fire flow.

5.4.1 Potentially Deficient Fire Flows

It is not possible within the scope of a master plan process to analyze individual sites and areas to determine the required fire flow for specific buildings and sites and then compare that requirement to estimated available fire flow. However, it is possible to compare available flows (estimated using the hydraulic model) to benchmark flow rates and determine where potential deficiencies may exist. Benchmark flow rates set for the purposes of this Technical Memorandum are as follows:

+ For low density residential areas (consisting of single-family dwellings) available fire flows less than 150 L/s (9,000 L/min) are considered to potentially be deficient.
+ For all other areas (industrial, commercial, multi-residential) available fire flows less than 250 L/s (18,000 L/min) are considered to potentially be deficient.

  Using the above noted benchmarks, groups/clusters of junctions with potentially deficient fire flow have been identified.

+ Low density residential areas having estimated available fire flows less than 75 L/s (4,500 L/min) and industrial/commercial areas having flows less than 250 L/s (18,000 L/min) should be prioritized and integrated into LUSI's capital program for upgrades in the near term. These areas are identified in red on **Figure 5.4.**
+ Low density residential areas having estimated available fire flows between 75 L/s (4,500 L/min) and 150 L/s (9,000 L/s) should be planned for upgrades in the future when existing watermains reach or approach the end of their useful service life. These areas are identified in purple on **Figure 5.4.** It is also recommended that these areas be discussed in further detail with Fire Department staff to confirm required fire flows and if necessary, prioritize upgrades into the near term.

In general, options that may be considered to improve the available fire flows for each area containing groups of junctions with available fire flows that fall below the above noted benchmarks include improving connectivity of local watermains to existing trunk or sub-trunk watermains and/or up-sizing of existing local watermains. Section 4.2 of TM-5 provides recommendations specific to each area

It is recommended that watermain upgrades to improve available fire flows in the areas listed in **Table 5.2** be prioritized and integrated into LUSI's capital program in the near term. These areas generally have available fire flows less than 75 L/s (4,500 L/min). For some areas site specific investigation and discussion with Fire Department staff may be sufficient to confirm that adequate fire flow is provided from adjacent streets reducing the priority and allowing upgrades to be deferred.

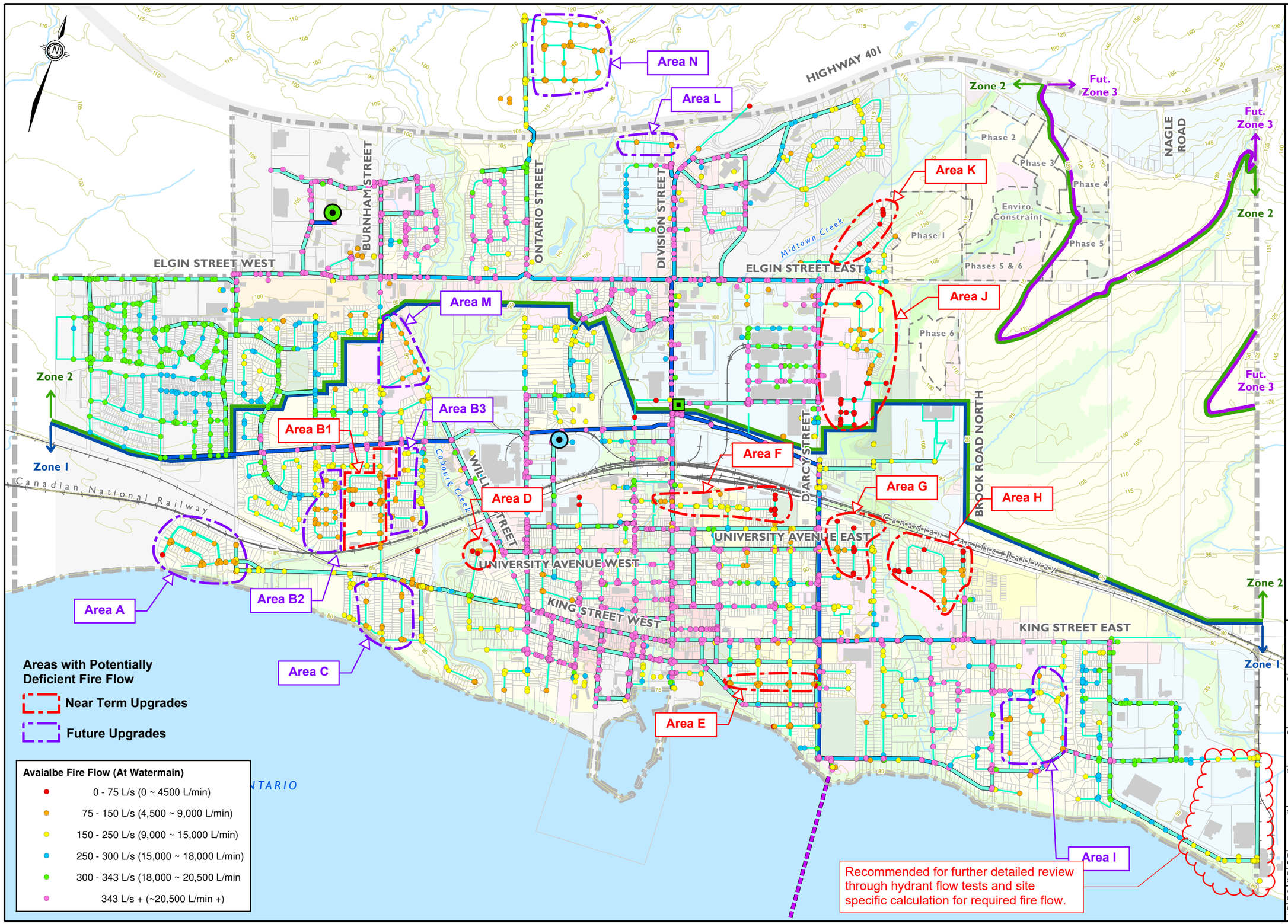
Table 5.2: Areas Recommended for Near Term Upgrades to Improve Available Fire Flow

Area	Description
Area B1	Shirley Street, Burnham Street and Westwood Drive where higher density residential development is located
Area D	Margaret Street
Area F	Munroe Street and portions of Park Street
Area E	Perry Street
Area G	East of D'Arcy Street between C.R. Gummow School and the CNR/CPR
Area H	Thomas Street, Jane Street and Meredith Avenue
Area J	East of D'Arcy Street and South of Elgin Street
Area K	Nickerson Drive

The areas listed in **Table 5.3** generally have available fire flows between 4,500 and 9,000 L/min, which may be adequate. It is recommended that these areas be discussed in further detail with Fire Department staff to confirm required fire flows and if necessary, prioritize upgrades with the areas listed above. Otherwise, these areas would be considered locations where opportunities to improve available fire flow exist and the provision of watermain upgrades as part of any future capital projects driven by asset management planning are recommended. The general recommendations for future upgrades should be refined through a detailed design process to confirm the specific location and sizing for larger watermains.

Table 5.3: Areas Recommended for Future Upgrades to Improve Available Fire Flow

Area	Description
Area A	Pebble Beach Area
Area B2	Burnham Street and Westwood Drive area south of Future Kerr Street
Area B3	Residential developments between Burnham Street and Sinclair St, south of Future Kerr Street
Area C	Monks Cove Area
Area I	Springbrook Road, Parkwood Drive, portions of Hamilton Avenue
Area L	White Street West of Division Street
Area M	William Street North of Boulton Street
Area N	North of Highway 401 in Hamilton Township


Area N
Area L
Area K
Area J
Area M
Area B3
Area B1
Area F
Area G
Area H
Area D
Area A
Area B2
Area C
Area E
Area I
HIGHWAY 401
BURNHAM STREET
ONTARIO STREET
DIVISION STREET
NAGLE ROAD
D'ARCY STREET
BROOK ROAD NORTH
ELGIN STREET WEST
ELGIN STREET EAST
UNIVERSITY AVENUE WEST
UNIVERSITY AVENUE EAST
KING STREET WEST
KING STREET EAST
Midtown Creek
Cobourg Creek
Canadian National Railway
Zone 1
Zone 2
Fut. Zone 3
Phase 1
Phase 2
Phase 3
Phase 4
Phase 5
Phase 6
Phases 5 & 6
Enviro. Constraint
Areas with Potentially Deficient Fire Flow
Near Term Upgrades
Future Upgrades
Avaialbe Fire Flow (At Watermain)
0 - 75 L/s (0 ~ 4500 L/min)
75 - 150 L/s (4,500 ~ 9,000 L/min)
150 - 250 L/s (9,000 ~ 15,000 L/min)
250 - 300 L/s (15,000 ~ 18,000 L/min)
300 - 343 L/s (18,000 ~ 20,500 L/min
343 L/s + (~20,500 L/min +)
Recommended for further detailed review through hydrant flow tests and site specific calculation for required fire flow.
LEGEND
ELEVATED TANK (ZONE 1)
ELEVATED TANK (ZONE 2)
BOOSTER PUMPING STATION (ZONE 2)
EXISTING WATERMAIN
LESS THAN 300MM
300MM
400MM
450MM
600MM
RAW INTAKE PIPE
LAND USE
RESIDENTIAL
HIGH DENSITY RESIDENTIAL
ENVIRONMENTAL CONSTRAINT
PARK
MAIN CENTRAL AREA
SHOPPING NODE
MIXED USE
MAJOR INSTITUTIONAL
EMPLOYMENT
SECONDARY PLAN AREA
OTHER FEATURES
PRESSURE ZONE 1/ZONE 2 BOUNDARY
PRESSURE ZONE 2/FUTURE ZONE 3 BOUNDARY
CONTOUR (5M INTERVAL)
BUILDING FOOTPRINT (>= 10,000 SQ. FT.)
RONDEAU DEVELOPMENT PHASING
TOWN OF COBOURG MUNICIPAL BOUNDARY
CIMA+
CLIENT
Lakefront Utility Services Inc.
PROJECT NAME:
COBOURG DRINKING WATER SYSTEM MASTER PLAN
SHEET TITLE:
AVAILABLE FIRE FLOWS EXISTING CONDITIONS - ALL UPGRADES
SCALE:
100 50 0 100 200 300 400 500
meters
1:20,000
PROJECT No: C14-0364
CLIENT FILE No: ---
DRAFTER: S. ELLIOTT
DESIGNER ---
APPROVER D. CAMPBELL
APPROVER ---
DATE: 10/20/2020
FIGURE No: 5.4

