CORPORATION OF THE CITY OF
CLARENCE-ROCKLAND
SPECIAL COMMITTEE OF THE WHOLE MEETING

April 30, 2018, 7:15 pm
Council Chambers
415 rue Lemay Street, Clarence Creek, Ont.

CORPORATION DE LA CITÉ DE
CLARENCE-ROCKLAND
RÉUNION SPÉCIALE DU COMITÉ PLÉNIER

le 30 avril 2018, 19 h 15
Council Chambers
415 rue Lemay Street, Clarence Creek, Ont.

Pages

REPORT N° ADMIN2018-012

Date	30/04/2018
Submitted by	Helen Collier, Chief Administrative Officer
Subject	Fire Stations (Rockland and Bourget)
File N°	Click here to enter text.

1) **NATURE/GOAL :**
To approve the construction of the Rockland and Bourget combined Fire Paramedic stations.

2) **DIRECTIVE/PREVIOUS POLICY :**
N/A

3) **DEPARTMENT'S RECOMMENDATION :**
QUE le comité plénier recommande au conseil municipal d'adopter un Règlement pour autoriser le maire et la greffière à signer un contrat avec Asco au montant de 8 112 586 $ plus HST pour effectuer les travaux de construction des stations combinées d'incendie et de services paramédicaux de Rockland et de Bourget, tel que recommandé; et

QUE le directeur des services de la Protection soit autorisé à dépenser 120 000$ sur le contenu nécessaire pour les casernes; et

QU'une délégation de pouvoir soit accordée à la directrice générale afin de dépenser les fonds restants de la contingence sur les items jugés nécessaires, identifiés dans les annexes 1 et 2 du rapport ADM2018-012.

THAT the Committee of the whole hereby recommends that Municipal Council adopt a By-Law to authorize the Mayor and the City Clerk to sign a contract with Asco in the amount of $8,112,586 plus HST for the construction of the Rockland and Bourget combined Fire Paramedic stations, as recommended; and

THAT the Director Protective Services be authorised to spend $120,000 on the necessary contents for the stations; and

THAT the Chief Administrative Officer be delegated the authority to spend any remaining contingency funds on the items listed in Attachment 1 and 2 of Report ADM2018-012 that are deemed necessary.

4) **BACKGROUND :**

These two Fire station projects have been identified as a need for expansion in the approved 2015 development charges study. They were also identified in the Fire Service Master plan as being in need of expansion and repair. Our 3rd station in Clarence Creek was also identified in these studies requiring the same attention just a few years out. Following the study budgeted funds were identified in the 2015 Capital Budget for Rockland and in the 2017 budget for Bourget. Almost 2 years passed while the municipality undertook to expropriate the property adjacent to City Hall to allow enough room for the construction. Then on May 1st 2017, Council approved Collier's International as the expert consultants to manage the overall project.

Once the expropriation was cleared Council reviewed the draft station proposal on June 5th 2017. Staff returned with a revised report in September 6th, 2017. During the fall Collier's International pre-qualified builders to expedite the tendering process. On December 4, 2017 Council adopted the memorandum of agreement with the United Counties regarding moving forward with construction of the paramedic centre.

The 2018 budget was adopted on Dec. 18, 2018 with the total amount approved for both projects at $9,530,000. On Jan. 9th, 2018 the tender documents were sent out to the 9 pre-qualified builders requesting design build proposals.

5) **DISCUSSION :**

These combined Fire and Paramedic stations will provide increased service delivery to our Clarence-Rockland ratepayers. In Rockland the Fire station will be better equipped and able to house the departmental staff.

It will include improved health and safety features, such as diesel exhaust capture system and specialized washing machines to properly clean bunker gear. It will have safe storage of bunker gear. It will also provide a space for training, which will serve as an Emergency operations centre for future emergencies. In the last 12 months, two emergencies have occurred in Clarence-Rockland, the flood of 2017 and the ice storm of 2018. The station will be powered by back up generator, which is essential during an emergency. As well it will include a fitness facility space and the equipment will bein supplied by the Volunteer Fire Fighter association.

In Bourget, the current Fire station is not adequate. The new station will allow for the same safety features as in the Rockland station as well as sufficient space for vehicles a fitness centre, safe storage of equipment and a training facility. The training facility will serve as a regional training centre. The paramedic service in the new Rockland station will see additional vehicles. In Bourget, the paramedics do not have a station. Currently, an ambulance idles outside and occasionally accesses the Fire station for services. Now they will have space for 2 ambulances to serve our southern end of the municipality. Clarence–Rockland has the potential to grow to almost 40,000 residents by 2040. These two stations will be there to serve the community well.

These projects will provide essential paramedic and fire services to the municipality of Clarence-Rockland. Bringing the paramedic station into the City core will assist in improving response times. The paramedic station will increase the number of ambulances available in Rockland and will provide ambulance service to the south end of the municipality from the Bourget station which currently does not exist.

The location of the Fire Stations was addressed in the Fire Service Master Plan study as being adequate to serve the ratepayers. The Rockland Fire station has already been identified as a very desirable site. It is close to the municipality's older homes, industrial park and county road 17. The Bourget station is in the core of Bourget and has immediate access to Russell Road.

On January 9th, 2018, the RFP was sent out by invitation to the 9 pre-qualified builders /Contractors: Asco, Laurin, Assaly, Daniel Côté, Frecon and Grant Marion Construction.

On March 8th, 2018, 4 qualified bids were received from the following Contractors. Asco, Laurin, Frecon and Grant Marion Construction. Nine (9) addendums were issued to provide additional clarity throughout the process.

The proposals were evaluated on a 2-tier point system. The point system was 50% technical and 50% price. The technical points were assigned based on the following:

- Project Understanding, Methodology and Delivery Plan (15%)
- Proposed Project Delivery Team (15%)
- Design Approach (10%)
- Construction Approach (5%)
- Completeness and Quality of Proposal (5%)
- Price Proposal (50%)

The evaluation team consisted of the following members:

- Brian Wilson, Director of Protective Services

- Luc Frechette, Consulting Engineer from Collier's International; and
- Pierre Jolicoeur, Facility Expert.

Resulting scores of the evaluation:

In summary Asco and Laurin had competitive bids providing sound technical proposals. The pricing however was significantly different and ASCO won because they provided the most competitive bid.

In the table below you can see the results of the review team. The highest points we assigned to ASCO construction overall. All of the bid proposals were over the approved budget.

TABLE ONE FIRE /EMS STATION EVALUATION POINT SCORES				
	Asco	Frecon	Grant Marion	Laurin
Technical Score	32.9	15.6	10.8	39.5
Financial Score	50.0	42.6	46.2	37.4
Total	82.9	58.2	57.0	76.9

Since all of the submissions were over budget The City of Clarence-Rockland met with the proponent that had the most points and began an extensive value engineering exercise. "**Value engineering** (VE) is a systematic method to improve the "**value**" of goods or products and services by using an examination of **function**. **Value**, as defined, is the ratio of **function** to cost. **Value** can therefore be increased by either improving the **function** or reducing the cost."

This review exercise was conducted by a team. That team included the project manager and engineer, Luc Frechette, Engineering Consultant, Dave Darch, Director of Protective Services, Brian Wilson, Deputy Fire Chief, Mario Villeneuve, CAO, Helen Collier, Purchasing Manager Gerry Lalonde and the proponent. The team worked to adjust the quantities and substances pricing to bring the project within budget. There are a number of items that were adjusted to reduce the bid amount to meet budget. The items that have been eliminated or changed are not critical to service delivery day one. It would be desirable to reintroduce some of the items if the budgeted contingency is available.

The financial results of the review exercise are illustrated in the table below:

TABLE ONE FIRE /EMS STATION FINAL BUDGET			
STATION CONSTRUCTION	LOWEST BID	REVISED PRICE = BUDGET	VALUE ENGINEERED REDUCTIONS
1) Rockland Fire/ EMS	5,558,242	4,851,567	-706,675
2) Bourget Fire /EMS	4,163,000	3,261,019	-901,981
Sub-total	**9,721,242**	**8,112,586**	**-1,608,656**
1) HST * 1.8%	174,982	146,027	-28,955
Sub-total	**9,896,224**	**8,258,613**	**-1,637,611**
OTHER EXPENSES			
1) Contingency	972,124	405,629	-566,495
2) Previously Committed	746,427	746,427	0
3) Station Contents (Fire Only)	120,000	120,000	0
Sub-total	**1,838,551**	**1,272,056**	**-566,495**
GRAND TOTAL	**11,734,775**	**9,530,669**	**-2,204,106**

STATION CONSTRUCTION

To achieve the budget adjustments were made totalling $1.6M. The list of adjustments can be found in Attachment "1" (Rockland Station) and

Attachment “2” (Bourget Station). The significant items that created the most savings were changing from a steel truss to prefabrication construction method, landscaping, and eliminating the hose tower in Bourget. Landscaping saving were significant because the buildings were repositioned, this significantly reduced the amount of asphalt required around the stations. Other noteworthy adjustments include not co-locating by-law employees, eliminating some security and eliminating the detox option (sauna). Subsequently there is a reduction in the amount of HST paid by $28,955.

OTHER EXPENSES

The adjustment of the project contingency from 5% to 10% saves $405k. At this stage in the project, many factors that require a contingency have been eliminated: soil-testing phase 1 and 2, elevations and aggressive pricing. Both the project management firm and the proponent agree that a 5% contingency is sufficient at this time.

The amount of $746,427 included the expropriations costs, land purchase, project management, surveys, soil testing.

The amount of $120,000 (approximately $60,000 per station) is the allowance to purchase station contents such as furniture, filing cabinets, training a screens, appliances, specialized laundry machines to clean bunker gear

TIMING

This project is scheduled to be approved by Council on May 7th following the discussion and review by committee of the Whole on April 30th, 2018. Work will commence immediately. Occupancy is expected in the spring of 2019. Any delays in the project may force winter construction, which would have an impact on the cost.

3) **CONSULTATION:**
N/A

4) **RECOMMENDATIONS OR COMMENTS FROM COMMITTEE/ OTHER DEPARTMENTS :**
N/A

5) **FINANCIAL IMPACT (expenses/material/etc.):**

The following summarizes the budget approved by Council and the financing:

Budget Summary	Rockland	Bourget	Total	
Fire station	$ 3,850,000	3,000,000	$6,850,000	
EMS	2,110,914	569,755	2,680,669	
Total costs	$ 5,960,914	3,569,755	$9,530,669	
Rockland Financing	Amount	Annual debt charge	Operating costs	Tax impact
Development charges financing	$ 2,310,000	140,157		-
Debt financing	1,540,000	93,438	30,000	0.65
UCPR recovery	2,110,914	128,078		-
	$ 5,960,914	361,673	30,000	0.65
Bourget Financing				
Development charges financing	1,800,000	109,213		-
Debt financing	1,200,000	72,809	15,000	0.46
UCPR recovery	569,755	34,569		-
	3,569,755	216,591	15,000	0.46

The table below summarizes how the total budget of $9,530,669 is allocated.

Previously committed	$ 746,427
Construction contract	$ 8,112,586
HST (1.8%)	$ 146,027
Project Contingency	$ 405,629
Non-construction items	$ 120,000
Total	**$ 9,530,669**

6) **LEGAL IMPLICATIONS :**
N/A

7) **RISK MANAGEMENT :**
N/A

8) **STRATEGIC IMPLICATIONS :**
N/A

9) **SUPPORTING DOCUMENTS:**
Attachment 1 – Rockland Station – Reductions made to proposal
Attachment 2 – Bourget Station – Reductions made to proposal

City of Clarence-Rockland

Fire / Paramedic Rockland Station

Reductions made to proposal

#	Adjustment - Description	$ Amount
1	Change from Steel truss to prefabrication	181,847
2	Landscaping, less asphalt, grass & shrubs, no flagpoles, curbs, retaining wall, Fill, fencing	172,708
3	Remove Building Automation System	58,500
4	Security / Antennas	56,200
5	Remove Infloor heating	32,300
6	Eliminate Linolieum and carpet floors and replace with polished concrete	29,250
7	Change exterior doors to steel instead of FRP	27,560
8	Equipment (pressure washer for trucks range hood, lockers)	26,735
9	Reduced Square Footage	25,000
10	Reduce AV equipment and scope of Work	16,000
11	Remove Folding Partion in Classroom	15,300
12	Remove windows above Garage doors	14,640
13	Washroom Finishes	10,334
14	Remove grey water tank systems	9,000
15	Reduce Financial Bonding	7,940
16	Grant for energy incentives	7,500
17	Detox unit / Sauna	5,114
18	Remove energy modeling	4,480
19	Remove Interior Décor (Blinds & consultant)	3,717
20	Elecricity Savings	2,550
	TOTAL REDUCTIONS	706,675

City of Clarence-Rockland

Fire / Paramedic Bourget Station

Reductions made to proposal

#	Adjustment - Description	$ Amount
1	Landscaping, less asphalt, grass & shrubs, no flagpoles, curbs, retaining wall, Fill, fencing	183,706
2	Change to prefabrication	152,851
3	Remove Hose Tower	130,000
4	Change from Steel truss to Wood	104,180
5	Remove Building Automation System	58,500
6	Security / Antennas	42,050
7	Price amendments	35,000
8	Change exterior doors to steel instead of FRP	31,640
9	Remove Infloor heating	23,800
10	Equipment (pressure washer for trucks range hood), lockers	19,239
11	Reduce AV equipment and scope of Work	17,550
12	Eliminate Linolieum and carpet floors and replace with polished concrete	13,500
13	Remove windows above Garage doors	11,280
14	Change to Non drive thru bays	10,780
15	Remove second hydrant	10,568
16	Reduced Square Footage	10,000
17	Remove grey water tank systems	9,000
18	Washroom Finishes	8,234
19	Grant for energy incentives	7,500
20	Reduce Financial Bonding	6,060
21	Detox unit / Sauna	5,114
22	Remove Storage Building	4,500
23	Remove energy modeling	4,480
24	Remove Interior Décor (Blinds & consultant)	2,450
	TOTAL REDUCTIONS	901,982

REPORT N° INF2018-027 Water Supply to the Nation

Date	30/04/2018
Submitted by	Julian Lenhart
Subject	Water Supply to the Nation
File N°	INF2018-027

1) **NATURE/GOAL :**
The purpose of this report is to obtain authority from Council to enter in a memorandum of understanding with the Nation to supply water to the City of Limoges.

2) **DIRECTIVE/PREVIOUS POLICY :**
On March 6th 2017, Council approved a resolution to undertake an assessment of the City's ability to address potable water supply needs for both the City of the Clarence-Rockland (The City) and The Nation Municipality.

3) **DEPARTMENT'S RECOMMENDATION :**
WHERE AS the Clarence-Rockland and Limoges Water Servicing Study is complete and that the Department recognizes significant advantages in proceeding with this project.

THAT Council authorizes the Director of the Infrastructure and Planning to execute a Memorandum of Understanding with the Nation Township to supply potable water to the City of Limoges.

AND THAT Council authorizes the Director of Infrastructure and Planning to retain legal services in order to negotiate the terms and conditions of the Memorandum of Understanding on behalf of the City of Clarence-Rockland.

ATTENDU QUE l'étude *Clarence-Rockland and Limoges Water Servicing Study* est terminée et que le Département reconnaît des avantages importants dans la réalisation de ce projet.

QUE le conseil autorise le directeur de l'Infrastructure et l'aménagement du territoire à signer un protocole d'entente avec la municipalité de la Nation afin de fournir de l'eau potable à la ville de Limoges.

ET QUE le conseil autorise le directeur de l'Infrastructure et l'aménagement du territoire à retenir les services juridiques afin de négocier les termes et les conditions du protocole d'entente au nom de la Cité de Clarence-Rockland.

4) **BACKGROUND :**

On March 6th 2017, Council approved a resolution to undertake an assessment of the City's ability to address potable water supply needs for both the City of the Clarence-Rockland (The City) and The Nation Municipality. Following Councils resolution, Reports INF2017-032 was presented to Council on April 17, 2017 detailing the requirements of the analysis and requesting the authority to retain the services of CH2M to undertake this analysis. Council authorised the Department to retain the services of CH2M. This report is attached for reference.

The final draft of the study was submitted on January 19, 2018. The analysis assessed the following conditions:

- The City's existing water distribution system and its ability to supply its projected future water demands;
- Whether the City's water system could be expanded to include the community of Limoges;
- The required capital upgrades, costs and timing to service the City alone;
- The required capital upgrades, costs and timing to service the City plus Limoges;
- The cost sharing of the capital upgrades between Municipalities.

Throughout this process, both the City and the Nation staff regularly consulted and met in order to coordinate and shape the outcomes of the analysis. Report INF2018-001 was presented to Council on February 2, 2018 to provide Council with an update on the water supply project. Report is attached for reference.

5) **DISCUSSION :**

The project consists of installing approximately 10 km of watermain from the Cheney water reservoir along Indian Creek Road to the Nation's existing water treatment plant in Limoges along Limoges Road. Refer to the key map attached in Appendix "A" for the City's existing water network layout and the preliminary water supply layout alternative to service Limoges. Subsequent to the construction of the watermain, the City's existing infrastructure will require capital improvements to meet both Municipalities development needs.

With completion of the analysis, the next step is to proceed with the Memorandum of Understanding (MoU). The MoU will establish the agreed upon principles of the common line of actions between Municipalities. The MoU is not a legal binding contract between Municipalities, however, it allows the project to proceed while a formal agreement is negotiated between both Municipalities. The Department recommends that the following principles form part of the MoU;

- Capital upgrades and cost share percentages between Municipalities
- Front ending agreement
- Bulk rate

Capital upgrades and cost distribution between Municipalities

Table 1.1 identifies the required capital upgrades, costs and timing to service the City alone.

Table 1.1. Infrastructure Implementation Schedule – City alone

Time Period	**Estimated Cost (millions)**		**Projects**
	Total	**Clarence-Rockland**	
2017-2022	$0.46	$0.46	• New Watermain: Zone 1, St. Jean between Patricia and Dr. Corbeil
2023-2027	$22.12	$22.12	• Rockland Waste Water Treatment Plant Upgrades • New Watermain – Caron Booster Station to Bouvier Rd. and Labonte St. • Replace Watermain – Zone 1 – Edwards St: Rockland Waste Water Treatment Plant to County Road 17 (East Pipe)
2028-2032	$0	$0	-
2033-2037	$-	$0	-
2038-2042	$0	$0	-
Beyond 2042	$6.46	$6.46	• Caron Booster Station Upgrades • New Watermain – Bouvier Rd. and Labonte St. to Bouvier ET • Replace Watermain – Zone 1 – Caron St: Dr. Corbeil to Caron BS
Total	**$29.04**	**$29.04**	

Table 1.2 identifies the required capital upgrades, costs and timing to service the City plus Limoges and the average cost sharing of capital upgrades between Municipalities.

Table 1.2. Infrastructure Implementation Schedule – Scenario 2 – City plus Limoges

Time Period	Estimated Cost (Million)					Projects
	Total	Clarence-Rockland	Cost Share %	Limoges	Cost Share %	
2017-2022	$24.67	$6.18	40%	$18.49	60%1	• Caron BS Upgrades • New Watermain – Caron BS to Bouvier Rd. and Labonte St. • New Watermain – Bouvier Rd. and Labonte St. to Bouvier ET • New Watermain – Cheney ET to Limoges • New Watermain: Zone 1, St. Jean between Patricia and Dr. Corbeil • Replace Watermain – Zone 1 – Caron St: Dr. Corbeil to Caron BS
2023-2027	$16.06	$10.35	72%	$5.71	28%	• Rockland WTP Upgrades • Replace Watermain – Zone 1 – Edwards St: Rockland WTP to County Road 17 (East Pipe)
2028-2032	$3.61	$0.72	23%	$2.89	77%	• New Bouvier BS
2033-2037	$11.45	$0.52	5%	$10.93	95%	• New Watermain – Bouvier BS to Cheney ET
2038-2042	$0.44	$0	0%	$0.44	100%	
Beyond 2042	$0.44	$0	0%	$0.44	100%	
Total	**$56.67**	**$17.77**	**32%**	**$38.89**	**68%**	

As shown in table 1.2, the average total cost share percentages each Municipality will bare is 32% for the City and 68% for the Nation. The Department recommends that the cost percentages a shown in table 1.2 be included as a founding principle in the MoU.

The cost sharing rationale is based on which Municipality benefits the most from the capital upgrade. In general, capital upgrades north of Clarence-Creek benefit the City more than they do the Nation and therefore, the City bares a higher cost for these capital upgrades. An example of this is the upgrades to the Rockland Water Treatment Plant, the City's share of the cost is 66% and the Nation's is 34%. This is also true of capital upgrades south of Clarence-Creek, where the

Nation bares a higher cost for these upgrades. Refer to Table 6-8 in the Clarence-Rockland and Limoges Water Servicing Study attached in Appendix "B" for the cost distribution for each capital upgrade.

Front Ending Agreement

When comparing the City's cost and the timing of capital upgrades in table 1.1 and 1.2, the City saves $11.27 million over 20 years by supplying water and sharing capital upgrade costs with the Nation. However, the City must advance by 10 years (costs from 2027 advanced to 2017) $5.72 million of capital upgrades to service the City plus the Nation. In order to mitigate the City's risks and costs, the Department recommends that a front ending agreement be included as a founding principle in the MoU. The front ending agreement will require the Nation Municipality to bare the cost of advancing $5.72 million while The City will pay back the Nation over 10 years.

Bulk Rate

The Department recommends that the City charge to the Nation a bulk rate of $\$1.2811/m^3$, equal to the variable water fee charged to the City's ratepayers. The bulk rate includes the City's fixed and variable operating costs of producing and supplying water. The Bulk rate will be revised and adjusted annually to match the City's variable water fee calculated during each budget. The Department recommends that the bulk rate be included as a founding principle in the MoU.

Advantages,

The Department recognises significant advantages in proceeding with this project and thus, recommends retaining legal services to proceed with the MoU for the following reasons:

- Overall capital savings of $11.27 million over 20 years
- Front Ending Agreement will offload the risks and debt financing cost of advancing capital upgrades to the Nation
- The bulk rate will pay for additional fixed and variable operating costs of producing water
- Nation receives a reliable and safe source of potable water for the residents of Limoges.

6) **CONSULTATION:**

City Staff has regularly met and consulted with the Nation staff in order to coordinate and shape the outcomes of the analysis.

7) **RECOMMENDATIONS OR COMMENTS FROM COMMITTEE/ OTHER DEPARTMENTS :**

N/A

8) **FINANCIAL IMPACT (expenses/material/etc.):**

The City’s capital upgrade costs are development related and will be founded by development charges. As such, the cost will be included in the 2019 development charge study.

A budget for legal services was approved during the 2018 operations budget. As such, the legal fees incurred to execute the Memorandum of Understanding and to negotiate the terms and conditions of an agreement will be paid through the operations budget and funded from the water reserve fund.

The intent with the bulk rate is that the City has no financial impact from additional operating costs of producing and supplying water to service both the City’s and the Nation’s future development needs.

9) **LEGAL IMPLICATIONS :**

Legal services are required to execute a Memorandum of Understanding and to negotiate the terms and conditions of a formal agreement between both Municipalities.

10) **RISK MANAGEMENT :**

The water upgrades will allow the City to address the impact of committed development and future growth on the City's key water treatment and distribution infrastructure. This will ensure that consumption demands for future growth are addressed.

11) **STRATEGIC IMPLICATIONS :**

In view of the partnership approach with The Nation Municipality, the study proposed in this report will enable the municipality: (a) to identify its future water supply and distribution needs inclusive of financing strategies in advance of implementation pressures and (b) enable the City of work in a cooperative venture and longer-term water needs.

12) **SUPPORTING DOCUMENTS:**

- Attachment 1 : Report INF2017-032
- Attachment 2 : Report INF2018-001
- Attachment 3 : Key Map
- Attachment 4 : Clarence-Rockland and Limoges Water Servicing Study

REPORT N° INF-2017-032

Date	19/04/2017
Submitted by	Dave Darch
Subject	INF2017-032 Nation Water Study.docx
File N°	INF-2017-032

1) NATURE/GOAL :

The purpose of this report is to appoint a consultant to undertake a water supply analysis of the City's water treatment and distribution systems taking into consideration a request from The Nation Municipality to provide water for their purposes.

2) DIRECTIVE/PREVIOUS POLICY :

At its' March 6, 2017 meeting, Council endorsed a resolution to undertake an assessment of the City's ability to address potable water supply needs of the Nation Municipality. The Nation Municipality similarly adopted a resolution to partner with the City in this initiative. A copy of both of these resolutions is enclosed in Attachment 1.

3) DEPARTMENT’S RECOMMENDATION :

THAT the Committee of the Whole recommends that Council supports that the services of CH2M be retained to undertake the water supply study as detailed in Report No. INF-2017-032; and

THAT the City’s share of this study of $ 23,000, including HST, be funded from the Development Charges.

QUE le Comité plénier recommande que le Conseil approuve que les services de CH2M soient retenus pour entreprendre l'étude sur l'approvisionnement en eau tel que détaillé au Rapport No. INF-2017-021; et

QUE la part de la Cité pour cette étude de 23 000 $, incluant la TVH, soit financée par les frais de développement.

4) **BACKGROUND :**

Based on current water consumption demands, staff advises the City should be initiating a water capacity and upgrade review of its water treatment plant and distribution system within the next 12-24 months. It is, therefore, timely to initiate this assessment at this time not only to quantify the City's future water needs and expansion requirements but, as well, to assess the feasibility of providing potable water to The Nation Municipality.

It is necessary to undertake an assessment of the City's existing infrastructure and water demands taking into account future growth projections, committed development and special initiatives such as the looping of the Clarence Creek and Bourget water mains. The "needs" of The Nation Municipality will then be superimposed into the City's initial assessment to determine the magnitude, scope, cost and timing of required operational and capital upgrades.

It has been agreed between the two parties that the cost of this assessment will be shared equally at this point in time. The gross estimated cost of the assessment is $46,000.00 (EXCL) H.S.T. The City will be the contracting authority.

Historically, CH2M was responsible for the upgrade and expansion of the Rockland Water Treatment Plant from 6 to 13 MLD in 2003, which included a complete replacement of the main treatment processes and upgrades to the raw and treated water pumping. This part of the project also included the construction of a new water boosting pumping station and elevated water storage tank. CH2M completed the modeling, design, and services during construction.

In 2010, the City retained CH2M to undertake a similar assessment of its water supply and distribution needs to evaluate an initial request by The Nation Municipality. This analysis concluded that upgrades were required to most of the water production and conveyance infrastructure from Rockland to Cheney.

However, extensive changes have occurred to the City's water system since that time and there is a need to update the City's demand projections. As such, a reanalysis is now required with respect to the 2010 assessment.

5) **DISCUSSION :**

In order to initiate the demand assessment, it will be necessary to retain a consultant to undertake the analysis. As noted above, CH2M was retained by the City to undertake the 2010 water supply and distribution assessment. The firm has a detailed working knowledge of the City's water infrastructure. The firm provided a good level of service in carrying out the 2010 analysis. CH2M is identified in the City's Standing Offer list and based on their knowledge and familiarity with the City's water infrastructure; represent an ideal appointment to undertake the proposed demand assessment.

The criteria for a Standing Offer appointment provides that the Department is able to select a firm from the list providing the total cost of the assignment is less than $50,000. This particular assignment has an estimated cost of $46,000.00(EXCL H.S.T).

The proposed study will comprise 5 tasks:

Task 1: Project Management:

The consulting firm will provide a qualified project management team with an extensive background in similar municipal water client studies. A Steering Committee will be formulated comprising representatives from the City of Clarence-Rockland, The Nation Municipality and the consultant. Regular meetings will be convened throughout the study period with at least one status report being directed to Committee of the Whole/Council. A detailed schedule will be developed by the project Steering Committee.

Task 2-Background Data Collection and Review:

This activity will require the preparation of a background data summary document with respect to the water treatment plant and distribution system and will rely upon a hydraulic model, GIS data, SCADA data, planning data etc.
Updates to water demand projections based on planning data for population and employment will be completed. This phase of the study will also include the collection and review of historical flow monitoring data from the water treatment plant and the booster pumping station.

Task 3-Hydraulic Model Development and Analysis

A base condition hydraulic model will be developed to assess the following future water demand scenarios:

- 2016: Existing Clarence-Rockland Demands + The Nation Municipality Demands of 500m^3/day;
- 2022: 2022 Clarence-Rockland Demands + The Nation Municipality Demands of 1,000 m^3/day;
- 2030: 2030 Clarence-Rockland Demands + The Nation Municipality Demands of 1,500 m^3/day;
- 2038: 2038 Clarence-Rockland Demands + The Nation Municipality Demands of 2,000 m^3/day;
- 2048: 2048 Clarence-Rockland Demands + The Nation Municipality Demands of 4,500 m^3/day.

This will use forecasted growth data provided by the Planning Division.

The model will assess the impacts to the water distribution system of The Nation Municipality's water demands that are over and above those required for the projected Clarence-Rockland demands. Potential upgrade scenarios will be identified and costed for 2016 to 2048 inclusive of transmission mains, booster pumping and storage requirements.

Task 4-Assessment of Water Treatment Facility

Based on the after mentioned analyses, this activity will identify required upgrades and costs to increase the capacity of the City's water treatment facility and The Nation Municipality’s demands.

Task 5- Technical Memorandum and Cost Estimates

This activity will comprise a consolidation of the results of the hydraulic model analysis and the water treatment facility assessment in the form of a technical memorandum. Cost estimates inclusive of cost-sharing scenarios will be developed and included in this memorandum.

A Capital Works Plan will be developed including cost estimates and timing of the recommended infrastructure. Upgrades to the treatment facility and the distribution system (which could include pump station, water mains and storage) will be identified*. The cost estimates will be at a Class 'D' level (i.e. conceptual level estimates).*

In some cases, the existing infrastructure may not need to be upgraded to service The Nation Municipality demands; however the City of Clarence-Rockland will still be giving up spare capacity in the infrastructure. The cost of the capacity being given to The Nation Municipality will also be determined. The recommendations and cost estimates will be broken down as follows:

- Infrastructure needed to service The Nation Municipality (with no direct benefit to Clarence-Rockland)
    - 100% of this cost would be the responsibility of The Nation Municipality
- Infrastructure needed to service both The Nation Municipality and Clarence-Rockland
    - The cost share of this infrastructure would be determined based on the capacity used by the respective municipalities
- Existing infrastructure that doesn't require upgrading where a portion of the capacity is used to service The Nation Municipality.
    - The cost share of this infrastructure would be determined based on the capacity used by the respective municipalities and the current replacement cost of the infrastructure.

Once the findings of the study have been identified and reviewed by the Steering Committee, staff will present a full report to Committee/Council in inclusive of recommendations with respect to future expansion requirements and costs and the feasibility of meeting The Nation Municipality's water needs.

The estimated cost of the above study is estimated to be $46,000 and will be shared equally between the City of Clarence-Rockland and The Nation Municipality. The Nation Municipality has confirmed its' cost participation in the study.

The City's share of the study cost is estimated to be $23,000 (EXCL H.S.T.) and staff recommends that this be funded from the Development Charge Reserve.

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6) **CONSULTATION:**
N/A

7) **RECOMMENDATIONS OR COMMENTS FROM COMMITTEE/ OTHER DEPARTMENTS :**
N/A

8) **FINANCIAL IMPACT (expenses/material/etc.):**

As noted above, the City’s share of this study will be $23,000 and funded from the Development Charge Reserve

9) **LEGAL IMPLICATIONS :**

N/a

10) **RISK MANAGEMENT :**

The implementation of this water study at this time represents a proactive initiative to address the impact of committed development and future growth on the City's key water treatment and distribution infrastructure. This will ensure that infrastructure requirements and funding strategies are considered and addressed in advance of implementation pressures.

11) **STRATEGIC IMPLICATIONS :**

In view of the partnership approach with The Nation Municipality, the study proposed in this report will enable the municipality : (a) to identify its future water supply and distribution needs inclusive of financing strategies in advance of implementation pressures and (b) enable the City of work in a cooperative venture and longer-term water needs.