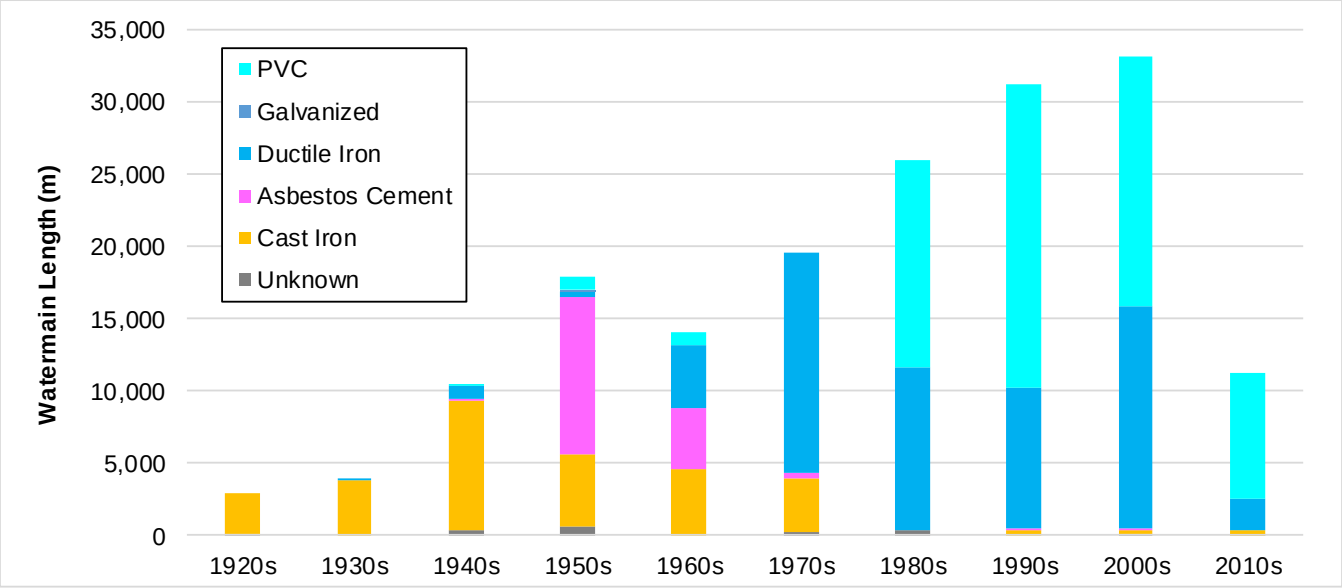
5.5 Replacement of Existing Distribution System

In order to sustain the Cobourg water distribution system an annual investment to replace a portion of the 170.5 km of existing watermains is necessary.

Just over 100 km of the existing distribution system is relatively new (installed since 1980) and consists almost entirely of PVC or ductile iron watermain. The balance of the existing distribution system (±70 km) is older (installed prior to 1980) and consists of a mixture of cast iron, asbestos cement and early ductile iron watermain.

Figure 5.5 illustrates the length of the Cobourg water distribution system by installation decade and watermain material.

Figure 5.5: Watermain Length by Installation Decade and Material



From a top down perspective, the annual investment that should be made in the water distribution system to replace and otherwise renew existing watermains can be estimated by considering the age and length of the distribution system (as illustrated above), the typical useful life of various watermain materials and the unit cost for replacing various types of watermain.

5.5.1 Useful Life of Existing Infrastructure

LUSI and the Town's current asset management planning framework establishes the typical useful life for each watermain material as outlined in the **Table 5.4** below.

The useful life of a watermain can vary greatly based on a number of factors including quality of manufacture of the pipe itself, the quality of installation in terms of jointing, bedding and backfill and also soil conditions such as moisture and chemistry, which can accelerate rates of corrosion or other forms of chemical attack. However, at a system-wide level typical life spans are a useful tool for evaluating the overall funding requirements associated with a program to undertake ongoing replacement of the system.

Table 5.4: Typical Watermain Useful Life

Material	Typical Useful Life	Length (m)	Percentage of System
PVC	125 years	63,342	37.15%
Ductile Iron	100 years	59,522	34.91%
Cast Iron	95 years	29,828	17.49%
Asbestos Cement	70 years	15,955	9.36%
Galvanized Steel	70 years	132	0.08%
Unknown	70 years	1,731	1.02%
Total		**170,510**	**100.00%**

5.5.2 Replacement Costs

Watermains in the Cobourg distribution system are most often replaced as part of capital projects where the Town of Cobourg and LUSI coordinate to replace watermain, sewer, road and sidewalk infrastructure on specific streets at the same time. Watermain replacement in these circumstances typically costs LUSI $1,600/m including the watermain, lateral services, hydrants, valves and other appurtenances as well as a portion of the road restoration costs and a pro-rata share of general contract costs (e.g. insurance, bonds, traffic control, site preparation, etc.).

In less frequent circumstances, water quality issues or other factors require that LUSI undertake replacement of a watermain independent of a larger capital project, which increases costs to approximately $2,000/m.

Table 5.5: Weighted Watermain Replacement Cost

Project Type	Watermain Replacement Cost ($/m)	Percentage of Projects
Coordinated with ToC	1,600	80%
Independent LUSI	2,000	20%
Weighted Average	1,680	100%

Based on a weighted average replacement cost of $1,680/m the estimated replacement value of the Cobourg water distribution system is approximately $286 million.

While some technologies do exist to repair/reline existing watermains instead of replacing them the financial feasibility of these technologies is often challenging. Typically, watermain relining technologies are only financially viable in instances where they translate into savings by reducing costs associated with constraints such as major traffic control, contaminated soil or significant rock excavation. As such open-cut replacement is typically the preferred approach in most small to mid-sized municipalities.

5.5.3 Annual Funding Requirement

Over the next 10-years (2021 to 2030) 21 km of watermain, or 12.4% of the Cobourg distribution system, will reach the end of its expected useful life and would ideally be replaced to ensure the sustainability of the system.

The length of watermain to be replaced in the next 10-years can be somewhat reduced to 17.5 km (10.2% of the distribution system) considering that:

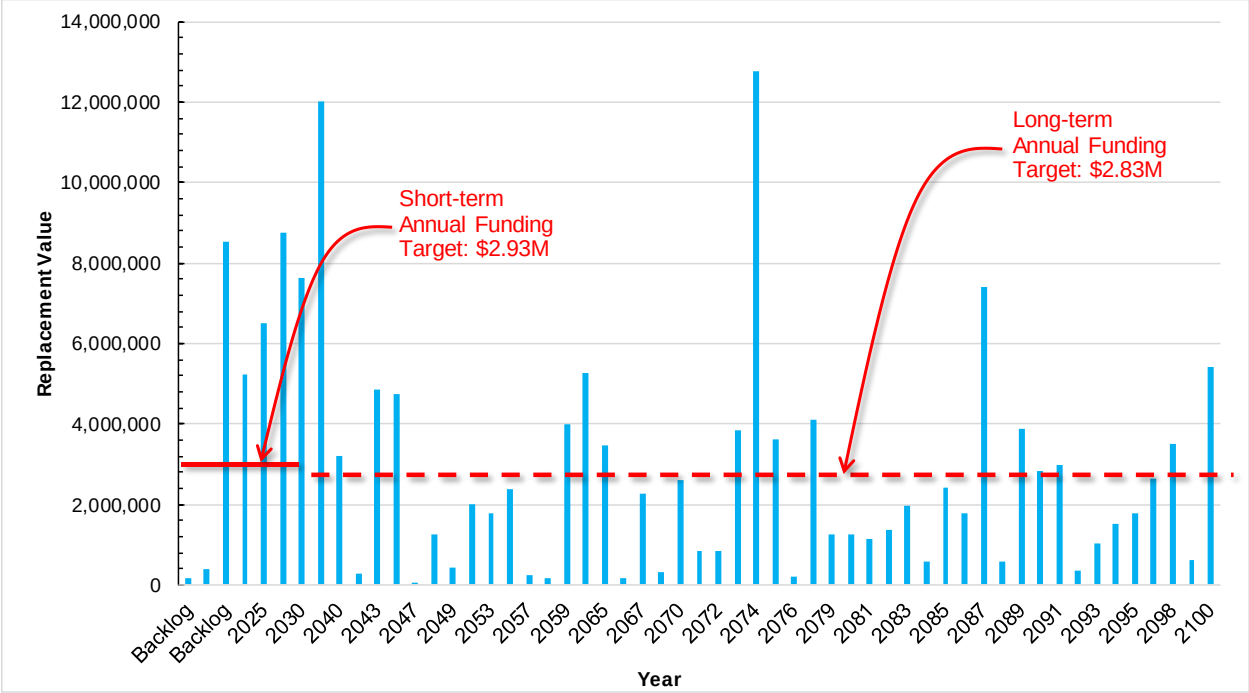
- 1,190 m of this older watermain is no longer required as it is already paralleled by newer, larger watermain and can simply be abandoned; and
- 2,785 m is older asbestos cement watermain, which has no known performance issues and will likely continue to perform well unless it is exposed to disturbance and vibration due to adjacent construction, which is most often the cause of failure for asbestos cement watermain.

In the short term, replacement of 17.5 km of watermain over the next 10-years is expected to have an overall cost of $29.3 million. This results in a target funding level for watermain replacement of $2.93 million per year to replace 1,750 m of water annually.

Similarly, looking forward at the long-term annualized average replacement cost for all watermains in the distribution system the recommended target funding level for watermain in the future is $2.83 million per year. The long-term value should be adjusted (increased) over time to reflect system growth resultant from the assumption of new watermains. This increased cost should generally be offset by corresponding growth in the number of customers.

Figure 5.6 illustrates consistent short-term and long-term annual funding levels that are recommended to sustain the linear components of the water distribution system.

Figure 5.6: Annual Watermain Replacement Cost Forecast



5.6 Growth Related Upgrades

The Cobourg DWS will have to be expanded and upgraded to accommodate the projected full build-out residential service population of approximately 39,000 persons. Sections 3.0 and 4.0 outline the pumping, storage and water treatment related upgrades and expansions that are required and recommended. Population and water demand forecasts are provided in Section 2.4 and summarized in the following section.

5.6.1 Projected Growth

Growth is projected to occur primarily within Zone 2 with a significant portion planned to occur in the Cobourg East Community secondary plan area. The Cobourg East Community is expected to include an additional population of approximately 9,900 persons in Zone 2 and 2,500 persons in Zone 3, totalling approximately 12,400 persons. The balance of the growth will occur within the existing serviced areas with an additional population totalling approximately 5,700 persons split between Zone 1 (2,400 persons) and Zone 2 (3,300 persons). A zone-by-zone breakdown of population projections at full build-out is provided in **Table 2.2.**

The anticipated residential growth will result in an estimated increase in average day water demand of ±5,100 m^3/d and an increase in maximum day demand of ±8,700 m^3/d. The anticipated non-residential growth (commercial, employment, etc.) will result in approximately ±2,100 m^3/d of additional water demand under average day conditions and ±3,500 m^3/d under maximum day conditions. A breakdown of projected residential and non-residential water demands at full build-out are provided in **Table 2.5** and **Table 2.6** respectively.