12) **SUPPORTING DOCUMENTS:**

Resolution from both municipalities

REPORT N° INF2018-001

Date	21/02/2018
Submitted by	Denis Longpré
Subject	INF2018-001 Clarence-Rockland and The Nation Wate Servicing Study (5).docx
File N°	INF2018-001

1) **NATURE/GOAL :**
The purpose of this report is to provide council with an update on the water sharing project with the municipality of The Nation.

2) **DIRECTIVE/PREVIOUS POLICY :**
N/A

3) **DEPARTMENT'S RECOMMENDATION :**
THAT Report INF2018-001 in regards to the water servicing study be received as information

QUE le rapport INF2018-001 au sujet de l'étude pour l'approvision d'eau soit reçu à titre d'information.

4) **BACKGROUND :**
On March 6th 2017, Council approved a resolution to undertake an assessment of the City's ability to address potable water supply needs for both the City of the Clarence-Rockland (The City) and The Nation Municipality.

This assessment was to collect data, update the hydraulic model, analyse the data and evaluate the water treatment plant and distribution system's capacity. The analysis would also assess the future water demands of the City and overlay The Nation Municipality's water demands on the total demand. The analysis would cover different scenarios for the years 2017 to 2037 and beyond.

The final report would identify required upgrades and costs to increase the capacity of the City's infrastructure (water treatment plant and distribution system) to address the City's future water demand in addition to the water demands of The Nation Municipality.

5) **DISCUSSION :**
The assessment is progressing well and several meetings were held with The Nation throughout the process. The final report with the results of the analysis, recommendations and Capital works plan is anticipated to be completed by the end of February.

In view of the partnership approach with The Nation Municipality, the study proposed in this report will enable the City to:

(a) to identify its future water supply and distribution needs inclusive of financing strategies in advance of implementation pressures and

(b) enable the City to work in a cooperative venture with The Nation Municipality to address its short-term, medium and longer-term water needs.

As indicated in the March 2017 report, staff will present a full report to Committee/Council inclusive of recommendations with respect to future expansion requirements and costs and the feasibility of meeting Nation Township's water by the month of April.

6) **CONSULTATION:**
N/A

7) **RECOMMENDATIONS OR COMMENTS FROM COMMITTEE/ OTHER DEPARTMENTS :**
N/A

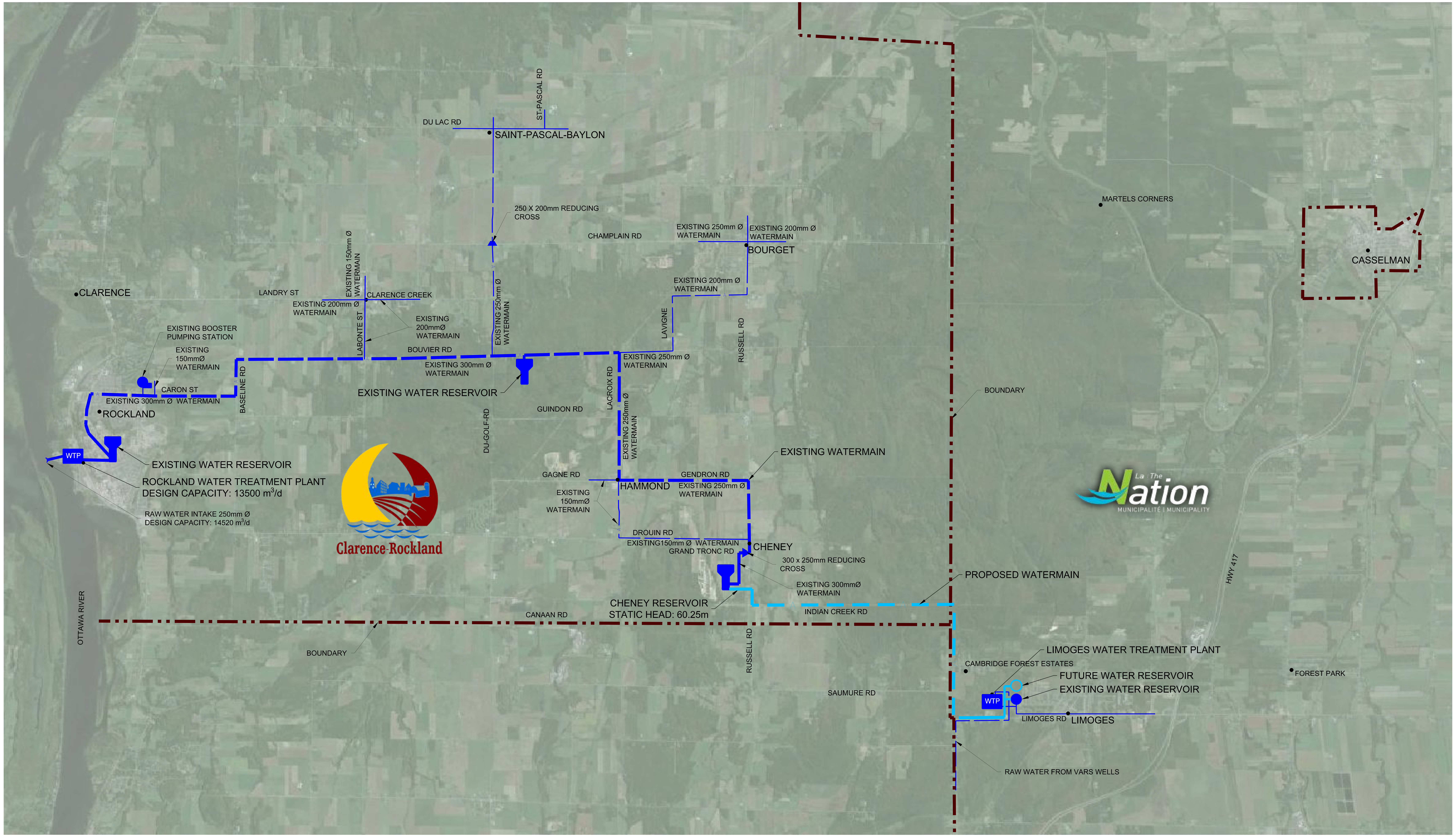
8) **FINANCIAL IMPACT (expenses/material/etc.):**
N/A

9) **LEGAL IMPLICATIONS :**
N/A

10) **RISK MANAGEMENT :**
This analysis will address the City's needs separately of the additional water consumption demand by The Nation and will allow the City to properly plan for future growth, committed development and special initiatives such as the looping of the Clarence-Creek and Bourget villages' water mains.

11) **STRATEGIC IMPLICATIONS :**
N/A

12) **SUPPORTING DOCUMENTS:**
N/A



NOTES

1. DO NOT SCALE DRAWINGS; ONLY FIGURED DIMENSIONS ARE TO BE USED. WHERE DOUBT EXISTS; FILE REQUEST FOR INTERPRETATION AND REQUEST CLARITY.
2. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO VERIFY DIMENSIONS ON SITE; REPORT DISCREPANCIES TO THE ARCHITECT PROMPTLY.
3. GENERAL CONTRACTOR TO TAKE INTO ACCOUNT CONSTRUCTION TOLERANCE; GENERAL CONTRACTOR TO COORDINATE THE WORK OF DIFFERENT TRADES TO COMPLY WITH DESIGN INTENT.
4. DRAWINGS AND SPECIFICATIONS ARE COMPLEMENTARY AND ARE TO BE READ TOGETHER.

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LEGEND

EXISTING		FUTURE
	WATERMAIN	
	WATER RESERVOIR	
	WATER BOOSTER STATION	
	WATER TREATMENT PLANT	

REV. No.	DATE	NATURE	DRAWN	APPROVED
3	2017/03/14	PRELIMINARY	M-O GRATTON	P.MAGUIRE
2	2017/03/10	PRELIMINARY	M-O GRATTON	P.MAGUIRE
1	2017/02/24	PRELIMINARY	M-O GRATTON	P.MAGUIRE

ISSUE RECORD: ______ BY ______

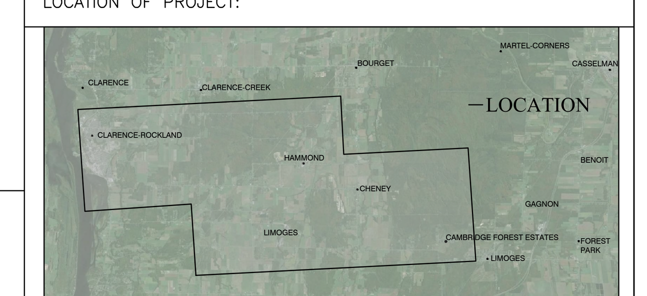
exp Services inc.

0 1500m 3000m

PROJECT:
LIMOGES WATER SUPPLY ALTERNATIVE

DRAWING:
PRELIMINARY WATER SYSTEM LAYOUT

LOCATION OF PROJECT:



SURVEYED:	-	CONCEPTION :	P.MAGUIRE, ing.
DRAWN:	M-O.GRATTON, ing.jr	REVIEWED:	P.MAGUIRE, ing.
REVIEWED :	P.MAGUIRE, ing.	APPROVED :	P.MAGUIRE, ing.
DATE :	2016/10/05	SCALE :	HOR. 1:40000
CONTRACT No. :	GAT-00235661-A0	PLAN No. :	C01

1 de 1

FINAL REPORT

Clarence-Rockland and Limoges Water Servicing Study

Prepared for

City of Clarence-Rockland

April 24, 2018

CH2M HILL Canada Ltd.
245 Consumers Road
Suite 400
Toronto, ON, M2J 1R3

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Acronyms and Abbreviations

ADD	Average Day Demand
BS	Booster Station
CH2M	CH2M HILL Canada Limited
City	City of Clarence-Rockland
EPS	Extended Period Simulation
ET	Elevated Tower
L/p/d	Litres per Person per Day
L/s	Litre per Second
m	Metre
MDD	Maximum Day Demand
MHD	Minimum Hour Demand
mm	Millimetre
m^3/d	Cubic Metres per Day
PZ	Pressure Zone
PHD	Peak Hour Demand
SSS	Steady State Simulation
Town	Town of Limoges
WDS	Water Distribution System
WTP	Water Treatment Plant

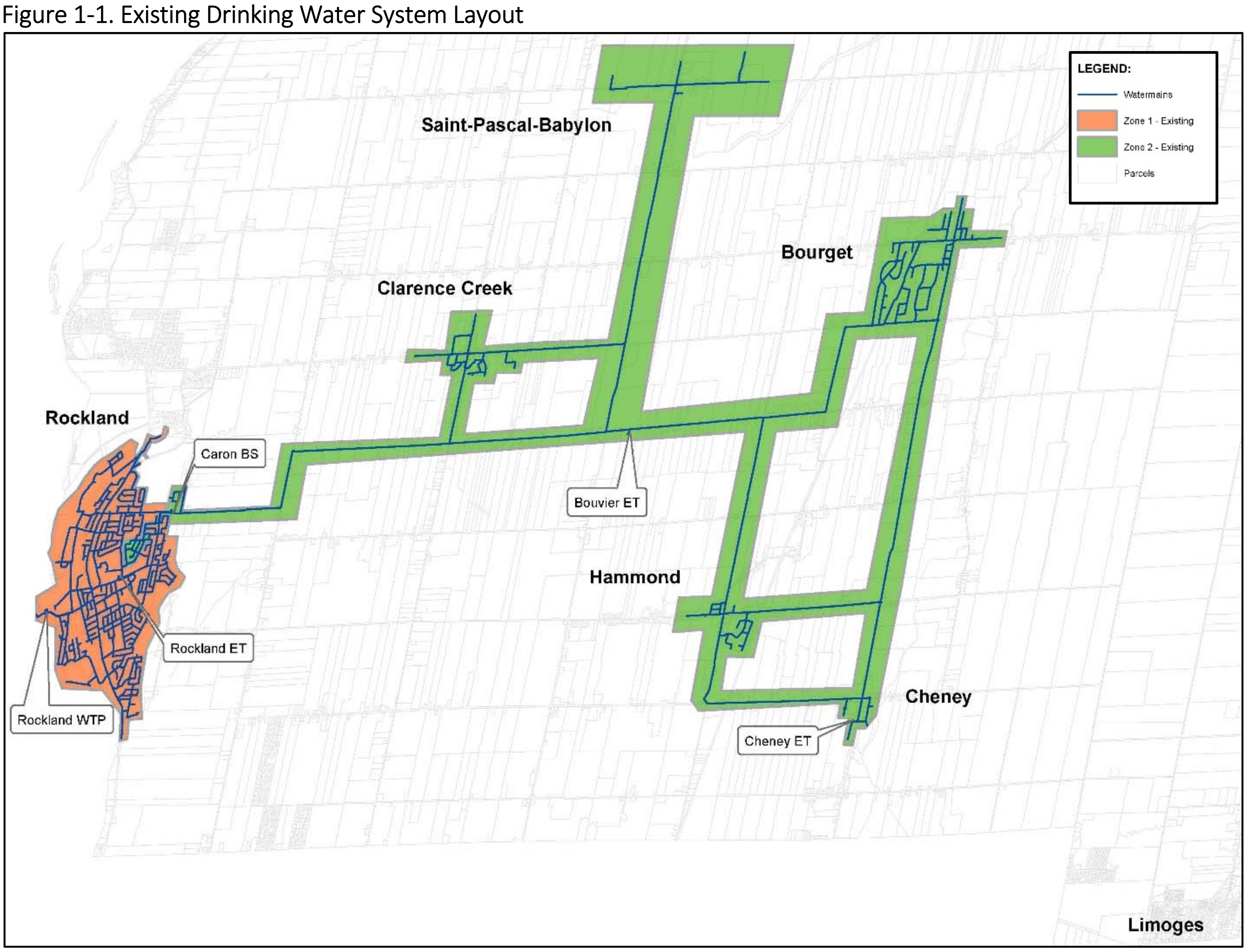
SECTION 1

Background

The City of Clarence-Rockland (City) retained CH2M HILL (CH2M) to assess the City's existing water distribution system (WDS) and examine its ability to supply projected future water demands. The Nation Municipality has approached the City to inquire whether the City's water system could be expanded to include the community of Limoges. The future Clarence-Rockland water demands, and the combined Clarence-Rockland plus Limoges water demands were projected and applied to the hydraulic model of the water system to determine what upgrades would be required to service the City alone, and the City plus Limoges water demands. Costs of the recommended upgrades were calculated and the cost share of the upgrades between Municipalities was examined. The timing of the recommended upgrades and cost sharing was also examined.

Figure 1-1 illustrates the existing Clarence-Rockland Regional Water Supply system. Pressure Zone (PZ) 1 is the Rockland distribution network and includes the Rockland Water Treatment Plant (WTP), and the Rockland Elevated Tower (ET). The Caron Booster Station (BS) is located at the edge of Pressure Zone 1 (PZ-1) and supplies water to PZ-2. PZ-2 includes the transmission and distribution network that supplies water to the villages (Clarence Creek, Saint-Pascal-Babylon, Bourget, Hammond, and Cheney), and has two storage tanks: Bouvier ET, and Cheney ET. In PZ-2 it is assumed that the new transmission main looping in Clarence Creek and between Bourget and Cheney will be constructed (as discussed in Section 2.2.4.1, and shown in Figure 1-1).

Figure 1-1. Existing Drinking Water System Layout



2 Model Parameters and Assumptions

2.1 Water Demands

2.1.1 Historical Clarence-Rockland Water Demands

Existing SCADA daily flow data was examined to determine existing demands and peaking factors (see Figure 2-1 for graphical, and Table 2-1 for tabular representation of the data). From the Rockland WTP and the Caron BS flows, the PZ-1 and PZ-2 flows were calculated. The total system flow was taken from the Rockland WTP flow meter. The PZ-1 flow was calculated by subtracting the Caron BS flow from the Rockland WTP flow. The PZ-2 flow was taken from the Caron BS flow meter.

Figure 2-1. Daily SCADA Flow Records – January 2012 to May 2017

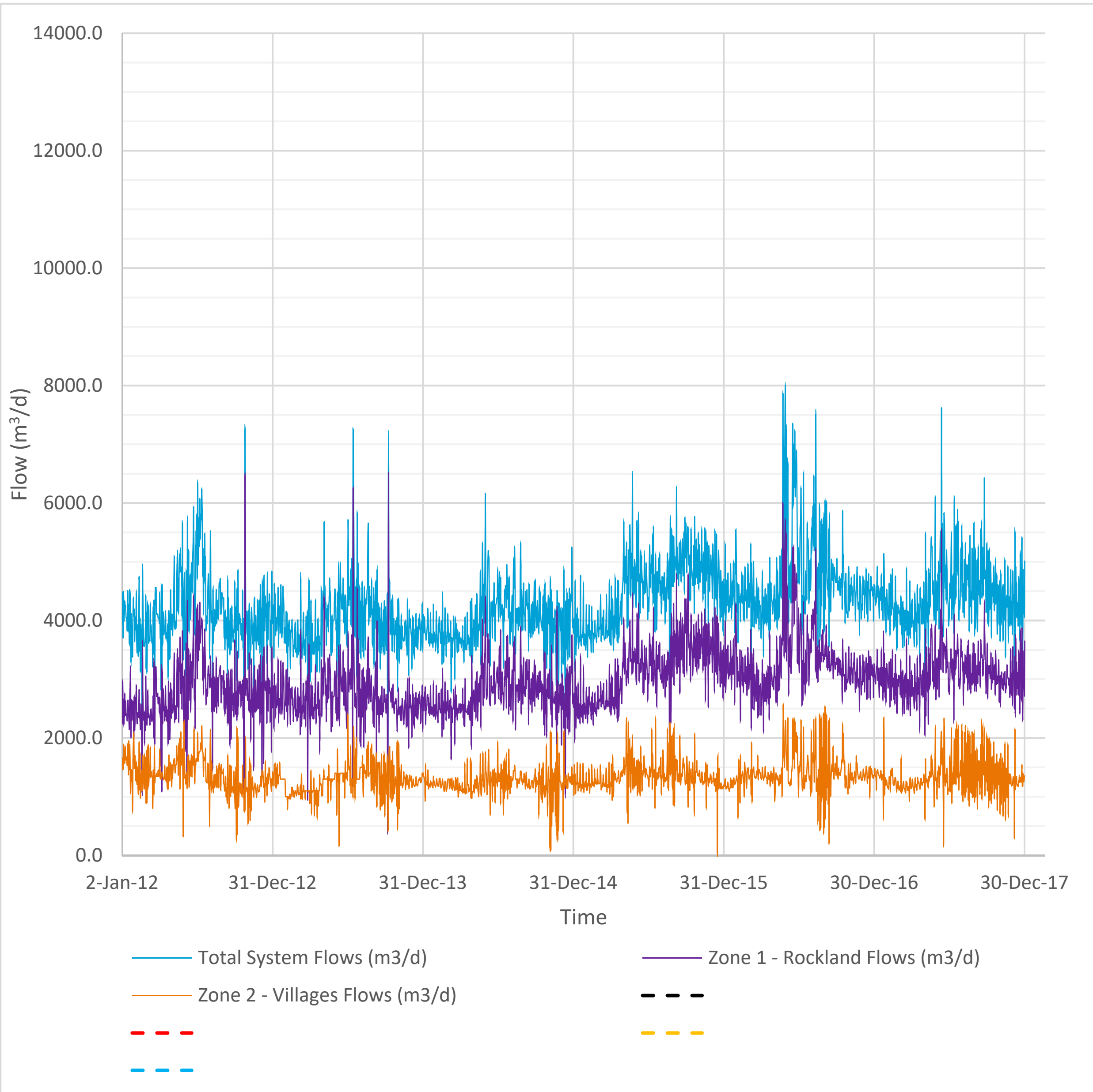


Table 2-1. Daily SCADA Flow Records – Annual Average – 2012 to 2017

Year	Total System	Zone 1 – Rockland	Zone 2 – Villages
2012	4,128.5	2,752.3	1,376.1
2013	3,960.1	2,698.6	1,261.5
2014	3,985.4	2,748.4	1,237.0
2015	4,508.5	3,156.8	1,351.7
2016	4,573.5	3,197.0	1,376.5
2017	4,427.3	3,092.8	1,334.5

Table 2-2. Daily SCADA Flow Records – Total System Average Day, Maximum Day, and 99th Percentile Maximum Day Demands – 2012 to 2017

Year	Average Day	Maximum Day	Maximum Day 99th Percentile
2012	4,128.5	7,260.1	5,981.8
2013	3,960.1	7,182.1	5,751.7
2014	3,985.4	6,161.1	5,242.7
2015	4,508.5	6,461.7	5,749.3
2016	4,573.5	7,942.6	6,938.0
2017	4,427.3	7,619.2	5,946.4

2.1.2 Future Clarence-Rockland Water Demands

The future City water demand projections are based on the following sources:

- Table: Province of Ontario *Residential Population by Age Groups (2016-2041)* (Province of Ontario)
- Report: *United Counties of Prescott and Russell Official Plan (2016-2035)*, Planning Department of the United Counties of Prescott and Russell (April, 2017) (Planning Department of the United Counties of Prescott and Russell, 2017)
- Report: *Official Plan of the Urban Area of the City of Clarence-Rockland (2016-2035)*, Planning Department of the City of Clarence-Rockland, (November 19, 2013) (Planning Department of the City of Clarence-Rockland, 2013)
- Table: *Development Charges Study – Growth Forecast – Residential Units* (April 7, 2017) (Planning Department of the City of Clarence-Rockland, 2017)
- Report: *Urban Area Statistiques – Lots approuvés (2015)*, City of Clarence-Rockland Planning Department, 2016 (Planning Department of the City of Clarence-Rockland, 2016)
- Table: Daily SCADA flow records for the WTP and the Caron BS (2012-2017) (City of Clarence-Rockland, 2017)
- GIS shapefile: UCPR Zoning layer (United Counties of Prescott and Russell, 2017)
- Map: The City of Clarence-Rockland – Future Development (Planning Department of the City of Clarence-Rockland)

2.1.2.1 Residential and Employment Population Projections

The water demand projections are broken up in to the residential portion (number of people living in the area), and employment population (the industrial/commercial/institutional equivalent population working in the area).

Using the *United Counties of Prescott and Russell Official Plan (2016-2035)* report and the Province of Ontario *Residential Population by Age Groups (2016-2041)* table, the total City residential and employment populations were linearly interpolated and extrapolated for the 2022, 2027, 2032, 2037, 2042, and 2047 design years.

Using the *Urban Area Statistiques – Lots approvés (2015)* report, the City's connected residential population was determined for the years 2011 to 2016. Using the *Development Charges Study – Growth Forecast – Residential Units* table the number of future connected residential units for each design year were determined. An average value of 2.69 people per unit was used to determine the connected population for each design year. The additional connected population for each design year was added to the connected population for 2016 obtained in the *Urban Area Statistiques – Lots approves (2015)* report to project the future connected populations.

It should be noted that the population growth forecasted using data from the Development Charges Study was greater than the projections in the United Counties of Prescott and Russel Official Plan. However, the growth forecasts using data from the Development Charges Study were deemed to be more conservative. Additionally, through discussions with the City planning department it was noted that the rate of growth is expected to increase once Highway 17 between Ottawa and Rockland is expanded to four lanes.

It was assumed that all of the employment population indicated in the *United Counties of Prescott and Russell Official Plan (2016-2035)* is connected to the municipal water system. The projected 2047 connected employment was adjusted to account for a large proposed commercial/industrial development in Bourget, at the intersection of Marcil Rd. and Russell Rd. in Bourget.

The total residential, connected residential, and connected employment populations for the City are summarized in Table 2-3 for each of the design years.

Table 2-3. Clarence-Rockland Residential and Employment Population Projections

Design Year[1]	Total Residential Population	Connected Residential Population	Approximate Number of Connected Residential Units[2]	Connected Employment Population
2017	26,714	14,893	5,536	5,676
2022	29,934	18,113	6,733	5,851
2027	33,351	21,529	8,003	6,025
2032	36,183	24,362	9,056	6,200
2037	39,239	27,418	10,192	6,314
2042	41,978	30,156	11,210	6,479
Beyond 2042	48,718	36,896	13,716	6,644

Notes:

1. The Beyond 2042 scenario includes the full build-out of developments in Clarence-Rockland that are currently known of. The timing of the full build outs are not known, and therefore the exact design year that this scenario represents, cannot be determined.
2. Assuming an average number of people per household of 2.69 people per household.

2.1.2.2 Unit Water Demands

The Daily SCADA flow records for the WTP and the Caron BS for 2012 to 2016 were examined to calculate unit residential and employment demand factors. Using the connected residential and employment populations indicated in Table 2-3, and the SCADA flow records, various unit residential and employment demand factors were calculated. A unit residential demand factor was assumed, and the resulting unit employment demand factors were calculated for each year of SCADA data. Various unit residential and employment demand factors were calculated to obtain values that were within reasonable ranges of what has been observed within other municipalities. The unit residential demand factor of 250 L/p/d was selected and the resulting unit employment demand factors are shown in Table 2-4 for each year of SCADA data. The unit demand factors of 250 L/p/d for residential and 188 L/p/d for employment (i.e. the highest of the range) were selected to calculate the projected future water demands.

Table 2-4. Clarence-Rockland Residential and Employment Unit Water Demand Factors

Design Year	Unit Residential Demand (L/p/d)	Unit Employment Demand (L/p/d)
2012	250	154
2013	250	107
2014	250	101
2015	250	183
2016	250	188

2.1.2.3 Maximum Day and Peak Hour Demand Multipliers

The Daily SCADA flow records for the WTP and the Caron BS between 2012 and 2017 were examined to determine the average and maximum daily flows. Table 2-5 summarizes the minimum, average, maximum and 99^{th} percentile maximum flows (demands) in PZ-2 – Villages (Caron BS flow), PZ-1 – Rockland (WTP flow minus Caron BS flow), and total system (WTP flow) for the years 2015 and 2016.

Using the 99th percentile maximum and average flows, a maximum day multiplier was calculated. The design maximum day multiplier was rounded up for each.

Hourly flow data from the pumping facilities and the elevated tower would be required to calculate a peak hour multiplier, however this data was not available. Therefore, the peak hour multiplier was assumed to be 1.5 times the maximum day multiplier as indicated in the Ministry of Environment (MOE) *Design Guidelines for Drinking-Water Systems, 2008* (Ministry of the Environment, 2008).

Table 2-5. Clarence-Rockland Residential and Employment Demand Multipliers

Description	PZ-2 – Villages	PZ-1 – Rockland	Total[3]
Minimum (m^3/d)	50.4	436.5	1,349.2
Average (m^3/d)	1,328.7	2,955.9	4,284.6
Maximum (m^3/d)	2,563.0	6,470.0	7,942.6
Maximum (percentile)[1] (m^3/d)	2,289.6	4,458.8	6,383.3
Maximum Day Multiplier (percentile) (times Average Day)	1.72	1.51	1.49
Peak Hour Multiplier (times Maximum Day)	1.5	1.5	1.5
Design Maximum Day Multiplier (times Average Day)	1.8	1.6	1.66[2]
Design Peak Hour Multiplier (times Maximum Day)	1.5	1.5	1.5

Notes:
1. Max (percentile) is used for 99th percentile of the observed data to exclude the outliers or erroneous data point
2. Calculated based on total maximum day demand divided by total average day demand with PZ specific demand multipliers
3. The Totals are the combined PZ-1 + PZ-2 flows. The minimum and maximum total flows do not occur concurrently with the PZ-1 or PZ-2 minimum or maximum flows and therefore are not additive.

2.1.2.4 Projected Future Clarence-Rockland Water Demands

With the total connected residential and employment populations from Section 2.1.2.1, and the unit residential and employment demand factors from Section 2.1.2.2, the total projected future City average day water demands were calculated. Using the maximum day and peak hour multipliers from Section 2.1.2.3, the maximum day and peak hour demands were also calculated. A summary of the average day, maximum day, and peak hour demands are presented in Table 2-6 for each design year.

Table 2-6. Clarence-Rockland Total Water Demands (2016-2047)

Year	ADD (m^3/d)	MDD (m^3/d)	PHD (m^3/d)
2016	4,575.7	7,610.9	11,416.3
2017	4,793.4	8,008.0	12,012.0
2022	5,631.4	10,247.0	15,370.5
2027	6,518.2	11,929.6	17,894.4
2032	7,259.2	13,413.6	20,120.4
2037	8,044.7	15,202.9	22,804.3
2042	8,760.5	16,866.6	25,300.0
Beyond 2042	10,695.2	19,912.8	29,869.3

Notes:
1. Definitions: ADD – Average Day Demands, MDD – Maximum Day Demands, PHD – Peak Hour Demands

2.1.2.5 Clarence-Rockland Diurnal Curve

The diurnal curve is a theoretical maximum day pattern with the peak hour multiplier of 1.5 times maximum day demand. This pattern is applied to both the average day, and maximum day EPS scenarios.

2.1.3 Future Limoges Water Demands

The future Limoges water demand projections are based on the following source:

- Table: Limoges Water Demand Projections, Sept 7 2017, provided by Alexander O'Beirn, EXP Services Inc., by email on November 9, 2017 (EXP Services Inc., 2017)

The projected Limoges total average day, maximum day, and peak hour water demands are summarized in Table 2-7 for each design year. It is assumed that the Clarence-Rockland system would provide maximum day flows to Limoges and that the Limoges system (through storage and/or pumping) would provide flows above maximum day demands to meet the peak hour and fire flow demands. Therefore, the Limoges peak hour and fire flow demands that the Clarence-Rockland water system needs to meet are assumed to be the same as the maximum day demands. The Limoges water demand projections were provided by EXP, and were not verified by CH2M.

The total Limoges water demand projections are summarized in Table 2-7, and carried forward to the total Clarence-Rockland water system demand summary table in Table 2-8.

Table 2-7. Limoges Total Water Demands (2017-2047)

Year	ADD (m^3/d)	MDD (m^3/d)	PHD (m^3/d)
2017	1,055.0	2,066.0	2,066.0
2022	1,572.0	3,094.0	3,094.0
2027	2,099.0	4,144.0	4,144.0
2032	2,638.0	5,216.0	5,216.0
2037	3,189.0	6,007.0	6,007.0
2042	3,755.0	7,076.0	7,076.0
Beyond 2042	3,755.0	7,076.0	7,076.0

Notes:

1. Definitions: ADD – Average Day Demands, MDD – Maximum Day Demands, PHD – Peak Hour Demands

2.1.4 Total System Demand Summary

The Clarence-Rockland, Limoges, and total water demands are summarized in Table 2-8. Since the Limoges peak hour demands are supplied through storage and/or pumping in Limoges, the peak hour Limoges demands that the Clarence-Rockland system need to supply are assumed to be equal to the maximum day demands.