5.6.2 Growth Related Watermain Improvements

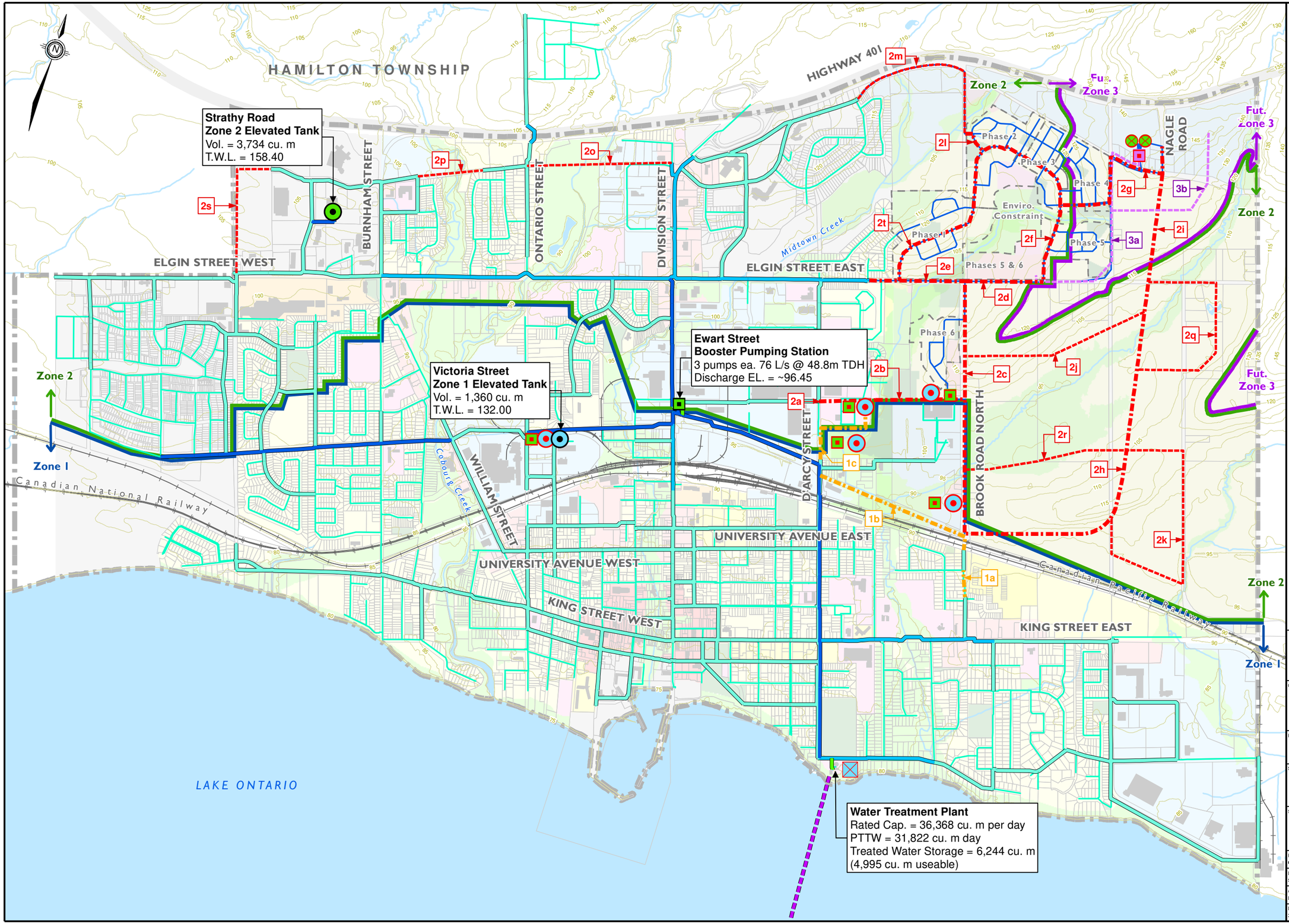
In order to support anticipated growth, the water distribution system will have to be expanded to:

+ Service lands outside of the current service area (i.e. Cobourg East); and
+ Provide improved connectivity for future pumping and storage facilities.

The majority of recommended growth-related improvements are located within Zone 2, specifically in the Cobourg East area, which coincides with the expected location of majority of future residential growth in the Town of Cobourg.

Figure 5.7 illustrates the conceptual configuration of the recommended trunk and sub-trunk watermains required to service growth areas. The exact alignment of the recommended watermains as depicted in **Figure 5.7** is flexible and can be further refined to suit the proposed road pattern within development areas provided the suggested general connectivity is achieved and the pressure zone boundary elevations are maintained.

Appendix A provides a summary of growth related watermain projects including cost estimates.



LEGEND

POTENTIAL WATER INFRASTRUCTURE

STORAGE FACILITIES
- INGROUND RESERVOIR (ZONE 1)
- ELEVATED TANK (ZONE 1)
- GRADE LEVEL TANK(S) - GROUND ELEVATION OF +/-139M (ZONE 2)

PUMPING FACILITIES
- BOOSTER PUMPING STATION (ZONE 2)
- BOOSTER PUMPING STATION (ZONE 3)

RECOMMENDED TRUNK WATERMAIN UPGRADES
- ZONE 1 TRUNK WATERMAIN
- ZONE 2 SUB-TRUNK WATERMAIN
- ZONE 2 TRUNK WATERMAIN
- ZONE 3 SUB-TRUNK WATERMAIN
- POTENTIAL RONDEAU DEVELOPMENT WATERMAIN

EXISTING WATER INFRASTRUCTURE
- ELEVATED TANK (ZONE 1)
- ELEVATED TANK (ZONE 2)
- BOOSTER PUMPING STATION (ZONE 2)

WATERMAIN
- LESS THAN 300MM
- 300MM
- 400MM
- 450MM
- 600MM
- RAW WATER INTAKE PIPE

OTHER FEATURES
- PRESSURE ZONE 1/ZONE 2 BOUNDARY
- PRESSURE ZONE 2/FUTURE ZONE 3 BOUNDARY
- CONTOUR (5M INTERVAL)
- BUILDING FOOTPRINT (>= 10,000 SQ. FT.)
- RONDEAU DEVELOPMENT PHASING
- TOWN OF COBOURG MUNICIPAL BOUNDARY

CIMA+

CLIENT: Lakefront Utility Services Inc.

PROJECT NAME: **COBOURG DRINKING WATER SYSTEM MASTER PLAN**

SHEET TITLE: **PREFERRED BOOSTER PUMPING STATIONS, STORAGE FACILITIES & RECOMMENDED TRUNK WATERMAIN UPGRADES**

SCALE: 100 50 0 100 200 300 400 500 meters 1:20,000

PROJECT No: C14-0364		CLIENT FILE No: ---
DRAFTER: S. ELLIOTT	DESIGNER ---	FIGURE No: 5.7
APPROVER D. CAMPBELL	APPROVER ---	
DATE: 3/15/2021		

5.6.3 Zone 1 Watermain Improvements

Watermain improvements in Zone 1 to support growth are generally required to provide connectivity to a new Zone 1 Elevated Tank and a new Zone 2 BPS co-located on same site. As outlined in TM-2 & 3B the preferred location is on the east side of D'Arcy Street on Cobourg Community Centre Campus lands at the rear of Buildings 18 & 19 of the Northam Industrial Park. The recommended watermain improvements include:

- Interconnection of the existing Zone 1 sub-trunk watermains on Brook Road North (south of the railway corridor) to provide a continuous 300 mm dia. watermain on Brook Road.
- Extending the existing sub-trunk watermain on Brook Road North under the railway corridor and installing a new 300 mm dia. sub-trunk watermain along future Kerr Street to connect with the existing Zone 1 trunk watermain network north of the railway corridor at D'Arcy Street.
- Extending a new Zone 1, 400 mm dia. trunk watermain on D'Arcy Street north to the new Zone 1 Elevated Tank and new Zone 2 BPS site.

5.6.4 Zone 2 Trunk Watermain Improvements

In order to effectively service the Cobourg East area a network of new Zone 2 trunk watermains (400 mm or 450 mm dia.) will be required. The recommended trunk watermain improvements are based on the preferred pumping and storage strategy for Zone 2 and Zone 3, which includes:

- New Zone 2 BPS co-located with a new Zone 1 Elevated Tank on the east side of D'Arcy Street on Cobourg Community Centre Campus lands at the rear of Buildings 18 & 19 of the Northam Industrial Park;
- New Zone 2 storage facility located in the vicinity of Nagle Road; and
- New Zone 3 BPS located near Nagle Road.

The recommended Zone 2 trunk watermains will convey water to:

- Meet additional Zone 2 demands in Cobourg East;
- Supply the new Zone 3 BPS to meet new Zone 3 demands; and
- Supply the new Zone 2 storage facilities located in Cobourg East.

Initially, upon construction of the new Zone 2 BPS, a new 300 mm dia. watermain will be required on Barracks Drive to connect the new Zone 2 BPS to the existing sub-trunk watermain on D'Arcy Street at 3rd Street (Project 2a). This watermain will allow the Zone 2 BPS to provide additional redundancy for the existing Ewart Street BPS in the short-term before additional Zone 2 trunk watermains are constructed further east of D'Arcy Street.

Ultimately, to provide a Zone 2 trunk watermain loop in the Cobourg East area additional Zone 2 trunk watermains are recommended as follows:

- East from the preferred Zone 2 BPS site to Brook Road North potentially along the south side of the existing soccer fields east of the CCC and through Phase 2 of the Rondeau/Tribute development lands (Project 2b);
- Along Brook Road from Future Kerr Street to Elgin Street (Project 2c);

- Along Elgin Street from Brook Road North to the future arterial/collector road in the "Rondeau" development (Project 2d);
- Along Elgin Street from Conger Avenue to Brook Road North (Project 2e);
- Northerly along the future collector road in the "Rondeau" development into Zone 3 (at Zone 2 pressure) and easterly towards Nagle Road terminating in Zone 3 at the new Zone 2 storage facility and new Zone 3 BPS (Project 2f/2g);
- Along Future Kerr Street following the future arterial road alignment east of Brook Road North towards Nagle Road, eventually entering Zone 3 (at Zone 2 pressure) and terminating at the new Zone 2 storage facility and new Zone 3 BPS (Project 2h/2i); and

5.6.5 Zone 2 Sub Trunk-Watermains

In addition to the trunk watermains described above in **Section 5.6.4**, additional Zone 2 sub-trunk watermains (typically 300 mm dia.) will be required to feed local watermains and provide long-term redundancy for the trunk watermain network.