Table 2-8. Total System Demand Summary (2016-2047)

Area	Year[1]	Employment			Residential			Total Demands (m^3/d)		
		Population[2]	Unit Demand (L/p/d)	Demand (m3/d)	Population	Unit Demand (L/p/d)	Demand (m^3/d)	Average Day	Maximum Day[3]	Peak Hour[4]
CLARENCE-ROCKLAND										
Zone 1 (Rockland)	2016	-	-	-	-	-	-	3,120.4	4,992.7	7,489.0
	2017	-	-	-	-	-	-	3,371.8	5,394.8	8,092.2
	2022	-	-	-	-	-	-	4,417.2	7,067.5	10,601.3
	2027	-	-	-	-	-	-	5,048.2	8,077.1	12,115.6
	2032	-	-	-	-	-	-	5,620.5	8,992.8	13,489.2
	2037	-	-	-	-	-	-	6,404.2	10,246.8	15,370.1
	2042	-	-	-	-	-	-	7,112.5	11,380.1	17,070.1
	>2042	-	-	-	-	-	-	8,204.9	13,127.8	19,691.7
Zone 2 (Villages-North)	2016	-	-	-	-	-	-	669.6	1,205.3	1,807.9
	2017	-	-	-	-	-	-	668.3	1,202.9	1,804.4
	2022	-	-	-	-	-	-	867.9	1,562.2	2,343.3
	2027	-	-	-	-	-	-	1,228.3	2,211.0	3,316.5
	2032	-	-	-	-	-	-	1,538.0	2,768.4	4,152.6
	2037	-	-	-	-	-	-	1,834.8	3,302.6	4,953.9
	2042	-	-	-	-	-	-	2,129.5	3,833.1	5,749.7
	>2042	-	-	-	-	-	-	2,850.9	5,131.5	7,697.3
Zone 3 (Villages-South)	2016	-	-	-	-	-	-	784.9	1,412.9	2,119.3
	2017	-	-	-	-	-	-	783.5	1,410.3	2,115.4
	2022	-	-	-	-	-	-	898.5	1,617.3	2,425.9
	2027	-	-	-	-	-	-	912.0	1,641.5	2,462.3
	2032	-	-	-	-	-	-	918.0	1,652.4	2,478.6
	2037	-	-	-	-	-	-	918.6	1,653.5	2,480.2
	2042	-	-	-	-	-	-	918.6	1,653.5	2,480.2
	>2042	-	-	-	-	-	-	1,137.2	2,047.0	3,070.4

Area	Year[1]	Employment			Residential			Total Demands (m^3/d)		
		Population[2]	Unit Demand (L/p/d)	Demand (m3/d)	Population	Unit Demand (L/p/d)	Demand (m^3/d)	Average Day	Maximum Day[3]	Peak Hour[4]
Clarence-Rockland Total	2016	-	-	-	-	-	-	4,575.0	7,610.9	11,416.3
	2017	5,676	188.5	1,069.9	14,894	250.0	3,723.5	4,793.4	8,008.0	12,012.0
	2022	5,851	188.5	1,102.9	18,114	250.0	4,528.5	5,631.4	10,247.0	15,370.5
	2027	6,025	188.5	1,135.7	21,530	250.0	5,382.5	6,518.2	11,929.6	17,894.4
	2032	6,200	188.5	1,168.7	24,362	250.0	6,090.5	7,259.2	13,413.6	20,120.4
	2037	6,314	188.5	1,190.2	27,418	250.0	6,854.5	8,044.7	15,202.9	22,804.3
	2042	6,479	188.5	1,221.3	30,157	250.0	7,539.3	8,760.5	16,866.6	25,300.0
	>2042	7,804	188.5	1,471.0	36,897	250.0	9,224.3	10,695.2	20,306.3	30,459.5
LIMOGES										
Zone 2/3 (Villages)	2016	-	-	-	-	-	-	-	-	-
	2017	-	-	-	-	-	-	1,055.0	2,066.0	2,066.0
	2022	-	-	-	-	-	-	1,572.0	3,094.0	3,094.0
	2027	-	-	-	-	-	-	2,099.0	4,144.0	4,144.0
	2032	-	-	-	-	-	-	2,638.0	5,216.0	5,216.0
	2037	-	-	-	-	-	-	3,189.0	6,007.0	6,007.0
	2042	-	-	-	-	-	-	3,755.0	7,076.0	7,076.0
	>2042	-	-	-	-	-	-	3,755.0	7,076.0	7,076.0
TOTALS										
Zone 1 (Rockland)	2016	-	-	-	-	-	-	3,120.4	4,992.7	7,489.0
	2017	-	-	-	-	-	-	3,371.8	5,394.8	8,092.2
	2022	-	-	-	-	-	-	4,417.2	7,067.5	10,601.3
	2027	-	-	-	-	-	-	5,048.2	8,077.1	12,115.6
	2032	-	-	-	-	-	-	5,620.5	8,992.8	13,489.2
	2037	-	-	-	-	-	-	6,404.2	10,246.8	15,370.1
	2042	-	-	-	-	-	-	7,112.5	11,380.1	17,070.1
	>2042	-	-	-	-	-	-	8,204.9	13,127.8	19,691.7

Area	Year[1]	Employment			Residential			Total Demands (m^3/d)		
		Population[2]	Unit Demand (L/p/d)	Demand (m3/d)	Population	Unit Demand (L/p/d)	Demand (m^3/d)	Average Day	Maximum Day[3]	Peak Hour[4]
Zone 2 (Villages-North)	2016	-	-	-	-	-	-	669.6	1,205.3	1,807.9
	2017	-	-	-	-	-	-	668.3	1,202.9	1,804.4
	2022	-	-	-	-	-	-	867.9	1,562.2	2,343.3
	2027	-	-	-	-	-	-	1,228.3	2,211.0	3,316.5
	2032	-	-	-	-	-	-	1,538.0	2,768.4	4,152.6
	2037	-	-	-	-	-	-	1,834.8	3,302.6	4,953.9
	2042	-	-	-	-	-	-	2,129.5	3,833.1	5,749.7
	>2042	-	-	-	-	-	-	2,850.9	5,131.5	7,697.3
Zone 3 (Villages-South)	2016	-	-	-	-	-	-	784.9	1,412.9	2,119.3
	2017	-	-	-	-	-	-	1,838.5	3,476.3	4,181.4
	2022	-	-	-	-	-	-	2,470.5	4,711.3	5,519.9
	2027	-	-	-	-	-	-	3,011.0	5,785.5	6,606.3
	2032	-	-	-	-	-	-	3,556.0	6,868.4	7,694.6
	2037	-	-	-	-	-	-	4,107.6	7,660.5	8,487.2
	2042	-	-	-	-	-	-	4,673.6	8,729.5	9,556.2
	>2042	-	-	-	-	-	-	4,892.2	9,123.0	10,146.4
System Total	2016	-	-	-	-	-	-	4,575.0	7,610.9	11,416.3
	2017	-	-	-	-	-	-	5,848.4	10,074.0	14,078.0
	2022	-	-	-	-	-	-	7,203.4	13,341.0	18,464.5
	2027	-	-	-	-	-	-	8,617.2	16,073.6	22,038.4
	2032	-	-	-	-	-	-	9,897.2	18,629.6	25,336.4
	2037	-	-	-	-	-	-	11,233.7	21,209.9	28,811.3
	2042	-	-	-	-	-	-	12,515.5	23,942.6	32,376.0
	>2042	-	-	-	-	-	-	14,450.2	27,382.3	37,535.5

Notes:
1. The >2042 scenario is the Beyond 2042 scenario.
2. Large commercial/industrial development (Lavoie) in Bourget assumed to be built in the Beyond 2042 scenario.
3. Maximum Day Multipliers: Zone 1 - Rockland - 1.6 X Average Day, Zone 2 - Villages - 1.8 X Average Day, Limoges - 1.8 X Average Day
4. Peak Hour Multipliers: Clarence-Rockland - 1.5 X Maximum Day, Limoges - 1.5 X Maximum Day

2.2 Model Setup

2.2.1 Base Model

The hydraulic model was developed using data from the City's Aquadata model and the CH2M model developed for the Regional Water Supply project. The City provided GIS shapefiles from the Aquadata model of the watermains, junctions, pumps, tanks, reservoirs, and valves. A new existing conditions hydraulic model was built using these shapefiles.

The pipes in the base model have nominal sizes for all materials with a combination of friction factors for different material and diameter combinations. The existing HDPE transmission main pipes between the Caron BS and the Cheney ET were updated with the exact internal diameter for the different diameters. All new watermains have been added to the model with the exact internal diameter of PVC pipe and a friction factor of 130.

The existing model demands were scaled equally to increase the demands up to the projected 2017 scenario demands.

2.2.2 Scenarios

The following temporal scenarios were established in the hydraulic model to correspond to the water demand projection years: 2017, 2022, 2027, 2032, 2037, 2042, and Beyond 2042.

The following steady state (SS) and extended period simulation (EPS) demand scenarios were established in the hydraulic model:

- SS: Maximum Day Demand Plus Fire Flow
- EPS: Average Day Demand with Diurnal Curve for Minimum Hour Demand
- EPS: Maximum Day Demand with Diurnal Curve for Peak Hour Demand

Table 2-9 summarizes the model scenarios that were set up in the model.

Table 2-9. Model Scenarios Summary

Year	Scenario 1 – Clarence-Rockland Only	Scenario 2 – Clarence-Rockland Plus Limoges
2017	1-1A 1-1B 1-1C	2-1A 2-1B 2-1C
2022	1-2A 1-2B 1-2C	2-2A 2-2B 2-2C
2027	1-3A 1-3B 1-3C	2-3A 2-3B 2-3C
2032	1-4A 1-4B 1-4C	2-4A 2-4B 2-4C
2037	1-5A 1-5B 1-5C	2-5A 2-5B 2-5C
2042	1-6A 1-6B 1-6C	2-6A 2-6B 2-6C

Table 2-9. Model Scenarios Summary

Year	Scenario 1 – Clarence-Rockland Only	Scenario 2 – Clarence-Rockland Plus Limoges
2047	1-7A 1-7B 1-7C	2-7A 2-7B 2-7C

Notes:

- Scenario A: Maximum Day/Peak Hour Extended Period Simulation, Scenario B: Maximum Day Plus Fire Flow Stead State Simulation, Scenario C: Average Day/Minimum Hour Extended Period Simulation

2.2.3 Demand Allocation

2.2.3.1 Clarence-Rockland Demand Allocation

The existing demand allocation in the base model provided by Aquadata was assumed to represent the existing spatial location of the demands in the City. These base model demands were scaled using a global multiplier to match the projected 2017 scenario demands.

The table *Development Charges Study – Growth Forecast – Residential Units* (April 7, 2017) along with the map *The City of Clarence-Rockland – Future Development* were used to determine the number of proposed residential units for each design year, and the spatial location of the future development. These two data sources were used to generate a GIS polygon feature class of the proposed residential developments with the water demands for each development for each design year. Pipe networks for the future developments were added to the model, and the shapefile was loaded in to the hydraulic model using the WaterGEMS tool Load Builder.

The employment water demands were added the model by using a global multiplier on the existing Rockland demand nodes from the base Aquadata model. In addition, a proposed commercial/industrial development in Bourget that was not accounted for in the above projections was added in to the model at the intersection of Russell Rd. and Marcil Rd.

2.2.3.2 Limoges Demand Allocation

As indicated by the Town, the water from the Clarence-Rockland system will discharge to a ground storage reservoir at an elevation of 76.95 m. This elevation corresponds to the high-water level in the existing Limoges water reservoir at the WTP. A flow control valve was used to control the incoming flow to the Limoges reservoir according to the demands indicated in Table 2-7. The flow was kept at a constant rate throughout all simulations.

2.2.4 Future Infrastructure

2.2.4.1 Future Clarence-Rockland Infrastructure

A new 250 mm diameter transmission main in Clarence Creek on Landry St. from south of Henri Rd. to Du Golf Rd. was assumed to be constructed for the base 2017 scenario. Additionally, a new 300 mm diameter transmission main between Bourget and Cheney on Russell Rd. from Marcil Rd. to Gendron Rd. was assumed to be constructed in this scenario. Both of these new links are currently being designed and expected to proceed to construction shortly.

Infrastructure to service future developments was added in to the model based on the year the development is expected to be completed. From previous projects, CH2M has reviewed some of the proposed developments with the City Planning Department, and where possible used the information provided by the developers to determine the watermain alignment and diameters (such as for the Clarence Crossing, Brigil, Morris Village, Nolin-Simard, and CR Lands developments).

2.2.4.2 Future Limoges Infrastructure

A new transmission main from the Cheney elevated storage tank to the Limoges WTP was assumed to be constructed for the base 2017 scenario. As indicated in Section 2.2.3.2, the watermain was assumed to discharge to a ground storage reservoir at an elevation of 76.95 m. A flow control valve was used to control the incoming flow rate to the Limoges reservoir.

2.3 Design Parameters

2.3.1 System Pressures

The (Ministry of the Environment, 2008) guidelines indicate the minimum pressure under normal operation during peak hour demands should not be lower than 276 kPa (40 psi). The guidelines also indicate the minimum pressure under emergency fire flow conditions (under maximum day demands) should not be lower than 138 kPa (20 psi).

The (Ministry of the Environment, 2008) guidelines indicate the maximum pressure under normal operation should not be greater than 700 kPa (100 psi). This guideline is for areas with water services to avoid damage to household plumbing and unnecessary water and energy consumption. However, separated high pressure transmission mains can exceed this guideline provided there are no water services along the pipe, and the pipe is designed to handle the higher pressure.

2.3.2 Storage Operation

The tank storage levels were examined to determine the minimum levels they could drop to during the model simulations. Two minimum levels were examined: the calculated fire and emergency storage requirements, and the critical minimum level to maintain acceptable system pressures.

2.3.2.1 Fire and Emergency Minimum Levels

The fire and emergency storage is the minimum volume needed to maintain those portions of the storage volume equation. The required volume, and the resulting levels (percent) are summarized for each tank and each design year in Table 2-10. It should be noted that the required percent full indicated in the table (and on the tank level results in Section 3.0) are assuming that both tanks are at the same level. For PZs with multiple tanks, the total volume combined must meet the fire and emergency requirements (ie. one of the tanks can be below this level provided the minimum volume is met).

Table 2-10. Fire and Emeregency Storage Volume and Levels

Year	Pressure Zone[1]	Required Fire + Emergency Volume (m^3)[2]	Required Fire + Emergency Percent Full[2]
Beyond 2042	1E	3,520.5	78%
	2E	1,348.7	46%
	2F	1,220.7	67%
	3F	1,027.9	96%
2042	1E	3,411.3	75%
	2E	1,242.9	43%
	2F	1,139.6	62%
	3F	1,003.3	94%
2037	1E	3,340.4	74%
	2E	1,209.8	42%
	2F	1,106.4	60%
	3F	1,003.3	94%
2032	1E	3,262.0	72%
	2E	1,176.3	41%
	2F	1,073.0	58%
	3F	1,003.3	94%
2027	1E	3,204.8	71%
	2E	1,140.8	39%
	2F	1,038.2	57%
	3F	1,002.6	94%
2022	1E	3,141.7	69%
	2E	997.6	34%
2017	1E	3,012.0	66%
	2E	975.3	34%

Notes:

1. E – Existing PZ configuration, F – Future PZ configuration
2. The total calculated fire and emergency volume requirement for each PZ and year.
3. The tank level for all storage tanks in the PZ, assuming that all tanks are at the same level.

2.3.2.2 Critical Minimum Levels

The critical minimum level must be maintained at all times. The critical minimum level was determined through examination of the system pressures under various design scenarios and conditions. The following critical minimum levels were established: Rockland ET – 68 %, Bouvier ET – 25 %, and Cheney ET – 25 %.

2.3.3 Pipe Velocity

The target maximum velocity in the transmission system is 1.5 m/s. To identify infrastructure that needs upgrading, a maximum velocity of 2.0 m/s was used.

2.3.4 Fire Flow

Typically, the required fire flow for a particular building is determined using the Fire Underwriters Survey *Water Supply for Public Fire Protection, 1999* (Fire Underwriters Survey, 1999). A full review of target fire flows for the City of Clarence-Rockland is outside the scope of this report. It is recommended that further study be completed to define targets for each area of the City.

The existing fire flow targets for the City are 125 L/s in PZ-1 (Rockland), and 67 L/s for PZ-2 (Villages). These targets were identified as being low for the types of buildings within Rockland and the Villages. The targets were increased for the storage requirements calculations in Table 4-1 to 200 L/s for PZ-1 and 100 L/s for PZ-2. Note that these values were not calculated for the specific land uses within Clarence-Rockland.

Areas with dead end watermains in the system generally have poor available fire flow (below 67 L/s, or below 50 L/s). The available fire flow in all of St. Pascal is below 50 L/s due to the lack of looping in this area, and the small diameter of the watermain (200 mm) along this section. The available fire flow in the area between Hammond and Cheney along Drouin Rd is below 50 L/s due to the small diameter of the watermain (150 mm), and higher elevation along this section.

2.3.5 Water Age

The City of Ottawa *Water Distribution System Design Guidelines, 2017* indicate that below 5 days is reasonable, and that 8 days should not be exceeded. High water ages could have negative implications on the residual chlorine concentrations and the risk of trihalomethane formation. It is recommended that a plan be developed to address areas with high water ages through operational changes, flushing, etc.