The exact alignment and configuration of future sub-trunk watermains, especially in the Cobourg East area, will be significantly influenced by the timing and form of individual development proposals. Conceptual sub-trunk loops and linkages are recommended to include:

- A sub-trunk connection between the Cobourg East area and the existing Zone 2 distribution system in the Parkview Hills area consisting of watermains extended:
  - North along Brook Road North from the future arterial/collector road in the "Rondeau" development to Danforth Road (Project 2l); and
  - East along Densmore Road from Parkview Hills Drive to Brook Road North and southerly on Brook Road (Project 2m).
  - Northerly from Elgin Street East along the future collector road in the "Rondeau" development and then easterly (Project 2t).
- Sub trunk links between Brook Road North and Future Kerr Street with one located north of the Brook Creek tributary (Project 2j) and another located south of the Brook Creek tributary (Project 2r).
- Sub-trunk watermain loops through the area east of Future Kerr Street as represented conceptually by Project 2k and Project 2q and potentially an interconnection between the two.
- Completion of the White Street sub-trunk loop with a connection across:
  - The west branch of Cobourg Creek between Riddell Avenue and west of Glenhare Street (Project 2p); and
  - The east branch of Cobourg Creek between Ontario Street and Division Street (Project 2o).
- Completion of the sub-trunk watermain loop though the Cobourg West Business Park secondary plan area including new watermains along future Rogers Road north from Elgin Street to the current terminus of DePalma Drive.

5.6.6 Zone 3 Sub-Trunk Watermains

The total serviced population in Zone 3 will be relatively small compared to Zones 1 and 2. As such, large diameter trunk watermains are not anticipated to be required. In this regard, Zone 2 trunk watermains (as described in Section 5.6.4) will extend into Zone 3, but not service any lands in Zone 3. Within the limits of Zone 3 these Zone 2 watermains will have pressures typically less than 40 psi and will provide water to fill the Zone 2 storage facilities located on the high ground in Zone 3 and supply the suction-side of the new Zone 3 BPS.

A network of Zone 3 sub-trunk watermains will be required to distribute water through-out Zone 3. These are conceptually illustrated as Projects 3a and 3b.

5.7 Distribution System Pressures at Build-Out

At full build-out with no pumping (except into Zone 3 as a closed system), Maximum Day Demand (MDD) pressures at junctions within the trunk and sub-trunk watermain networks inclusive of proposed growth related improvements all fall within the recommended MECP guidelines for operating pressures within a water distribution system.

Table 5.6 provides a summary of pressures at key locations in each Zone. Similar pressures can be attributed to local watermains assuming they are appropriately sized to meet demands in specific areas, with subtle variations due to topography.

Table 5.6: Steady State Scenario Pressures – Existing Conditions

Scenario >	No Pumping				With Pumping	
	MHD	ADD	MDD	PHD	MDD	PHD
Pressure at Zone 1 High Point (±98 m)	48 psi	43 psi	43 psi	41 psi	43 psi	43 psi
Pressure at Zone 1 Low Point (±75 m)	80 psi	73 psi	68 psi	57 psi	76 psi	73 psi
Pressure at Zone 2 High Point (±122 m)	52 psi	48 psi	47 psi	44 psi	48 psi	47 psi
Pressure at Zone 2 Low Point (±85 m)	105 psi	101 psi	101 psi	98 psi	102 psi	99 psi
Pressure at Zone 3 High Point (±144.5 m)	63 psi	57 psi	51 psi	51 psi	51 psi	51 psi
Pressure at Zone 3 Low Point (±119 m)	98 psi	93 psi	87 psi	88 psi	87 psi	88 psi
Zone 1 (New)Elevated Tank Flow	-50 L/s (Draining)	-84 L/s (Draining)	-143 L/s (Draining)	-226 L/s (Draining)	-44 L/s (Draining)	-119 L/s (Draining)
Zone 2 Existing Elevated Tank Flow	-25 L/s (Draining)	-42 L/s (Draining)	-71 L/s (Draining)	-113 L/s (Draining)	-9 L/s (Draining)	7 L/s (Filling)
Zone 2 New At-Grade Tank Flow	-42 L/s (Draining)	-69 L/s (Draining)	-118 L/s (Draining)	-187 L/s (Draining)	-6 L/s (Draining)	29 L/s (Filling)

6.0 Summary

The Town of Cobourg Drinking Water System (DWS) currently services an estimated residential population of 20,961 persons and has an equivalent service population of 32,050 when accounting for non-residential water use as equivalent population. At full build-out of the current Cobourg boundary the residential service population is expected to increase to approximately

39,000 people and there is potential for the development of ±190 ha of commercial and employment land.

As a result of the forecasted growth, maximum day demand in the Cobourg DWS is expected to increase from just over 15,354 m^3/d to 27,578 m^3/d. The resultant increase in demand combined with the need to maintain existing assets will require investment in rehabilitation and expansion of the existing Cobourg DWS.

6.1 Water Treatment

The rated capacity of the Cobourg Water Treatment Plant (WTP) (36,368 m^3/d) is sufficient to accommodate the projected growth in water demand without a need to increase treatment capacity. However, given that the Cobourg WTP was constructed in the 1970s the are a number of items at the WTP that require an investment to ensure that the plant can continue to operate reliably into the future as it continues to age and demand increases.

The most significant requirement is associated with the rehabilitation or replacement of the existing clarifier in the next 5-10 years, which is a priority given the age of the clarifier and the fact that operation of the WTP is dependent on only a single clarifier.

Of the options evaluated, construction of a new clarification process at a new location on the WTP site, is considered the preferred option. Option C5 has an estimated cost of $11.8 million (incl. contingencies). It is anticipated that a Dissolved Air Floatation (DAF) clarification system (or similar) installed north of the existing chlorine contact tanks will be the most suitable approach along with the installation of a third filtration train at the location of the existing clarifier.

In addition to the clarifier replacement, identified needs at the WTP include:

+ $2,015,000 (incl. contingencies) of short-term needs that should be addressed in less than 5-years;
+ $1,476,000 (incl. contingencies) of non-clarifier related needs that should be addressed in the next 5-10 years; and
+ $2,015,000 (incl. contingencies) of long-term needs that should be addressed beyond a 10-year time horizon.

6.2 Pumping

The high-lift pumping system located at the WTP has a firm capacity of 751 L/s, which is sufficient to pump future maximum day demand plus fire flows at build-out. As such, expansion of the existing high-lift pumping system is not anticipated.

The Ewart Street BPS constructed in 1974 is currently the only pumping facility supplying water to Pressure Zone 2. The Ewart Street BPS has a firm rated capacity of 152 L/s. As growth continues the required Zone 2 pumping capacity is expected to increase to 432 L/s. As a result, additional/expanded Zone 2 pumping facilities will be required.

The preferred approach is to first provide an additional firm rated pumping capacity of 120 L/s at a new Zone 2 BPS that is located at the same site as a new Zone 1 Elevated Tank at a cost of $1,560,000 (incl. contingencies). This approach provides multiple Zone 2 pumping facilities to improve redundancy.

In the longer-term, the existing Ewart Street BPS would then be rehabilitated and upgraded to provide an additional pumping capacity of 312 L/s at an estimated cost of $1,560,000 (incl. contingencies) for an ultimate combined pumping capacity of 432 L/s.

Additional Zone 2 pumping capacity is expected to be required when the equivalent service population of Zone 2 increases by 2,225 persons (relative to its 2020 population). Based on growth forecasts this threshold is expected to be exceeded within the 10-year time horizon.

Furthermore, it is expected that future Pressure Zone 3 will operate as a closed system and require its own dedicated pumping system. It is expected that all Zone 2 pumping system upgrades would be funded through development charges.

6.3 Storage

Treated water storage for the Cobourg DWS is currently provided by the inground reservoir at the WTP (pumped storage) and the Zone 1 and Zone 2 elevated tanks (floating storage). The total usable storage volume provided by the existing facilities is 10,089 m^3. While the volume of storage to be provided is ultimately at the discretion of the Municipality, there is shortfall of 2,427 m^3 relative to current maximum day demand and estimated fire flow requirements (based on total population). Ideally, the Cobourg DWS would currently have a storage capacity of 12,516 m^3, with additional capacity to support continued growth.

In this regard, it is recommended that additional storage be provided in the near future in the form of a New Zone 1 elevated tank having a capacity of 5,000 m^3. At an estimated cost of $7.6 million this facility could operate in conjunction with or replace the existing Zone 1 elevated tank on Victoria Street which is in need of rehabilitation. It is anticipated that a new Zone 1 elevated tank will be funded in part by user rates (75%) and in part by development charges (25%).

In the longer term as growth continues, primarily in Pressure Zone 2, additional storage facilities will be required in Zone 2. The recommended approach is to provide 4,000 m^3 of storage in twin at-grade tanks on high ground near the future Nagle Road interchange (geographically within Zone 3, but hydraulically connected to Zone 2). The at-grade tanks would work in conjunction with the existing Zone 2 elevated tank on Strathy Road and are expected to be required in 10+ years at an estimated cost of $4.88 million, although construction can be phased by tank (4,000 m^3 each). An elevated tank could be constructed instead of the at grade tanks, but at greater cost.

Depending on whether the existing Zone 1 elevated tank on Victoria Street is rehabilitated or decommissioned it may be necessary to construct another storage facility (in addition to those noted above) to achieve the required total future storage volume of 19,000 m^3.

If the Zone 1 elevated tank is rehabilitated there will be a requirement for a near-term investment, but the eventual construction of an additional storage facility will be negated. If the Zone 1 elevated tank is decommissioned, there will be a need for at least 13,050 m^3 of storage prior to build-out. By the time this facility is required it will likely be reasonable to consider planning for a larger facility that can accommodate growth beyond the current build-out planning horizon.

6.4 Distribution System

The existing Cobourg water distribution system consists of 170.5 km of watermains.

The existing distribution system is generally well planned with provisions for redundancy in the event of a watermain break or other event that takes a particular watermain out of service. There are however several locations where security of supply can be improved by providing additional redundancy. These include:

+ Providing additional Zone 2 pumping capacity at a location separate from the existing Ewart Street BPS.
+ Completing the White Street sub-trunk watermain to provide east-west redundancy in Zone 2 for the Elgin Street trunk watermain where it crosses both branches of Cobourg Creek.
+ Monitoring the condition of and proactively planning for the replacement of the watermain crossing under Highway 401 that services a portion of Hamilton Township.
+ Potentially connecting the Pebble Beach area to the large distribution system at a second point by establishing watermain connection from Tracey Road under the CNR and CPR to Daintry Crescent.

Similarly, the Cobourg water distribution system is generally capable of supplying water to users at suitable pressures. However, a number of minor improvements are possible including:

+ Reconfiguration of the Zone 1/Zone 2 pressure zone boundary along Kerr Street west of Prince of Wales Drive to move it north and place Kerr Street and adjacent areas into Zone 1 rather than Zone 2 to eliminate pressures in excess of 100 psi.
+ Requiring PRVs on individual water services in Zone 2 where pressures exceed 80 psi.
+ Eliminating low pressures in Zone 1 by ultimately servicing of the high elevation areas along Brook Road (north of the CNR/CPR corridor) from Zone 2 rather than Zone 1, which can be done at such time as new Zone 2 watermains are constructed in conjunction with development.

Much of the Cobourg water distribution system is capable of supplying fire flows that meet or exceed contemporary benchmarks. However, hydraulic modeling suggests that certain older parts of the system provide fire flows that do not meet current standards. It is recommended that watermain improvements be implemented to address these issues. Some improvements have been identified as higher priority requiring near-term action while other improvements can be timed to coincide with the eventual replacement of older watermains.

An ongoing investment is required to sustain the 170.5 km of linear infrastructure that currently comprise the Cobourg water distribution system. In the next 10-years 17.5 km of the distribution system is expected to require replacement at total cost of $29.3 million. As a result, an investment of $2.93 million per year should be targeted for watermain replacement. Similarly, the future annualized replacement costs for the system indicate that an investment of $2.83 million annually is required.

To support growth, an extensive network of new trunk and sub-trunk watermains will be required. These trunk and sub-trunk watermains are expected to mainly be constructed by developers as development proceeds with cost sharing achieved through the use of development charges. As part of the master plan process, a conceptual arrangement of trunk and sub-trunk watermains has been established to align with the recommended pumping and storage upgrades. The nuances of watermain alignments can be refined through the detailed design process. However, major changes to configuration and connectivity should be considered at a system-wide level.

6.5 Cost Estimates

While the costs for several major projects are noted in the foregoing summary sections, a complete summary of preliminary cost estimates (in 2020 dollars) associated with treatment, pumping, storage and distribution system projects identified through the master plan is provided in **Appendix A**. It should be noted that this does not include watermain replacement projects to address fire flow issues as it is assumed this would be dealt with by funding provided through asset management planning for existing infrastructure.

Additionally, detailed cost estimates for the various storage, pumping and treatment options considered are included within the relevant technical memoranda.

7.0 Municipal Class Environmental Assessment Considerations

To integrate with the Municipal Class Environmental Assessment (MCEA) process, Master Planning typically follows one (1) of four (4) approaches as identified below:

- Approach #1 – Involves preparation of a Master Plan document at a broad level of assessment establishing the need and justification for facilities and identifying potential location options, thus requiring more detailed investigations at the project specific level to ultimately fulfil the Municipal Class EA documentation requirements for specific future Schedule B or Schedule C projects identified in the Master Plan. The Master Plan would be made available to the public prior to final approval by the Municipality.
- Approach #2 –Involves preparation of a Master Plan document done with a greater level of location specific detail and investigation such that the level of investigation, consultation and documentation undertaken as part of the process are sufficient to fulfil the requirements for Schedule B projects identified within it. The Master Plan would be made available to the public prior to final approval by the Municipality.
- Approach #3 - Involves preparation of a Master Plan document done with a greater level of location specific detail such that the level of investigation, consultation and documentation undertaken as part of the process are sufficient to fulfil the requirements for both the Schedule B projects and/or Schedule C projects identified within it. The Master Plan would be made available to the public prior to final approval by the Municipality.
- Approach #4 (Integration with the Planning Act) - Involves preparation of a Master Servicing Plan document establishing the need and justification in a very broad context for integration with approvals under the Planning Act.

The Cobourg Water Distribution System Master Plan primarily follows Approach #1. However, for more complex or challenging project elements Approach #2 has been integrated to provide additional location specific details that offer the public and stakeholders greater clarity about where projects may occur, subject to further review following the MECA process as necessary.

7.1 Treated Water Pumping Facilities

The current Municipal Class Environmental Assessment (MCEA) document, as amended in 2015, identifies *increase pumping station capacity by adding or replacing equipment and*

appurtenances where new equipment is located in a new building or structure as a Schedule B project, requiring completion of Phase 1 and Phase 2 of the planning and design process.

Major amendments to the MCEA document were proposed by the Municipal Engineers Association (MEA) in September of 2019 and are currently under review by MECP. It is possible that these amendments will be approved in 2021.

The proposed amendments to the MCEA planning and design process originally included language that would recategorize *construction of new pumping facilities, where the technical merits are assessed and approved by another process, and the work is contained within the proponent's property* as a Schedule A+ (pre-approved) project. However, this wording has been revised to the following in the current version of the proposed amendments:

- Project Type 5a: *Increasing pumping station capacity by adding or replacing equipment where new equipment, buildings or structures are located on an existing municipal servicing site, within an existing utility corridor, or within an existing road allowance.* ***Shifted from Schedule A and B to A+***
- Project Type 5b: *Construct a new pumping station on an existing municipal servicing site, within an existing utility corridor, or within an existing road allowance.* ***New Schedule A+***

This revised wording removes the broad reference to "the proponent's property" and replaces it with the term "municipal servicing site". While "municipal servicing site" does not presently appear to be specifically defined in the proposed amendment, for water and wastewater projects, it is expected that a "municipal servicing site" would refer to existing sites where water/wastewater facilities are already located and operate under an existing Certificate of Approval (CofA) or Environmental Compliance Approval (ECA).

Based on the foregoing, it is expected that:

- Construction of a new Zone 2 BPS would be a Schedule B project requiring completion of Phase 1 & Phase 2 of the MCEA planning and design process, building on the work previously completed as part of the current Master Plan process. This stems from the fact that all of the feasible location options that were evaluated except for Option 1B are not located on an existing "municipal servicing site" (Options 2, 3, 4) or require property acquisition to expand a "municipal servicing site.
- Future expansion of the Ewart Street BPS would most likely be Schedule A+ project if the proposed amendments to the MCEA are approved as currently drafted.
- Planning requirements for the future Zone 3 BPS can most likely be fulfilled through the development planning process integrated with the Municipal Class EA process but would otherwise require completion of a Schedule B Class EA.

7.2 Treated Water Storage Facilities

The current Municipal Class Environmental Assessment (MCEA) document, as amended in 2015, identifies *establish new or expand/replace existing water storage facilities* as a Schedule B project, requiring completion of Phase 1 and Phase 2 of the planning and design process.

Major amendments to the MCEA document were proposed by the Municipal Engineers Association (MEA) in September of 2019 and are currently under review by MECP. It is possible that these amendments will be approved in 2021.

The proposed amendments to the MCEA planning and design process originally included language that would recategorize *construction of new treated water storage facilities, where the technical merits are assessed and approved by another process, and the work is contained within the proponent's property* as a Schedule A+ (pre-approved) project. However, this wording has been revised to the following in the current version of the proposed amendments:

- Project Type 7: *Establish new or replace/expand existing water storage facilities provided all such facilities are on and existing municipal servicing site, within an existing utility corridor, or within an existing road allowance*
  Shifted from Schedule A and B to A+

This revised wording removes the broad reference to "the proponent's property" and replaces it with the term "municipal servicing site". While "municipal servicing site" does not presently appear to be specifically defined in the proposed amendment, for water and wastewater projects, it is expected that a "municipal servicing site" would refer to existing sites where water/wastewater facilities are already located and operate under an existing Certificate of Approval (CofA) or Environmental Compliance Approval (ECA).

Based on the foregoing, it is expected that:

- Construction of a new Zone 1 Elevated Tank would be a Schedule B project requiring completion of Phase 1 & Phase 2 of the MCEA planning and design process, building on the work previously completed as part of the current Master Plan process. This stems from the fact that all of the feasible location options that were evaluated except for Option 1B are not located on an existing "municipal servicing site" (Options 2, 3, 4) or require property acquisition to expand a "municipal servicing site".
- Construction of new Zone 2 storage facilities in the future would be a Schedule B project requiring completion of Phase 1 & Phase 2 of the MCEA planning and design process, building on the work previously completed as part of the current Master Plan process. It is also possible that a new Zone 2 storage facility project could be integrated into the development planning process.

Further to the above discussion, although subject to the particular funding program, many federal funding programs will require completion of a Canadian Environmental Assessment where the project receives federal contributions.

7.3 Water Treatment

Although amendments to further streamline the current Municipal Class EA planning process are currently under review, Schedule A and Schedule A+ (pre-approved) water infrastructure projects under the current Municipal Class EA document, as amended in 2015, include the following:

+ Normal or emergency operational activities (Schedule A);
+ Increasing pumping capacity where new equipment is located in an existing building or structure (Schedule A);

- Install chemical or other process equipment, provide additional treatment facilities such as filtration, for operational or maintenance purposes in existing treatment plants or pumping stations (Schedule A);
- Replace/expand existing water storage facilities where all facilities are in either an existing road allowance or an existing utility corridor or where no land acquisition is required (Schedule A);
- Installation or replacement of standby power equipment in a new building or structure (Schedule A); and
- Expand/refurbish/upgrade WTP up to existing rated capacity where no land acquisition is required (Schedule A+).

Since all works will occur within the limits of the existing site and will not involve expanding the WTP's total rated capacity it is anticipated that planning requirements for all required upgrades to the Cobourg WTP will be considered Schedule A or A+ (pre-approved) projects under the Municipal Class EA planning and design process.

Further to the above discussion, although subject to the particular funding program, many federal funding programs will require completion of a Canadian Environmental Assessment where the project receives federal contributions.

7.4 Water Distribution System

In general, projects to extend or enlarge water distribution systems are considered to be Schedule A projects when the proposed watermains are located within an existing road allowance or servicing corridor. When such projects are not located within existing road allowance or servicing corridor, they become Schedule B projects. This is essentially unchanged in the proposed amendments to the MCEA process.

7.5 Summary

The following tables (7.1 – 7.4) summarize the anticipated MCEA requirements for major projects and project types identified through the master plan process.