3 Model Analysis Results

The model results in Appendices A and B are taken from three model scenarios: Average Day Demand EPS, Maximum Day Demand EPS, and Maximum Day Plus Fire Flow Steady State. The average day demand EPS scenario has a diurnal curve pattern applied to the demands to simulate average day and minimum hours. The maximum day demand EPS scenario has a diurnal curve applied to the demands to simulate maximum day, and peak hour demands. The steady state maximum day plus fire flow scenario has fixed maximum day demands plus the maximum available fire flow at each junction in the model (while maintaining acceptable pressures and velocities in the system).

All scenarios assume that the proposed transmission mains in Clarence Creek and Bourget/Cheney discussed in Section 2.2.4.1 are constructed.

3.1 Scenario 1 – Clarence-Rockland Only

The Scenario 1 – Clarence-Rockland Only group of scenarios assume that Limoges is not connected to the Clarence-Rockland water system. These model results show the system performance with proposed upgrades needed to service Clarence-Rockland Only over the design horizon.

3.1.1 Scenario 1-1 – 2017 Existing Demands and Infrastructure

The hydraulic model outputs for this scenario are presented in Appendix A-1. This scenario includes the following upgrades: new valve actuator on the Bouvier ET inlet valve, new 300 mm diameter watermain on St. Jean St. in Rockland, and a new 350 mm diameter watermain from the Caron BS to the intersection of Bouvier Rd. and Labonte St. (including PRVs).

The following sections describe the system performance for this scenario related to storage, minimum and maximum pressures, pipe velocities, available fire flows, and water age.

3.1.1.1 Storage

The storage level results show that the tank levels fluctuate normally, with all tanks remaining above their minimum fire and emergency levels and critical minimum levels during the maximum day EPS scenario.

3.1.1.2 Pressures

The minimum pressure results show that the minimum pressures are above 40 psi during peak hour demands in the majority of the system. The following area of the existing system has pressures below 40 psi: Des-Pins Ave. (minimum 35.9 psi).

The maximum pressure results show that the maximum pressures are below 100 psi in the majority of the system. This scenario assumes that the Clarence Creek, St. Pascal, and Bourget PRV's are active to maintain pressures below 100 psi in these areas. The following areas of the existing system have pressures of 100 psi or above: the new Caron BS to Bouvier Rd. and Labonte Rd. transmission main, and the area upstream of the St. Pascal PRV. The new transmission main would have no water services on it and would be designed to handle the pressure. Therefore, higher pressures in this pipe are acceptable. According to records provided by the City, the area upstream of the existing St. Pascal PRV have individual PRVs installed in their houses to protect the building plumbing from the high pressures.

3.1.1.3 Velocities

The pipe velocity results show that the majority of maximum velocities are below 1.5 m/s and none are above 2.0 m/s, and are therefore acceptable.

3.1.1.4 Available Fire Flows

The available fire flow during the maximum day SS results have been provided for reference. However, a detailed analysis of available and recommended fire flows is outside the scope of this analysis. It is recommended that this be further examined through a master plan study.

3.1.1.5 Water Age

The maximum water age results during the average day EPS scenario have been provided for reference. However, a detailed analysis of water quality is outside the scope of this analysis. It is recommended that this be further examined through a master plan study. The model predicts that the average water age at the Cheney ET increases continuously throughout the analysis. This is expected due to the low water demands in the villages in Scenario 1 – Clarence-Rockland Only.

3.1.2 Scenario 1-2 – 2022 Demands and Infrastructure

The hydraulic model outputs for this scenario are presented in Appendix A-2. No additional upgrades are included in this scenario above those included in previous scenarios.

The following sections describe the system performance for this scenario related to storage, minimum and maximum pressures, pipe velocities, available fire flows, and water age.

3.1.2.1 Storage

The storage level results show that the tank levels fluctuate normally, with all tanks remaining above their minimum fire and emergency levels and critical minimum levels during the maximum day EPS scenario.

3.1.2.2 Pressures

The minimum pressure results show that the minimum pressures are above 40 psi during peak hour demands in the majority of the system. The following area of the existing system has pressures below 40 psi: Des-Pins Ave. (35.5 psi).

The maximum pressure results show that the maximum pressures are below 100 psi in the majority of the system. This scenario assumes that the Clarence Creek, St. Pascal, and Bourget PRV's are active to maintain pressures below 100 psi in these areas. The same areas of high pressure indicated in previous scenarios are found in this scenario. However, the magnitude is slightly lower due to increasing demands.

3.1.2.3 Velocities

The pipe velocity results show that the majority of maximum velocities are below 1.5 m/s and none are above 2.0 m/s, and are therefore acceptable.

3.1.2.4 Available Fire Flows

The available fire flow during the maximum day SS results have been provided for reference. However, a detailed analysis of available and recommended fire flows is outside the scope of this analysis. It is recommended that this be further examined through a master plan study.

3.1.2.5 Water Age

The maximum water age results during the average day EPS scenario have been provided for reference. However, a detailed analysis of water quality is outside the scope of this analysis. It is recommended that this be further examined through a master plan study. The model predicts that the average water age at the Cheney ET increases continuously throughout the analysis. This is expected due to the low water demands in the villages in Scenario 1 – Clarence-Rockland Only.

3.1.3 Scenario 1-3 – 2027 Demands and Infrastructure

The hydraulic model outputs for this scenario are presented in Appendix A-3. In addition to the upgrades indicated in previous scenarios, the following upgrades are required to service the demands in this scenario: upgrades at the Rockland WTP including treatment capacity, pumping capacity, and distribution storage capacity, replace 300 mm diameter watermain on Edwards St. with new 500 mm diameter watermain, and expand the Caron BS pumping capacity.

The following sections describe the system performance for this scenario related to storage, minimum and maximum pressures, pipe velocities, available fire flows, and water age.

3.1.3.1 Storage

The storage level results show that the tank levels fluctuate normally, with all tanks remaining above their minimum fire and emergency levels and critical minimum levels during the maximum day EPS scenario.

3.1.3.2 Pressures

The minimum pressure results show that the minimum pressures are above 40 psi during peak hour demands in the majority of the system. The following area of the existing system has pressures below 40 psi: Des-Pins Ave. (36.6 psi).

The maximum pressure results show that the maximum pressures are below 100 psi in the majority of the system. A new transmission main and two PRV's reduce the pressure in the existing transmission main at Baseline Rd. and Bouvier Rd. down to 100 psi. The only area of the system with pressures above 100 psi is on St. Pascal Rd. upstream of the PRV which has an increase in its maximum pressure to 103 psi. This scenario assumes that the Clarence Creek, St. Pascal, and Bourget PRV's are active to maintain pressures below 100 psi in these areas.

3.1.3.3 Velocities

This scenario assumes that the existing 300 mm watermain on Edwards St. (east side) from the Rockland WTP to south of Highway 17 has been replaced to address high velocity. With this upgrade the pipe velocity results show that the majority of maximum velocities are below 1.5 m/s and none are above 2.0 m/s, and are therefore acceptable.

3.1.3.4 Available Fire Flows

The available fire flow during the maximum day SS results have been provided for reference. However, a detailed analysis of available and recommended fire flows is outside the scope of this analysis. It is recommended that this be further examined through a master plan study.

3.1.3.5 Water Age

The maximum water age results during the average day EPS scenario have been provided for reference. However, a detailed analysis of water quality is outside the scope of this analysis. It is recommended that this be further examined through a master plan study. The model predicts that the average water age at the Cheney ET increases continuously throughout the analysis. This is expected due to the low water demands in the villages in Scenario 1 – Clarence-Rockland Only.

3.1.4 Scenario 1-4 – 2032 Demands and Infrastructure

The hydraulic model outputs for this scenario are presented in Appendix A-4. No additional upgrades are included in this scenario above those included in previous scenarios.

The following sections describe the system performance for this scenario related to storage, minimum and maximum pressures, pipe velocities, available fire flows, and water age.

3.1.4.1 Storage

The storage level results show that the tank levels fluctuate normally, with all tanks remaining above their minimum fire and emergency levels and critical minimum levels during the maximum day EPS scenario.

3.1.4.2 Pressures

The minimum pressure results show that the minimum pressures are above 40 psi during peak hour demands in the majority of the system. The following area of the existing system has pressures below 40 psi: Des-Pins Ave. (36.4 psi).

The maximum pressure results show that the maximum pressures are below 100 psi in the majority of the system. This scenario assumes that the Clarence Creek, St. Pascal, and Bourget PRV's are active to maintain pressures below 100 psi in these areas. The same areas of high pressure indicated in previous scenarios are found in this scenario. However, the magnitude is slightly lower due to increasing demands.

3.1.4.3 Velocities

The pipe velocity results show that the majority of maximum velocities are below 1.5 m/s and none are above 2.0 m/s, and are therefore acceptable.

3.1.4.4 Available Fire Flows

The available fire flow during the maximum day SS results have been provided for reference. However, a detailed analysis of available and recommended fire flows is outside the scope of this analysis. It is recommended that this be further examined through a master plan study.

3.1.4.5 Water Age

The maximum water age results during the average day EPS scenario have been provided for reference. However, a detailed analysis of water quality is outside the scope of this analysis. It is recommended that this be further examined through a master plan study. The model predicts that the average water age at the Cheney ET increases continuously throughout the analysis. This is expected due to the low water demands in the villages in Scenario 1 – Clarence-Rockland Only.

3.1.5 Scenario 1-5 – 2037 Demands and Infrastructure

The hydraulic model outputs for this scenario are presented in Appendix A-5. No additional upgrades are included in this scenario above those included in previous scenarios.

The following sections describe the system performance for this scenario related to storage, minimum and maximum pressures, pipe velocities, available fire flows, and water age.

3.1.5.1 Storage

The storage level results show that the tank levels fluctuate normally, with all tanks remaining above their minimum fire and emergency levels and critical minimum levels during the maximum day EPS scenario.

3.1.5.2 Pressures

The minimum pressure results show that the minimum pressures are above 40 psi during peak hour demands in the majority of the system. The following area of the existing system has pressures below 40 psi: Des-Pins Ave. (36.2 psi).

The maximum pressure results show that the maximum pressures are below 100 psi in the majority of the system. This scenario assumes that the Clarence Creek, St. Pascal, and Bourget PRV's are active to maintain pressures below 100 psi in these areas. The same areas of high pressure indicated in previous scenarios are found in this scenario. However, the magnitude is slightly lower due to increasing demands.

3.1.5.3 Velocities

The pipe velocity results show that the majority of maximum velocities are below 1.5 m/s and none are above 2.0 m/s, and are therefore acceptable.

3.1.5.4 Available Fire Flows

The available fire flow during the maximum day SS results have been provided for reference. However, a detailed analysis of available and recommended fire flows is outside the scope of this analysis. It is recommended that this be further examined through a master plan study.

3.1.5.5 Water Age

The maximum water age results during the average day EPS scenario have been provided for reference. However, a detailed analysis of water quality is outside the scope of this analysis. It is recommended that this be further examined through a master plan study. The model predicts that the average water age at the Cheney ET increases continuously throughout the analysis. This is expected due to the low water demands in the villages in Scenario 1 – Clarence-Rockland Only.

3.1.6 Scenario 1-6 – 2042 Demands and Infrastructure

The hydraulic model outputs for this scenario are presented in Appendix A-6. No additional upgrades are included in this scenario above those included in previous scenarios.

The following sections describe the system performance for this scenario related to storage, minimum and maximum pressures, pipe velocities, available fire flows, and water age.

3.1.6.1 Storage

The storage level results show that the tank levels fluctuate normally, with all tanks remaining above their minimum fire and emergency levels and critical minimum levels during the maximum day EPS scenario.

3.1.6.2 Pressures

The minimum pressure results show that the minimum pressures are above 40 psi during peak hour demands in the majority of the system. The following area of the existing system has pressures below 40 psi: Des-Pins Ave. (36.0 psi).

The maximum pressure results show that the maximum pressures are below 100 psi in the majority of the system. This scenario assumes that the Clarence Creek, St. Pascal, and Bourget PRV's are active to maintain pressures below 100 psi in these areas. The same areas of high pressure indicated in previous scenarios are found in this scenario. However, the magnitude is slightly lower due to increasing demands.

3.1.6.3 Velocities

The pipe velocity results show that the majority of maximum velocities are below 1.5 m/s and none are above 2.0 m/s, and are therefore acceptable.

3.1.6.4 Available Fire Flows

The available fire flow during the maximum day SS results have been provided for reference. However, a detailed analysis of available and recommended fire flows is outside the scope of this analysis. It is recommended that this be further examined through a master plan study.

3.1.6.5 Water Age

The maximum water age results during the average day EPS scenario have been provided for reference. However, a detailed analysis of water quality is outside the scope of this analysis. It is recommended that this be further examined through a master plan study. The model predicts that the average water age at the Cheney ET increases continuously throughout the analysis. This is expected due to the low water demands in the villages in Scenario 1 – Clarence-Rockland Only.

3.1.7 Scenario 1-7 – Beyond 2042 Demands and Infrastructure

The hydraulic model outputs for this scenario are presented in Appendix A-7. No additional upgrades are included in this scenario above those included in previous scenarios.

The following sections describe the system performance for this scenario related to storage, minimum and maximum pressures, pipe velocities, available fire flows, and water age.

3.1.7.1 Storage

The storage level results show that the tank levels fluctuate normally, with all tanks remaining above their minimum fire and emergency levels and critical minimum levels during the maximum day EPS scenario.

3.1.7.2 Pressures

The minimum pressure results show that the minimum pressures are above 40 psi during peak hour demands in the majority of the system. The following area of the existing system has pressures below 40 psi: Des-Pins Ave. (35.7 psi).

The maximum pressure results show that the maximum pressures are below 100 psi in the majority of the system. This scenario assumes that the Clarence Creek, St. Pascal, and Bourget PRV's are active to maintain pressures below 100 psi in these areas. The same areas of high pressure indicated in previous scenarios are found in this scenario. However, the magnitude is slightly lower due to increasing demands.

3.1.7.3 Velocities

The pipe velocity results show that the majority of maximum velocities are below 1.5 m/s and none are above 2.0 m/s, and are therefore acceptable.

3.1.7.4 Available Fire Flows

The available fire flow during the maximum day SS results have been provided for reference. However, a detailed analysis of available and recommended fire flows is outside the scope of this analysis. It is recommended that this be further examined through a master plan study.

3.1.7.5 Water Age

The maximum water age results during the average day EPS scenario have been provided for reference. However, a detailed analysis of water quality is outside the scope of this analysis. It is recommended that this be further examined through a master plan study. The model predicts that the average water age at the Cheney ET increases continuously throughout the analysis. This is expected due to the low water demands in the villages in Scenario 1 – Clarence-Rockland Only.

3.2 Scenario 2 – Clarence-Rockland Plus Limoges

The Scenario 2 – Clarence-Rockland Plus Limoges group of scenarios assume that Limoges is connected to the Clarence-Rockland water system. These model results show the system performance with proposed upgrades needed to service Clarence-Rockland and Limoges over the design horizon.

3.2.1 Scenario 2-1 – 2017 Demands and Infrastructure

The hydraulic model outputs for this scenario are presented in Appendix B-1. The following upgrades are required to service the demands in this scenario: new watermainfrom the Cheney ET to Limoges, increase the Caron BS capacity, new watermain from the Caron BS to the Bouvier ET (including valving to create a sub-pressure zone PZ-2A), new watermain on Caron St. from Docteur Corbeil Blvd. to the Caron BS, new watermain on St. Jean from Patricia St. to Docteur Corbeil Blvd.

The following sections describe the system performance for this scenario related to storage, minimum and maximum pressures, pipe velocities, available fire flows, and water age.

3.2.1.1 Storage

The storage level results show that the tank levels fluctuate normally, with all tanks remaining above their minimum fire and emergency levels and critical minimum levels during the maximum day EPS scenario.

3.2.1.2 Pressures

The minimum pressure results show that the minimum pressures are above 40 psi during peak hour demands in the majority of the system. The following area of the existing system has pressures below 40 psi: Des-Pins Ave. (35.2 psi).