Table 7.1 : Anticipated MCEA Requirements for Major Recommended Pumping Projects

Project		Project Description	EA Schedule
P4a	New Zone 2 BPS	New Zone 2 Booster Pumping Station with a 120 L/s firm rated capacity located on the same site as the new Zone 1 Elevated Tank.	Schedule B
P4b	Expansion of Ewart Street BPS	Addition of two (2) pumps to the existing Ewart Street Booster Pumping Station to improve the current firm rated pumping capacity.	Schedule A+
Z3	New Zone 3 BPS	New Zone 3 Booster Pumping Station with an ultimate firm rated capacity of 372.5 L/s to service future pressure Zone 3 (lands above ±120 m).	Schedule B *Integrated with Planning Act Process*

Table 7.2 : Anticipated MCEA Requirements for Major Recommended Storage Projects

Project		Project Description	EA Schedule
S2a	New Zone 1 ET at Preferred Site	New Zone 1 Elevated Tank located on the preliminary preferred site on Cobourg Community Centre campus lands to address the current need for additional Zone 1 floating storage.	Schedule B
S7	New Zone 2 At-Grade Tanks	New Zone 2 At-Grade Tanks located in the vicinity of Nagle Road and Danforth Road (Zone 3), required to support growth in Zone 2.	Schedule B

Table 7.3 : Anticipated MCEA Requirements for Major Water Treatment Projects

Project		Project Description	EA Schedule
C5	New Clarification System	Construction of a new clarification system located on the existing Cobourg Water Treatment Plant site to replace the existing clarifier that is reaching the end of its useful life and provides no redundancy, without increasing rated capacity.	Schedule A or Schedule A+
-	Rehabilitation / Improvement / Replacement of Treatment Processes	On-going rehabilitation, improvement, and replacement projects completed at the Cobourg Water Treatment Plant as necessary to ensure current demands continue to be met and processes continue to operate effectively to meet future demands at levels that approach 90% of the plant's rated capacity.	Schedule A or Schedule A+

Table 7.4 : Anticipated MCEA Requirements for Major Distribution Projects

Project		Project Description	EA Schedule
-	Linear Watermain Projects within and Existing Road Allowance	Reconstruction or new construction of distribution watermains within an existing road allowance necessary to support growth, address deficiencies, improve redundancy, or extend useful life. *Example: Trunk watermain construction on Brook Road North necessary to support growth in the Cobourg East Community.*	Schedule A
-	Linear Watermain Projects not within an Existing Road Allowance	Reconstruction or new construction of distribution watermains not within an existing road allowance necessary to support growth, address deficiencies, improve redundancy, or extend useful life. *Example: Trunk watermain construction from the preliminary preferred new Zone 1 Elevated Tank site, along the south limit of existing recreational facilities belonging to the Town of Cobourg and the future Phase 2 Villages of Central Park development, to Brook Road North.*	Schedule B

8.0 Community Engagement

The Cobourg Drinking Water System (DWS) Master Plan was developed from a series of technical memoranda that evaluated current and future water demands in the Town of Cobourg against available water storage, pumping and distribution infrastructure to determine infrastructure upgrades necessary to support and service the Cobourg DWS to full build-out and present preferred options/alternatives to fulfill those requirements.

Through consultation with key stakeholders (LUSI, TOC) several options for storage, pumping and distribution infrastructure were developed and preliminary decisions were made for the preferred infrastructure options/alternatives as presented in the draft Master Plan. Key concepts of the draft Master Plan were presented to the Public at a virtual Public Information Centre (PIC) held via Zoom on May 26th, 2021.

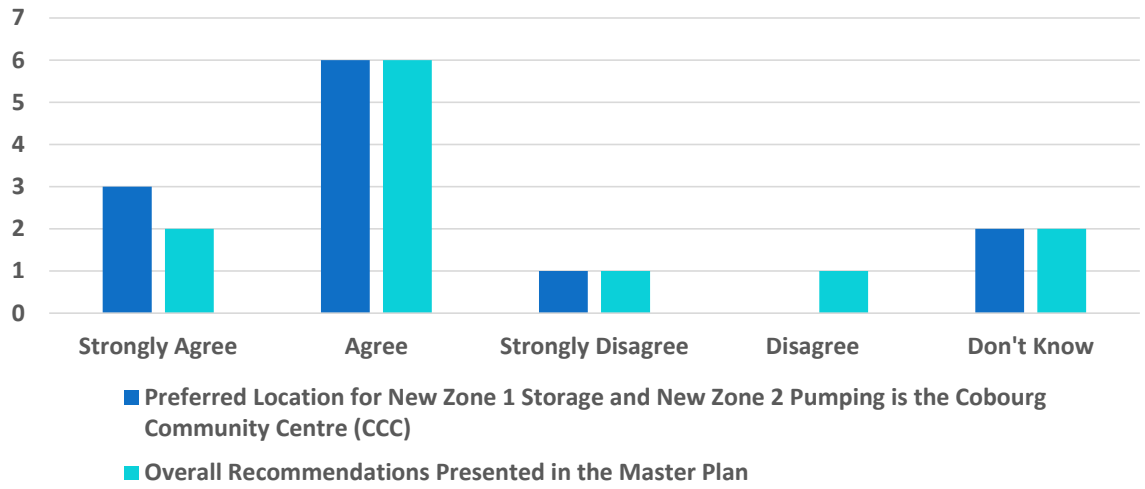
Notification of the PIC was provided through the Town of Cobourg's community engagement platform with a page specifically dedicated to the Cobourg DWS Master Plan: engagecobourg.ca/water-master-plan. Following the PIC, presentation materials (i.e. slide deck and presentation recording) and the draft Cobourg DWS Master Plan Executive Summary were made available through the project webpage.

Additionally, on May 27th, 2021 a survey was launched to allow the Public to provide their feedback on the content presented in the PIC. The survey consisted of nine (9) questions that included opportunities for the public to:

+ Provide their level of agreement with the preferred location presented for storage and pumping infrastructure, required in the near term in Zone 1 and Zone 2, and the recommendations of the Master Plan overall
+ Submit their own narrative feedback and/or comments on presented recommendations for water treatment, storage, pumping and distribution infrastructure

The survey was available to be completed by the public from May 27th, 2021 to June 9th, 2021 (14 days). A total of twelve (12) responses were received during that time. The responses to two (2) structured questions seeking the public's level of agreement with the Master Plan recommendations are illustrated on the graph below.

Table 8.1: Responses to Structured Questions



The narrative comments received through the survey were reviewed by the project team. Feedback submitted generally consisted of concern/request for consideration of the following topics:

- Impacts (increases) to water rates, wise use of financial resources and accessing alternative funding sources
- Actual growth may not justify the recommendations presented in the Master Plan
- Pumped storage (in-ground reservoirs) instead of floating storage (water towers)
- Climate change impacts on water use and lake levels
- Aesthetic design of new buildings and facilities and opportunities for additional public use
- Backflow prevention and exposure to potential sources of contamination

The draft Master Plan inclusive of public feedback received during the survey period was presented to the Town of Cobourg Council on June 21st, 2021.

A

Appendix A
Cost Estimate Summary

Cobourg DWS Water Master Plan
Summary of Projects

Project No. C14-0364
Revision Rev 06
Date 19-Mar-21

Linear Watermain Projects

	Location				Project Details					Estimated Project Cost (2020 $)						
Project ID	Location	From	To	Length (m)	Type	Extra	Proposed Improvement	Benefit to Existing	Extra Over Costs	$/m	Gross Capital	BTE %	Benefit to Existing	Subsidies	Growth %	Net Growth Related Capital
1a	Brook Road North	Jane Street	Thomas Street	170	Trunk on Exist. Road		Interconnect existing sub-trunk watermains on Brook Road North	Provides additional security of supply for Existing Ewart Street BPS and New Zone 1 elevated tank, which serve existing population.		1,523	258,885	75%	194,163	-	25%	64,721
1b	Fut. Kerr Street	South Side of Railway at Brook Road North	D'Arcy Street	970	Trunk on Fut. Road	Railway Crossing	Extend sub-trunk watermain on Brook Road North under railway corridor and along future Kerr Street to Connect with existing trunk network north of the railway corridor at D'Arcy Street.	Provides additional security of supply for Existing Ewart Street BPS and New Zone 1 elevated tank, which serve existing population.	600,000.00	1,031	1,599,828	75%	1,199,871	-	25%	399,957
1c	D'Arcy Street	Kent Street	New Zone 1 Elevated Tank	560	Trunk on Exist. Road		Extend existing Zone 1 trunk watermain on D'Arcy Street north to New Zone 1 elevated tank and Zone 2 BPS site.	Supports both new Zone 1 elevated tank and New Zone 2 BPS.	-	1,523	852,796	50%	426,398	-	50%	426,398
Zone 1 Sub Total											**2,711,508**		**1,820,432**			**891,076**
2a	Barracks Drive	Preferred Zone 2 BPS Site	3rd Street	320	Sub-Trunk on Exist. Road		Extend Zone 2 sub-trunk watermain on Barracks Drive from New Zone 2 BPS site to existing sub-trunk watermain on D'Arcy Street at 3rd Street.	None - Supports additional pumping capacity required exclusively to support growth to build-out. 100% Growth Driven.	-	1,290	412,832	0%	-	-	100%	412,832
2b	South Limit of Existing Recreational Soccer Facilities / South Lot Line of Future Phase 2 Villages of Central Park Development	Preferred Zone 2 BPS Site	Brook Road North	510	Trunk on Fut. Road	Minor Watercourse Crossing	New Zone 2 trunk watermain along the south limit of existing recreational soccer facilities east of the preferred Zone 2 BPS site and along the south lot line of the future Phase 2 Villages of Central Park, Rondeau development property to Brook Road to supply Cobourg East.	None - Supports growth entirely.	200,000.00	1,031	725,683	0%	-	-	100%	725,683
2c	Brook Road North	Fut. Kerr Street	Elgin Street East	1420	Trunk on Exist. Road		New Zone 2 trunk watermain along Brook Road North.	None - Supports growth entirely.	-	1,523	2,162,447	0%	-	-	100%	2,162,447
2d	Fut. Brook Road North	Elgin Street East	Fut. Road Internal to Rondeau Dev.	470	Trunk on Fut. Road	Minor Watercourse Crossing	New Zone 2 trunk watermain along Fut. Brook Road North.	None - Supports growth entirely.	200,000.00	1,031	684,453	0%	-	-	100%	684,453
2e	Elgin Street East	Conger Avenue	Brook Road North	540	Trunk on Exist. Road		Extend existing Zone 2 trunk watermain along Elgin Steet to meet new Zone 2 trunk watermain on Brook Road North.	None - Supports growth entirely.	-	1,523	822,339	0%	-	-	100%	822,339
2f	Fut. Road Internal to Rondeau Dev.	Fut. Brook Road North	Greer Road	990	Trunk on Fut. Road		New Zone 2 trunk watermain through Rondeau development to supply development, New Zone 2 at-grade tanks and New Zone 3 BPS.	None - Supports growth entirely.	-	1,031	1,020,443	0%	-	-	100%	1,020,443
2g	Danforth Road	Greer Road	Nagle Road	460	Trunk on Exist. Road		New Zone 2 trunk watermain to supply development, New Zone 2 at-grade tanks and New Zone 3 BPS.	None - Supports growth entirely.	-	1,523	700,511	0%	-	-	100%	700,511
2h	Fut. Kerr Street	Brook Road North	Elgin Street East	2210	Trunk on Fut. Road	Minor Watercourse Crossing	New Zone 2 trunk watermain along Fut. Kerr Street.	None - Supports growth entirely.	200,000.00	1,031	2,477,958	0%	-	-	100%	2,477,958
2i	Fut. Kerr Street	Elgin Street East	Danforth Road	620	Trunk on Fut. Road		New Zone 2 trunk watermain along Fut. Kerr Street.	None - Supports growth entirely.	-	1,031	639,065	0%	-	-	100%	639,065
2j	Cobourg East - Fut. Mid-block Connection	Brook Road North	Fut. Kerr Street	1070	Sub-Trunk on Fut. Road		New Zone 2 sub-trunk mid-block north of Brook Creek.	None - Supports growth entirely.	-	798	853,860	0%	-	-	100%	853,860
2k	Cobourg East - South East Loop	Fut. Kerr Street	Fut. Kerr Street	1720	Sub-Trunk on Fut. Road		Zone 2 sub-trunk loop through southeast portion of Cobourg East.	None - Supports growth entirely.	-	798	1,372,560	0%	-	-	100%	1,372,560
2l	Fut. Brook Road North	Fut. Road Internal to Rondeau Dev.	Danforth Road	810	Sub-Trunk on Fut. Road		Connect to existing Zone 2 watermains.	None - Supports growth entirely.	-	798	646,380	0%	-	-	100%	646,380

2m	Danforth Road	Parkview Hills Drive	Fut. Brook Road North	1020	Sub-Trunk on Exist. Road		Connect to existing Zone 2 watermains.	None - Supports growth entirely.	-	1,290	1,315,902	0%	-	-	100%	1,315,902
2o	White Street at Cobourg Creek E. Branch	Ontario Street	Division Street	820	Sub-Trunk in Valley Land	Watercourse Crossing	Crossing of east branch of Cobourg Creek.	Provides security of supply. Upgrade mainly for existing users with incidental benefit to growth.	400,000.00	998	1,217,950	50%	608,975	-	50%	608,975
2p	White Street at Cobourg Creek W. Branch	Riddell Avenue	W. of Glenhare Street	370	Sub-Trunk in Valley Land	Watercourse Crossing	Crossing of east branch of Cobourg Creek.	Provides security of supply. Upgrade mainly for existing users with incidental benefit to growth.	400,000.00	998	769,075	50%	384,538	-	50%	384,538
2q	Cobourg East - North East Loop	Fut. Kerr Street	Fut. Kerr Street	1260	Sub-trunk on Exist. Road		Zone 2 sub-trunk loop through northeast portion of Cobourg East.	None - Supports growth entirely.		1,290	1,625,526	0%	-	-	100%	1,625,526
2r	Cobourg East - Fut. Mid-block Connection	Brook Road North	Fut. Kerr Street	920	Sub-trunk on Fut. Road		New Zone 2 sub-trunk watermain mid-block north of Fut. Kerr Street.	None - Supports growth entirely.		798	734,160	0%	-	-	100%	734,160
2s	Rogers Road/DePalma Drive	Elgin Street West	West End of DePalma Drive	800	Sub-trunk on Fut. Road		New Zone 2 sub-trunk in Cobourg West Business Park	None - Supports growth entirely.		798	638,400	0%	-	-	100%	638,400
2t	Fut. Road Internal to Rondeau Dev.	Elgin Street East	Greer Road	990	Sub-trunk on Fut. Road		New Zone 2 sub-trunk watermain through Rondeau development to supply development, New Zone 2 at-grade tanks and New Zone 3 BPS.	None - Supports growth entirely.		798	790,020	0%	-	-	100%	790,020
Zone 2 Sub Total											**19,609,562**		**993,513**			**18,616,050**
3a	West Sub-Trunk	Future Zone 3		1350	Sub-Trunk on Fut. Road		Watermain loop in Zone 3.	None - Supports growth entirely.	-	798	1,077,300	0%	-	-	100%	1,077,300
3b	East Sub-Trunk	Future Zone 3		920	Sub-Trunk on Fut. Road		Watermain loop in Zone 3.	None - Supports growth entirely.	-	798	734,160	0%	-	-	100%	734,160
Zone 3 Sub Total											**1,811,460**		**-**			**1,811,460**
Grand Total											**24,132,530**		**2,813,945**			**21,318,586**

Pumping and Storage Facility Projects

	Project Details							Estimated Project Cost (2020 $)						
Project ID	**Project**	**Location**	**Type**	**Timing**	**Existing Conditions**	**Proposed Project Description**	**Benefit to Existing**	**$/m**	**Gross Capital**	**BTE %**	**Benefit to Existing**	**Subsidies**	**Growth %**	**Net Growth Related Capital**
Ex. BPS1	Ewart Street BPS Building Maintenance	Existing Ewart Street BPS on Division at Ewart Street	Pumping	2-5 Years	Routine maintenance of finished and weather proofing items.	Normal building maintenance and upkeep including replacement of corroded door frames and roof flashing.	100% benefit to existing.	n/a	32,500.00	100%	32,500.00	-	0%	-
Ex. BPS2	Replace Ewart Street BPS Stand-By Power System	Existing Ewart Street BPS on Division at Ewart Street	Pumping	5-10 Years	230 kW stand-by generator sized for existing facility.	Replace Ewart Street BPS stand-by power system with new system sized for ultimate capacity, including new diesel generator, fuel system and automatic transfer switch.	Replaces existing 230 kW generator system.	n/a	400,000.00	50%	200,000.00	-	50%	200,000
S2a	New 5,000 m^3 Zone 1 Elevated Tank	Cobourg Community Centre Campus Lands at Rear of Buildings 18 & 19 of the Northam Industrial Park	Storage	2-5 Years	2,427 m^3 (±20%) capacity short-fall in available storage and existing Zone 1 Victoria Street elevated tank in poor condition.	Construct a 5,000 m^3 Zone 1 elevated tank to address the current need for additional Zone 1 floating storage.	Replaces existing Zone 1 Victoria Street elevated tank (1360 m^3) and addresses existing storage deficiency (2,427 m^3), therefore 76% (3,787 m^3) of volume benefits existing.	n/a	7,150,000.00	76%	5,415,410.00	-	24%	1,734,590
S2b	Decomission Existing Zone 1 Victoria Street Elevated Tank	Victoria Street north of McGuire Street	Storage	2-5 Years	Existing Zone 1 Victoria Street elevated tank in poor condition.	Decomission existing Zone 1 elevated tank in place of rehabilitation.	100% benefit to existing.	n/a	325,000.00	100%	325,000.00	-	0%	-
P4a	New Zone 2 BPS with a 120 L/s Firm Rated Capacity at Same Site as New Zone 1 Elevated Tank	Located at Same Site as New Zone 1 Elevated Tank (Legion's Field Soccer Pitch on D'Arcy Street north of Kent Street).	Pumping	2-5 Years	All Zone 2 pumping capacity provided by Ewart Street BPS, which has a capacity to pump an additional 19.6 L/s before additional pumping is required.	New Zone 2 BPS with a 120 L/s firm rated capacity at same site as New Zone 1 Elevated Tank - Brings Zone 2 firm pumping capacity to 372 L/s.	None - Additional pumping capacity is required exclusively to support a percentage of build-out. 100% Growth Driven.	n/a	1,560,000.00	0%	-	-	100%	1,560,000
P4b	Expand the Existing Ewart Street BPS to Firm Rated Capacity of 312 L/s	Existing Ewart Street BPS on Division at Ewart Street	Pumping	10+ Years	All Zone 2 pumping capacity provided by Ewart Street BPS, which has a capacity to pump an additional 19.6 L/s before additional pumping is required (2,225 persons).	Expand existing Ewart Street BPS building and add 2x pumps to provide a firm rated capacity of 312 L/s - Brings Zone 2 firm pumping capacity to 432 L/s.	None - Additional pumping capacity is required exclusively to support growth to build-out. 100% Growth Driven.	n/a	1,560,000.00	0%	-	-	100%	1,560,000
S7a	First of Two (Twin) 2,000 m^3 Zone 2 at Grade Tanks	Vicinity of Nagle Road and Danforth Road	Storage	10+ Years	3,734 m^3 of floating storage provided by exisitng Zone 2 Strathy Road elevated tank. Additional storage reqiured to support growth.	First of two (twin) 2,000 m^3 Zone 2 at Grade Tanks providing for a total of 5,734 m^3 of Zone 2 storage.	None - Additional storage capacity is required exclusively to support growth in Z2/Z3.	n/a	2,925,000.00	0%	-	-	100%	2,925,000
S7b	Second of Two (Twin) 2,000 m^3 Zone 2 at Grade Tanks	Vicinity of Nagle Road and Danforth Road	Storage	20+ Years	3,734 m^3 of floating storage provided by exisitng Zone 2 Strathy Road elevated tank. Additional storage required to support growth.	Secord of two (twin) 2,000 m^3 Zone 2 at Grade Tanks providing for a total of 5,734 m^3 of Zone 2 storage.	None - Additional storage capacity is required exclusively to support growth in Z2/Z3.	n/a	1,950,000.00	0%	-	-	100%	1,950,000

z3	New Booster Pumping Station to Supply Future Zone 3	Vicinity of Nagle Road and Danforth Road (Near Future Zone 2 at Grade Tanks)	Pumping	Phased to Development	No existing development in future pressure Zone 3 area. Pumping station required to service lands above 120m.	First Phase of new booster pumping station to supply approximately 100 L/s. Subsequent phases to supply up to 272.5 L/s firm capacity.	None - Zone 3 servicing is required exclusively to support growth. First phase required to support Ph4 & Ph5 of Rondeau Development.	n/a	3,445,000.00	0%	-	-	100%	3,445,000
S4 (Mod.)	1,360 m^3 of New In-Ground Storage at the WTP	East of Existing WTP Reservoir Cells	Storage	10+ Years		Provide 1,360 m^3 of additional in-ground storage at the WTP to provide a total of 19,000 m^3 at build-out.	None - Additional storage capacity is required exclusively to support growth.	n/a	3,120,000.00	0%	-	-	100%	3,120,000
									22,467,500		**5,972,910**	**-**		**16,494,590**