The maximum pressure results show that the maximum pressures are below 100 psi in the majority of the system. This scenario assumes that the Clarence Creek, St. Pascal, and Bourget PRV's are active to maintain pressures below 100 psi in these areas. The following areas of the existing system have pressures of 100 psi or above: the new Caron BS to Bouvier Rd. and Labonte Rd. transmission main, and the area upstream of the St. Pascal PRV. The new transmission main would have no water services on it and would be designed to handle the pressure. Therefore, higher pressures in this pipe are acceptable. According to records provided by the City, the area upstream of the existing St. Pascal PRV have individual PRVs installed in their houses to protect the building plumbing from the high pressures.

3.2.1.3 Velocities

The pipe velocity results show that the majority of maximum velocities are below 1.5 m/s and none are above 2.0 m/s, and are therefore acceptable.

3.2.1.4 Available Fire Flows

The available fire flow during the maximum day SS results have been provided for reference. However, a detailed analysis of available and recommended fire flows is outside the scope of this analysis. It is recommended that this be further examined through a master plan study.

Areas with dead end watermains in the system generally have poor available fire flow (below 67 L/s, or below 50 L/s). The available fire flow in all of St. Pascal is below 50 L/s due to the lack of looping in this area, and the small diameter of the watermain (200 mm) along this section. The available fire flow in the area between Hammond and Cheney along Drouin Rd is below 50 L/s due to the small diameter of the watermain (150 mm) along this section.

3.2.1.5 Water Age

The maximum water age results have been provided for reference. However, a detailed analysis of water quality is outside the scope of this analysis. It is recommended that this be further examined through a master plan study. The average water age at the Cheney ET was predicted to be approximately 300 hours. The average water age of the water entering the Limoges reservoir was predicted to be approximately 300 hours. This is due to the low existing demands in PZ-2 and specifically within the vicinity of the Cheney ET. The increase in demands from Limoges improves the turnover of water in PZ-2 and PZ-3, and reduces the water age.

3.2.2 Scenario 2-2 – 2022 Demands and Infrastructure

The hydraulic model outputs for this scenario are presented in Appendix B-2. In addition to the upgrades indicated in previous scenarios, the following upgrades are required to service the demands in this scenario: upgrades at the Rockland WTP including treatment capacity, pumping capacity, and distribution storage capacity, replace 300 mm diameter watermain on Edwards St. with new 500 mm diameter watermain, and new watermain from the Bouvier ET to the intersection of Bouvier Rd. and Lacroix Rd.

The following sections describe the system performance for this scenario related to storage, minimum and maximum pressures, pipe velocities, available fire flows, and water age.

3.2.2.1 Storage

The storage level results show that the tank levels fluctuate normally, with all tanks remaining above their minimum fire and emergency levels and critical minimum levels during the maximum day EPS scenario.

3.2.2.2 Pressures

The minimum pressure results show that the minimum pressures are above 40 psi during peak hour demands in the majority of the system. The following area of the existing system has pressures below 40 psi: Des-Pins Ave. (36.8 psi).

The maximum pressure results show that the maximum pressures are below 100 psi in the majority of the system. This scenario assumes that the Clarence Creek, St. Pascal, and Bourget PRV's are active to maintain pressures below 100 psi in these areas. The same areas of high pressure indicated in previous scenarios are found in this scenario. However, the magnitude is slightly lower due to increasing demands.

3.2.2.3 Velocities

This scenario assumes various upgrades within PZ-1 to address high velocities leaving the WTP and around the Rockland ET. With these upgrades, the pipe velocity results show that the majority of maximum velocities are below 1.5 m/s and none are above 2.0 m/s, and are therefore acceptable.

3.2.2.4 Available Fire Flows

The available fire flow during the maximum day SS results have been provided for reference. However, a detailed analysis of available and recommended fire flows is outside the scope of this analysis. It is recommended that this be further examined through a master plan study.

3.2.2.5 Water Age

The maximum water age results have been provided for reference. However, a detailed analysis of water quality is outside the scope of this analysis. It is recommended that this be further examined through a master plan study. The average water age at the Cheney ET was predicted to be approximately 150 hours. The average water age of the water entering the Limoges reservoir was predicted to be approximately 150 hours.

3.2.3 Scenario 2-3 – 2027 Demands and Infrastructure

The hydraulic model outputs for this scenario are presented in Appendix B-3. In addition to the upgrades indicated in previous scenarios, the following upgrades are required to service the demands in this scenario: new watermain from Bouvier Rd. and Lacroix Rd. to the Cheney ET.

The following sections describe the system performance for this scenario related to storage, minimum and maximum pressures, pipe velocities, available fire flows, and water age.

3.2.3.1 Storage

The storage level results show that the tank levels fluctuate normally, with all tanks remaining above their minimum fire and emergency levels and critical minimum levels during the maximum day EPS scenario.

3.2.3.2 Pressures

The minimum pressure results show that the minimum pressures are above 40 psi during peak hour demands in the majority of the system. The following area of the existing system has pressures below 40 psi: Des-Pins Ave. (35.8 psi).

The maximum pressure results show that the maximum pressures are below 100 psi in the majority of the system. This scenario assumes that the Clarence Creek, St. Pascal, and Bourget PRV's are active to maintain pressures below 100 psi in these areas. The same areas of high pressure indicated in previous scenarios are found in this scenario. However, the magnitude is slightly lower due to increasing demands.

3.2.3.3 Velocities

The pipe velocity results show that the majority of maximum velocities are below 1.5 m/s and none are above 2.0 m/s, and are therefore acceptable.

3.2.3.4 Available Fire Flows

The available fire flow during the maximum day SS results have been provided for reference. However, a detailed analysis of available and recommended fire flows is outside the scope of this analysis. It is recommended that this be further examined through a master plan study.

3.2.3.5 Water Age

The maximum water age results have been provided for reference. However, a detailed analysis of water quality is outside the scope of this analysis. It is recommended that this be further examined through a master plan study. The average water age at the Cheney ET was predicted to be approximately 75 hours. The average water age of the water entering the Limoges reservoir was predicted to be approximately 87 hours.

3.2.4 Scenario 2-4 – 2032 Demands and Infrastructure

The hydraulic model outputs for this scenario are presented in Appendix B-4. In addition to the upgrades indicated in previous scenarios, the following upgrades are required to service the demands in this scenario: new Bouvier BS and pressure zone modifications.

The following sections describe the system performance for this scenario related to storage, minimum and maximum pressures, pipe velocities, available fire flows, and water age.

3.2.4.1 Storage

The storage level results show that the tank levels fluctuate normally, with all tanks except Cheney ET remaining above their minimum fire and emergency levels and critical minimum levels during the maximum day EPS scenario. Due to the splitting of PZ-2 and PZ-3 and the increasing demands, the Cheney ET fire and emergency level is very high. Therefore, the Bouvier BS pumping capacity has been increased to compensate for the limited storage available in the PZ. The Cheney ET remains above it's critical level during the simulation.

3.2.4.2 Pressures

The minimum pressure results show that the minimum pressures are above 40 psi during peak hour demands in the majority of the system. The following area of the existing system has pressures below 40 psi: Des-Pins Ave. (36.1 psi).

The maximum pressure results show that the maximum pressures are below 100 psi in the majority of the system. This scenario assumes that the Clarence Creek, St. Pascal, and Bourget PRV's are active to maintain pressures below 100 psi in these areas. The same areas of high pressure indicated in previous scenarios are found in this scenario. However, the magnitude is slightly lower due to increasing demands.

3.2.4.3 Velocities

The pipe velocity results show that the majority of maximum velocities are below 1.5 m/s and none are above 2.0 m/s, and are therefore acceptable.

3.2.4.4 Available Fire Flows

The available fire flow during the maximum day SS results have been provided for reference. However, a detailed analysis of available and recommended fire flows is outside the scope of this analysis. It is recommended that this be further examined through a master plan study.

3.2.4.5 Water Age

The maximum water age results have been provided for reference. However, a detailed analysis of water quality is outside the scope of this analysis. It is recommended that this be further examined through a master plan study. The average water age at the Cheney ET was predicted to be approximately 70 hours. The average water age of the water entering the Limoges reservoir was predicted to be approximately 87 hours.

3.2.5 Scenario 2-5 – 2037 Demands and Infrastructure

The hydraulic model outputs for this scenario are presented in Appendix B-5. No additional upgrades are included in this scenario above those included in previous scenarios.

The following sections describe the system performance for this scenario related to storage, minimum and maximum pressures, pipe velocities, available fire flows, and water age.

3.2.5.1 Storage

The storage level results show that the tank levels fluctuate normally, with all tanks except Cheney ET remaining above their minimum fire and emergency levels and critical minimum levels during the maximum day EPS scenario. Due to the splitting of PZ-2 and PZ-3 and the increasing demands, the Cheney ET fire and emergency level is very high. Therefore, the Bouvier BS pumping capacity has been increased to compensate for the limited storage available in the PZ. The Cheney ET remains above it's critical level during the simulation.

3.2.5.2 Pressures

The minimum pressure results show that the minimum pressures are above 40 psi during peak hour demands in the majority of the system. The following area of the existing system has pressures below 40 psi: Des-Pins Ave. (36.2 psi).

The maximum pressure results show that the maximum pressures are below 100 psi in the majority of the system. This scenario assumes that the Clarence Creek, St. Pascal, and Bourget PRV's are active to maintain pressures below 100 psi in these areas. The same areas of high pressure indicated in previous scenarios are found in this scenario. However, the magnitude is slightly lower due to increasing demands.

3.2.5.3 Velocities

The pipe velocity results show that the majority of maximum velocities are below 1.5 m/s and none are above 2.0 m/s, and are therefore acceptable.

3.2.5.4 Available Fire Flows

The available fire flow during the maximum day SS results have been provided for reference. However, a detailed analysis of available and recommended fire flows is outside the scope of this analysis. It is recommended that this be further examined through a master plan study.

3.2.5.5 Water Age

The maximum water age results have been provided for reference. However, a detailed analysis of water quality is outside the scope of this analysis. It is recommended that this be further examined through a master plan study. The average water age at the Cheney ET was predicted to be approximately 65 hours. The average water age of the water entering the Limoges reservoir was predicted to be approximately 75 hours.

3.2.6 Scenario 2-6 – 2042 Demands and Infrastructure

The hydraulic model outputs for this scenario are presented in Appendix B-6. No additional upgrades are included in this scenario above those included in previous scenarios.

The following sections describe the system performance for this scenario related to storage, minimum and maximum pressures, pipe velocities, available fire flows, and water age.

3.2.6.1 Storage

The storage level results show that the tank levels fluctuate normally, with all tanks except Cheney ET remaining above their minimum fire and emergency levels and critical minimum levels during the maximum day EPS scenario. Due to the splitting of PZ-2 and PZ-3 and the increasing demands, the Cheney ET fire and emergency level is very high. Therefore, the Bouvier BS pumping capacity has been increased to compensate for the limited storage available in the PZ. The Cheney ET remains above it's critical level during the simulation.

3.2.6.2 Pressures

The minimum pressure results show that the minimum pressures are above 40 psi during peak hour demands in the majority of the system. The following area of the existing system has pressures below 40 psi: Des-Pins Ave. (36.4 psi).

The maximum pressure results show that the maximum pressures are below 100 psi in the majority of the system. This scenario assumes that the Clarence Creek, St. Pascal, and Bourget PRV's are active to maintain pressures below 100 psi in these areas. The same areas of high pressure indicated in previous scenarios are found in this scenario. However, the magnitude is slightly lower due to increasing demands.

3.2.6.3 Velocities

The pipe velocity results show that the majority of maximum velocities are below 1.5 m/s and none are above 2.0 m/s, and are therefore acceptable.

3.2.6.4 Available Fire Flows

The available fire flow during the maximum day SS results have been provided for reference. However, a detailed analysis of available and recommended fire flows is outside the scope of this analysis. It is recommended that this be further examined through a master plan study.

3.2.6.5 Water Age

The maximum water age results have been provided for reference. However, a detailed analysis of water quality is outside the scope of this analysis. It is recommended that this be further examined through a master plan study. The average water age at the Cheney ET was predicted to be approximately 55 hours. The average water age of the water entering the Limoges reservoir was predicted to be approximately 62 hours.

3.2.7 Scenario 2-7 – Beyond 2042 Demands and Infrastructure

The hydraulic model outputs for this scenario are presented in Appendix B-7. No additional upgrades are included in this scenario above those included in previous scenarios.

The following sections describe the system performance for this scenario related to storage, minimum and maximum pressures, pipe velocities, available fire flows, and water age.

3.2.7.1 Storage

The storage level results show that the tank levels fluctuate normally, with all tanks except Cheney ET remaining above their minimum fire and emergency levels and critical minimum levels during the maximum day EPS scenario. Due to the splitting of PZ-2 and PZ-3 and the increasing demands, the Cheney ET fire and emergency level is very high. Therefore, the Bouvier BS pumping capacity has been increased to compensate for the limited storage available in the PZ. The Cheney ET remains above it’s critical level during the simulation.

3.2.7.2 Pressures

The minimum pressure results show that the minimum pressures are above 40 psi during peak hour demands in the majority of the system. The following area of the existing system has pressures below 40 psi: Des-Pins Ave. (36.1 psi).

The maximum pressure results show that the maximum pressures are below 100 psi in the majority of the system. This scenario assumes that the Clarence Creek, St. Pascal, and Bourget PRV’s are active to maintain pressures below 100 psi in these areas. The same areas of high pressure indicated in previous scenarios are found in this scenario. However, the magnitude is slightly lower due to increasing demands.

3.2.7.3 Velocities

The pipe velocity results show that the majority of maximum velocities are below 1.5 m/s and none are above 2.0 m/s, and are therefore acceptable.

3.2.7.4 Available Fire Flows

The available fire flow during the maximum day SS results have been provided for reference. However, a detailed analysis of available and recommended fire flows is outside the scope of this analysis. It is recommended that this be further examined through a master plan study.

3.2.7.5 Water Age

The maximum water age results have been provided for reference. However, a detailed analysis of water quality is outside the scope of this analysis. It is recommended that this be further examined through a master plan study. The average water age at the Cheney ET was predicted to be approximately 43 hours. The average water age of the water entering the Limoges reservoir was predicted to be approximately 52 hours.

4 Clarence-Rockland Pressure Zone, Storage, and Pumping Analyses

4.1 Pressure Zones

Changes to the configuration of the existing PZs will be required to satisfy the water storage requirements, pumping requirements, and pressures requirements for each PZ. Figure 4-1 shows the existing PZ configuration and Figure 4-2 shows the proposed configuration (see Appendix F for full size PZ maps). The existing PZ 2 configuration includes the Bouvier ET and the Cheney ET and is supplied from PZ 1 through the Caron BS. The PZ configuration changes include adding a new booster station downstream of the Bouvier ET, which would split the PZ in to the North section (supplied by Caron BS and includes the Bouvier ET), and the South section (supplied by the Bouvier BS and includes the Cheney ET). In Table 4-1, the water storage and pumping requirements are summarized for each PZ for each design year.