Water Treatment Projects

	Project Details						Estimated Project Cost (2020 $)						
Project ID	**Project**	**Type**	**Timing**	**Existing Conditions**	**Proposed Project Description**	**Benefit to Existing**	**$/m**	**Gross Capital**	**BTE %**	**Benefit to Existing**	**Subsidies**	**Growth %**	**Net Growth Related Capital**
WTP1	Intake Pipe Cleaning, Inspection and Upgrades		Short-term	Intake pipe last inspected in 2012 with noted sediment build-up. Chlorine and sample lines run through gate valve at low-lift pumping well. Intake crib last inspected in 2018 with some minor elements requiring repair.	Cleaning and inspection of raw water intake line, replacement of raw water sample line, replacement of chlorine solution line and repair of timber portion of intake crib.	All components required regardless of growth and considered to be benefit to existing	n/a	130,000.00	100%	130,000.00	-	0%	-
WTP2	Repair Leaking Pumphouse Roof		Short-term	Membrane style flat roof leaking due to solar panel installation.	Repair leaking pumphouse roof at locations where leaks have occurred due to solar panel installation.	Repairs required regardless of growth and considered to be benefit to existing.	n/a	By Others	100%	By Others	-	0%	-
WTP3	Provide Railing System on Retaining Walls at Shoreline		Short-term	The site is fenced, but there are no handrails on the retaining walls at the shoreline.	Provide handrails on retaining walls at shoreline.	Required regardless of growth and considered to be benefit to existing.	n/a	13,000.00	100%	13,000.00	-	0%	-
WTP4	Replace GAC Filter Media		Short-term	GAC filter media recommended for replacement on a 5-year cycle.	GAC filter media recommended for replacement on a 5-year cycle.	Required regardless of growth and considered to be benefit to existing.	n/a	520,000.00	100%	520,000.00	-	0%	-
WTP5	Improve Ventilation/Dehumidification in Backwash Pump Room		Short-term	Condensation on piping and equipment in backwash pump room.	Improve ventilation and/or dehumidification capacity in the backwash pump room.	Required regardless of growth and considered to be benefit to existing.	n/a	65,000.00	100%	65,000.00	-	0%	-
WTP6	Replace/Repair Sections of Backwash Piping		Short-term	Sections of backwash piping have developed deep pitting and corrosion.	Replace/repair the pitted and corroded sections of backwash piping.	Required regardless of growth and considered to be benefit to existing.	n/a	195,000.00	100%	195,000.00	-	0%	-
WTP7	Replace Wastewater Transfer Pumps and Provide Flow Meter on Discharge		Short-term	Existing submersible sludge pumps that transfer processed wastewater to the on-site SPS were origianlly installed in 1988 with no flow meter on discharge.	Replace wastewater transfer pumps with new pumps and install a flow meter on the wastewater discharge piping.	Required regardless of growth and considered to be benefit to existing.	n/a	97,500.00	100%	97,500.00	-	0%	-
WTP8	Upgrade Wastewater Discharge System (On-Site SPS)		Short-term	Existing on-site SPS discharge system cannot be operated effectively under all conditions due to constraints related to the existing Brook Road SPS and McGill Street SPS forcemain.	Upgrade SPS to provide discharge to the Lakeshore Road gravity sewer with provision for control of discharge rate to suite Brook Road SPS capacity.	Required regardless of growth and considered to be benefit to existing.	n/a	650,000.00	100%	650,000.00	-	0%	-
WTP9	Replace Chlorine Storage Room Monorail and Hoist		Short-term	Existing hoist/monorail inspected annually but in poor condition and in need of immediate replacement.	Replace chlorine storage room hoist and monorail with new system.	Required regardless of growth and considered to be benefit to existing.	n/a	65,000.00	100%	65,000.00	-	0%	-
WTP10	Replace Surge Valve on Highlift Pumping Station Discharge		Short-term	Surge anticipating valve on the common highlift discharge header has a minor leak that requires repair. Given the age of the valve it is recommended to replace the valve.	Replace highlift pumping station surge valve with a new valve.	Required regardless of growth and considered to be benefit to existing.	n/a	39,000.00	100%	39,000.00	-	0%	-
WTP11	Relocate Chlorine Residual Sampling Points		Short-term	Sampling point upstream of chlorine contact tank inlet weir occasionally picks-up unchlorinated water from the backwash well and the elevation of the chlorine sample point in the reservoir is set at an elevation that limits the total usable volume.	Relocate sampling point upstream of chlorine contact points to the downstream side of the weir and relocate chlorine sampling point in reservoir to a lower elevation.	Required regardless of growth and considered to be benefit to existing.	n/a	32,500.00	100%	32,500.00	-	0%	-
WTP12	Replace WTP SCADA Computers		Short-term	Existing SCADA computers have been in service for 5+ years.	Replace WTP SCADA computers.	Required regardless of growth and considered to be benefit to existing.	n/a	32,500.00	100%	32,500.00	-	0%	-
WTP13	Replace SCADAPack 32 PLCs at Ewart Street BPS		Short-term	SCADAPack 32 software used at remote locations (elevated tanks and BPS) is no longer well supported and should be replaced in the next 2-3 years.	Replace SCADAPack 32 PLCs at Ewart Street BPS.	Required regardless of growth and considered to be benefit to existing.	n/a	97,500.00	100%	97,500.00	-	0%	-
WTP14	Replace SCADAPack 32 PLCs at Zone 2 (Strathy Road) Elevated Tank		Short-term	SCADAPack 32 software used at remote locations (elevated tanks and BPS) is no longer well supported and should be replaced in the next 2-3 years.	Replace SCADAPack 32 PLCs at Zone 2 (Strathy Road) Elevated Tank.	Required regardless of growth and considered to be benefit to existing.	n/a	65,000.00	100%	65,000.00	-	0%	-
WTP15	Replace Low Lift Pump Discharge Valves		Long-term	Plan for replacement on a 20-year cycle.	Replace low lift pump discharge valves on a regular 20-year cycle as required.	Required regardless of growth and considered to be benefit to existing.	n/a	156,000.00	100%	156,000.00	-	0%	-
WTP16	Refurbish Low Lift Pumps		Long-term	Plan for refurbishment on a 10-year cycle.	Refurbish low lift pumps on a regular 10-year cycle as required.	Required regardless of growth and considered to be benefit to existing.	n/a	130,000.00	100%	130,000.00	-	0%	-
WTP17	Replace Alum Tanks (2)		Long-term	Alum tank #1 recently repaired. Monitor tanks actively for leakage and plan for future replacement.	Replace alum tanks with wooden stave tanks with flexible PVC liners or provide larger openings (doors) to accommodate single piece FRP tanks.	Required regardless of growth and considered to be benefit to existing.	n/a	260,000.00	100%	260,000.00	-	0%	-
WTP18	Replace Turbidimeters		Long-term	Turbidimeters last replaced in 2017. Plan for replacement on 10-year cycle.	Replace turbidimeters on a regular 10-year cycle as required.	Required regardless of growth and considered to be benefit to existing.	n/a	78,000.00	100%	78,000.00	-	0%	-
C5	Provide Redundant Dissolved Air Floatation Clarification System - Option C5		Long-term	Existing single circular upflow clarifier approaching the end of its useful life and provides no redundancy.	Five train dissolved air floatation (DAF) clarifier system constructed north of chlorine contact tanks.	Existing clarifier replacement accounts for 50% of cost. Adequate capacity for redundancy at full build-out accounts for 50% of cost.	n/a	8,320,000.00	50%	4,160,000.00	-	50%	4,160,000
C5	Provide Third Filter Train - Option C5		Long-term	Existing two train GAC filtration system functions adequately at present, but does not provide redundancy at build-out.	Provide third filter train in location of existing clarifier.	No benefit to existing, under existing conditions existing filter trains (two) provide adequate redundancy.	n/a	3,510,000.00	0%	-	-	100%	3,510,000

WTP19	Replace Supernatant Discharge Pumps		Long-term	Supernatant discharge pumps operating well, but have not been replaced since original install in 1988. Plan for replacement within next 10-years.	Replace supernatant pumps installed in 1988.	Required regardless of growth and considered to be benefit to existing.	n/a	26,000.00	100%	26,000.00	-	0%	-
WTP20	Equip High-lift Pumps HLP #1 & HLP #2 with VFDs		Long-term	HLP #1 and HLP #2 operate at fixed speed. HLP #3, HLP #4 and HLP #5 are already equiped with VFDs.	Equip high-lift pumps HLP #1 and HLP #2 with VFDs including the provision of an invert duty motor for HLP #2.	Required regardless of growth and considered to be benefit to existing.	n/a	130,000.00	100%	130,000.00	-	0%	-
WTP21	Replace High-lift Pump Discharge Butterfly Valves & Controls		Long-term	Existing valves and controls operating with no issues. Plan to replace in future as needed.	Replace high-lift pump discharge valves and controls on a regular 20-year cycle as required.	Required regardless of growth and considered to be benefit to existing.	n/a	260,000.00	100%	260,000.00	-	0%	-
WTP22	Refurbish High-Lift Pumps		Long-term	Plan for refurbishment on a 10-year cycle.	Refurbish high-lift pumps on a regular 10-year cycle as required.	Required regardless of growth and considered to be benefit to existing.	n/a	156,000.00	100%	156,000.00	-	0%	-
WTP23	Replace Low-Lift and High-Lift Pump Level Transmitters		Long-term	Existing instrumentation replaced in 2019.	Plan for replacement of low-lift and high-lift level transmitters on a 10-year cycle.	Required regardless of growth and considered to be benefit to existing.	n/a	260,000.00	100%	260,000.00	-	0%	-
WTP24	Replace Intake Crib Structure		Future	Intake structure has been previously repaired with certain elements replaced with wooden timbers.	Replace intake crib structure.	Required regardless of growth and considered to be benefit to existing.	n/a	975,000.00	100%	975,000.00	-	0%	-
WTP25	Construct Dividing Wall within High-Lift Pumping Well		Future	High-Lift pumping well is currently a single structure and cannot be taken out of service for inspection, repair and maintenance.	Construct dividing wall within the high-lift pumping well with a second supply connection to the high-lift pumps to allow cells to operate independently.	Required regardless of growth and considered to be benefit to existing.	n/a	650,000.00	100%	650,000.00	-	0%	-
WTP26	Replace WTP SCADA System		Future		Replace complete SCADA system.	Required regardless of growth and considered to be benefit to existing.	n/a	390,000.00	100%	390,000.00	-	0%	-
								17,303,000		**9,633,000**			**7,670,000**

Summary

Project Category	Gross Capital	BTE %	Benefit to Existing	Subsidies	Growth %	Net Growth Related Capital
Linear Watermain Projects	24,132,530.00	12%	2,813,944.50	-	88%	21,318,586
Pumping & Storage Projects	22,467,500.00	27%	5,972,910.00	-	73%	16,494,590
Water Treatment Projects	17,303,000.00	56%	9,633,000.00	-	44%	7,670,000
Grand Total	**63,903,030.00**	**29%**	**18,419,854.50**	**-**	**71%**	**45,483,176**