Figure 4-1. Pressure Zones – Existing Configuration

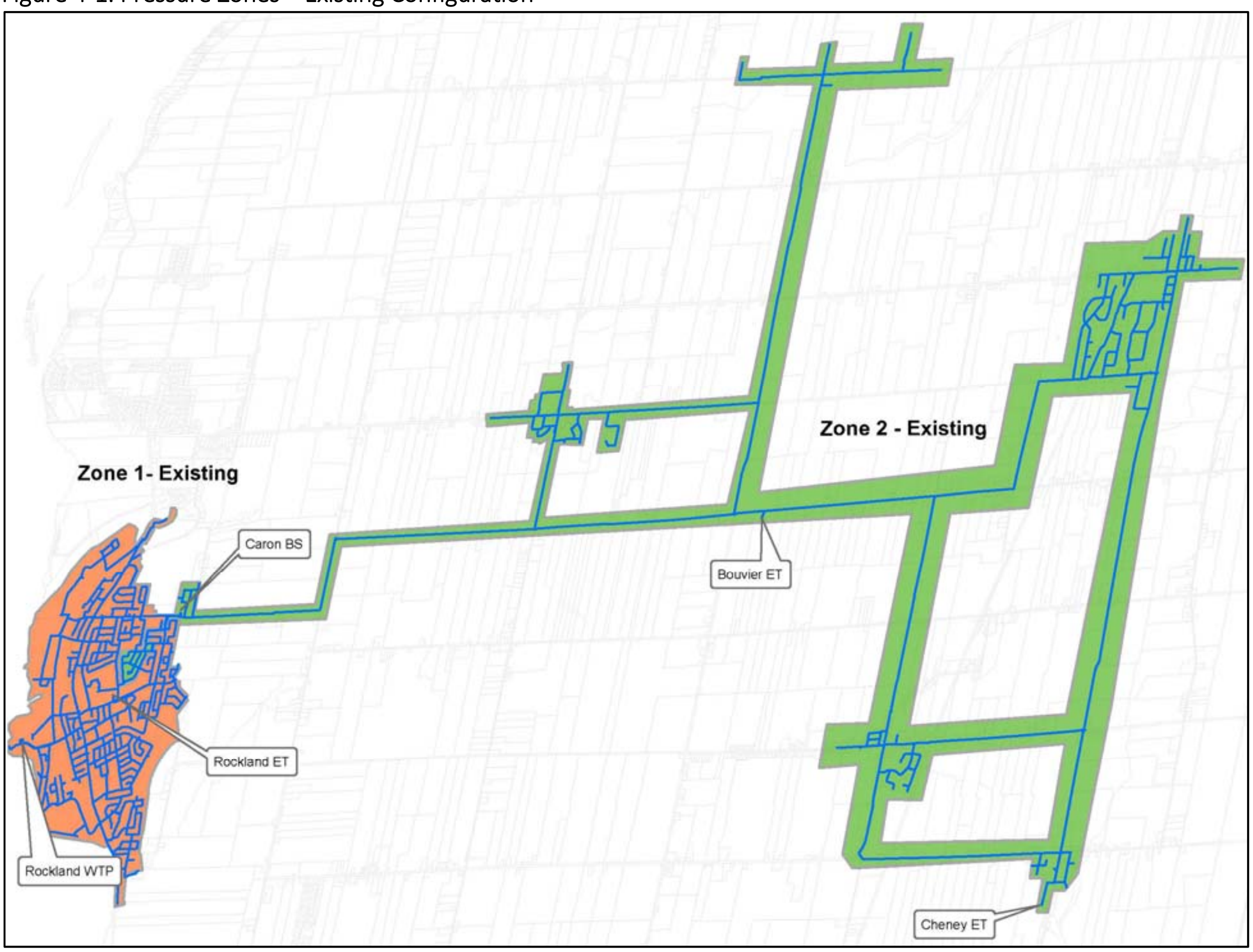
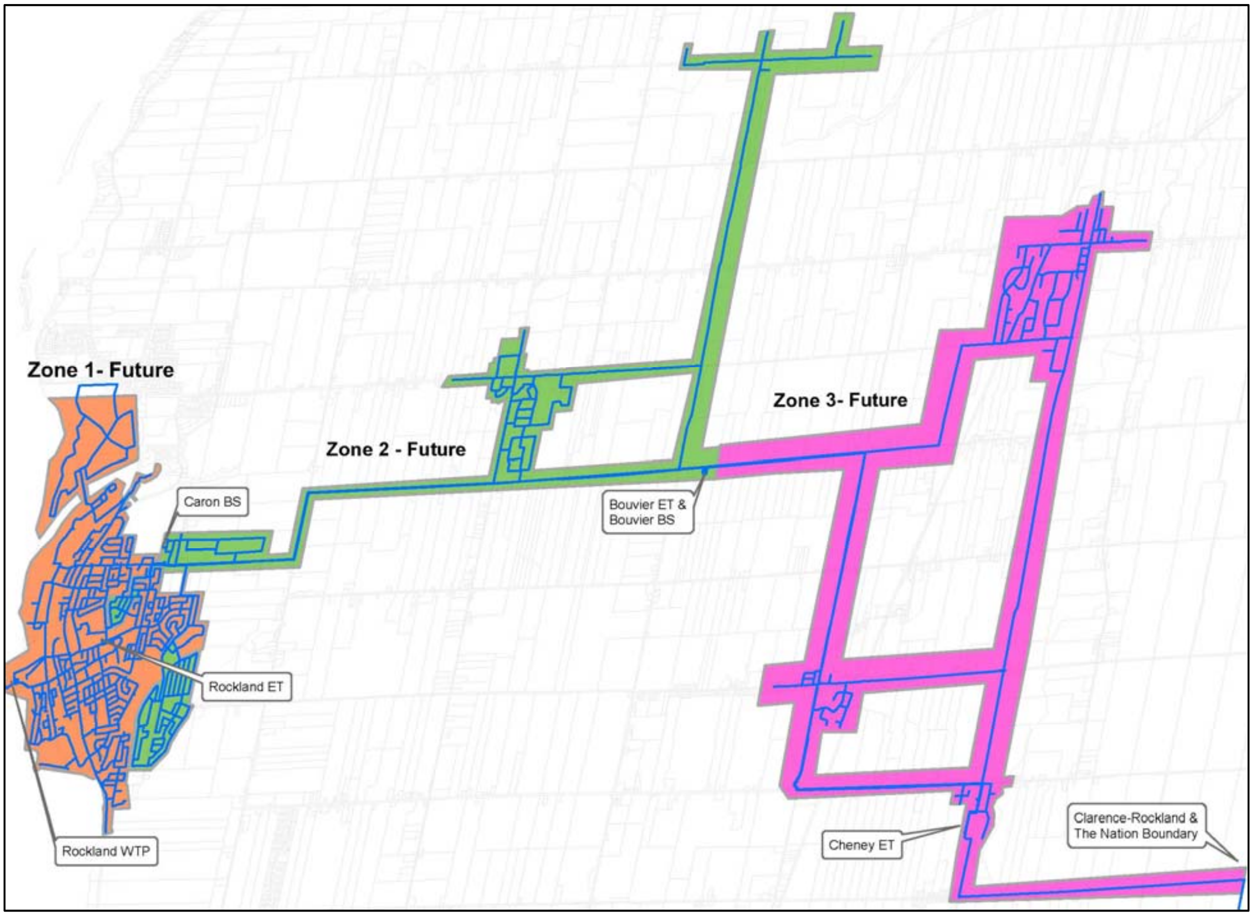


Figure 4-2. Pressure Zones – Proposed Future Configuration



4.2 Storage

4.2.1 Storage Volume Requirements

The calculated water storage requirements are shown for each design year in Table 4-1. The water storage requirements were calculated using the MOE Guidelines (Ministry of the Environment, 2008) equation: A (Fire) + B (Balancing/Equalization) + C (Emergency). The fire storage is calculated by taking the target fire flow rate times the duration required. The balancing storage is calculated by taking 25% of the maximum day demand in the PZ that the storage services. The emergency storage is calculated by taking 25% of the calculated balancing and fire storage volumes.

The fire storage component is calculated by multiplying the fire flow target for the zone multiplied by the duration the fire flow is required. The Zone 1 target was assumed to be 200 L/s for 3 hours. The Zone 2 – Existing, Zone 2 – Future, and Zone 3 – Future targets were assumed to be 100 L/s for 2 hours. It is recommended that this be these values be further examined through a master plan study.

The available storage for each zone includes the following storage assumptions:

- Zone 1 – Existing: Rockland ET
- Zone 1 – Future: Rockland ET
- Zone 2 – Existing: Bouvier ET, and Cheney ET
- Zone 2 – Future: Bouvier ET
- Zone 3 – Future: Cheney ET

Depending on the scenario (1-Clarence-Rockland Only, or 2-Clarence-Rockland Plus Limoges), and the design year (eg. 2017, 2022, etc.) the storage assumptions will change based on the infrastructure upgrade recommendations for that scenario and year.

To address the PZ-1 future storage deficiency identified in Table 4-1, it is recommended to increase the clearwell storage volume at the WTP and increase the WTP pumping capacity beyond maximum day demands, to meet the storage requirement.

To address the PZ-2 – Existing, PZ-2 – Future, and PZ-3 – Future storage deficiencies identified in Table 4-1, it is recommended to increase Caron BS capacity for PZ-2 (existing, and future), and the future Bouvier BS capacity for PZ-3.

4.3 Pumping

The calculated pumping requirements are shown for each design year in Table 4-1. The required firm pumping station capacity is equal to the maximum day demand if sufficient storage exists in the PZ. For PZs where there is insufficient storage available, the pumps must make up the volume deficiency. Firm pumping capacity is defined as the total installed capacity of a station or group of parallel stations minus the largest pump. Pumping station capacity is required to supply the demands in the entire service area, including any downstream PZs.

The available pumping capacity in Table 4-1 is based on the pump design points in the hydraulic model multiplied by the number of pumps. Future pumps have been sized using system head curves from the model, and the pumping requirements set out in this section. The minimum needed flow in Table 4-1 is calculated by taking the maximum day demands for the pumps in a particular PZ and adding on any additional volume to make up the storage deficiency identified (if applicable).

Table 4-1. Clarence-Rockland Water Storage and Pumping Requirements

Year	Pressure Zone[4]	Storage[1]						Pumping Capacity[2]		
		Design Capacity[3]				Available Capacity (m3)	Is Available > Design?	Available (m3/d)	Minimum Needed[6] (m3/d)	Is Available > Needed?
		Balancing (m3)	Fire[5] (m3)	Emergency (m3)	Total (m3)					
Beyond 2042	1F	3,282.0	2,160.0	1,360.5	6,802.4	4,538	No	30,120.53	29,646.97	Yes
	2E	1,794.6	720.0	628.7	3,143.3	2,903	No	15,552.00	14,495.02	Yes
	2F	1,282.9	720.0	500.7	2,503.6	1,834	No	15,552.00	14,923.84	Yes
	3F	511.7	720.0	307.9	1,539.7	1,068	No	9,979.20	9,594.14	Yes
2042	1F	2,845.0	2,160.0	1,251.3	6,256.3	4,538	No	26,336.90	25,661.12	Yes
	2E	1,371.6	720.0	522.9	2,614.6	2,903	Yes	13,824.00	12,562.59	Yes
	2F	958.3	720.0	419.6	2,097.8	1,834	No	13,824.00	12,826.17	Yes
	3F	413.4	720.0	283.3	1,416.7	1,068	No	9,504.00	9,077.71	Yes
2037	1F	2,561.7	2,160.0	1,180.4	5,902.1	4,538	No	26,336.90	22,574.20	Yes
	2E	1,239.0	720.0	489.8	2,448.8	2,903	Yes	13,824.00	10,963.11	Yes
	2F	825.7	720.0	386.4	1,932.1	1,834	No	13,824.00	11,060.92	Yes
	3F	413.4	720.0	283.3	1,416.7	1,068	No	9,504.00	8,008.71	Yes
2032	1F	2,248.2	2,160.0	1,102.0	5,510.2	4,538	No	26,336.90	19,602.06	Yes
	2E	1,105.2	720.0	456.3	2,281.5	2,903	Yes	13,824.00	9,636.81	Yes
	2F	692.1	720.0	353.0	1,765.1	1,834	Yes	13,824.00	9,636.81	Yes
	3F	413.1	720.0	283.3	1,416.4	1,068	No	9,504.00	7,216.29	Yes
2027	1F	2,019.3	2,160.0	1,044.8	5,224.1	4,538	No	26,336.90	16,759.93	Yes
	2E	963.1	720.0	420.8	2,103.9	2,903	Yes	13,824.00	7,996.54	Yes
	2F	552.8	720.0	318.2	1,590.9	1,834	Yes	13,824.00	7,996.54	Yes
	3F	410.4	720.0	282.6	1,413.0	1,068	No	9,504.00	6,130.00	Yes

Year	Pressure Zone[4]	Storage[1]						Pumping Capacity[2]		
		Design Capacity[3]				Available Capacity (m3)	Is Available > Design?	Available (m3/d)	Minimum Needed[6] (m3/d)	Is Available > Needed?
		Balancing (m3)	Fire[5] (m3)	Emergency (m3)	Total (m3)					
2022	1F	1,766.9	2,160.0	981.7	4,908.6	4,538	No	26,336.90	13,711.78	Yes
	2E	390.5	720.0	277.6	1,388.2	2,903	Yes	9,504.00	6,273.45	Yes
2017	1E	1,248.2	2,160.0	852.0	4,260.2	4,538	Yes	12,150.00	10,074.02	Yes
	2E	301.3	720.0	255.3	1,276.7	2,903	Yes	9,504.00	4,679.20	Yes

Notes:

1 Storage capacity is to service only Clarence-Rockland (Balancing, Fire, and Emergency is only for CR).

2 Pumping capacity services both Clarence-Rockland and Limoges maximum day demands. The pumping capacity may also supply some of the additional volume required to make up any storage deficiencies.

3 Balancing storage is 25% of the maximum day demand. Fire storage is the fire flow requirement times the duration required. Emergency storage is 25% of the balancing and fire storage.

4 E - Existing pressure zone configuration, F - Future pressure zone configuration

5 Fire Flow: Zone 1 - 200 L/s for 3 hrs, Zone 2 Existing, Zone 2 Future Villages N, and Zone 3 Future Villages S - 100 L/s for 2 hrs

6 The firm pumping station capacity should be at least equal to the maximum day demand if sufficient storage exists in the PZ. For PZs where there is insufficient storage available, the pumps must make up the volume deficiency. Firm pumping capacity is defined as the total installed capacity of station or group of parallel stations minus the largest pump. Pumping station capacity is required to supply the demands in the entire service area, including any downstream PZs.

5 Recommendations

5.1 Scenario 1 – Clarence-Rockland Only

5.1.1 Scenario 1-1 – 2017 Recommendations

This scenario represents the existing conditions in the system. No capacity upgrades are required for this scenario. However, the following operational upgrades are recommended:

- New 300 mm diameter watermain on St. Jean St. from Patricia St. to Docteur Corbeil Blvd. Note that this watermain is not required to meet the design criteria for Scenario 1-1, but is needed for redundancy and to improve pressures in future scenarios. However, it will be built in the short-term due to the timing of work on the Morris development.
- New 350 mm watermain from the Caron BS to the intersection of Bouvier Rd. and Labonte St. totaling approximately 6.2 km including pressure reducing valves to create sub-PZ-2A.

5.1.2 Scenario 1-2 – 2022 Recommendations

This scenario is an incremental increase in water demands compared to the 2017 scenario. No additional upgrades are required beyond what has been indicated in previous scenarios.

5.1.3 Scenario 1-3 – 2027 Recommendations

This scenario is an incremental increase in water demands compared to the 2022 scenario. The following capacity upgrades are recommended:

- Acquire land adjacent to the existing WTP to expand the WTP.
- Increase the Rockland WTP treatment capacity from 13,500 m^3/d to 23,000 m^3/d to meet the Beyond 2042 scenario maximum day demand (assuming an extra 10% for filter backwashes).
- Increase the Rockland WTP high lift pumping capacity from 13,500 m^3/d to 25,500 m^3/d to meet the Beyond 2042 scenario maximum day demand plus additional capacity to compensate for PZ-1 storage deficiency.
- Expand the Rockland WTP clearwell storage volume to meet the Beyond 2042 scenario storage requirements for PZ-1.
- Replace existing 300 mm Edwards St. watermain (east side of road) with new 500 mm watermain. Extent of replacement from the WTP to the south side of Highway 17.
- Expand the Caron BS capacity from 3,975 m^3/d to 8,000 m^3/d.

5.1.4 Scenario 1-4 – 2032 Recommendations

This scenario is an incremental increase in water demands compared to the 2027 scenario. No additional upgrades are required beyond what has been indicated in previous scenarios.

5.1.5 Scenario 1-5 – 2037 Recommendations

This scenario is an incremental increase in water demands compared to the 2032 scenario. No additional upgrades are required beyond what has been indicated in previous scenarios.

5.1.6 Scenario 1-6 – 2042 Recommendations

This scenario is an incremental increase in water demands compared to the 2037 scenario. No additional upgrades are required beyond what has been indicated in previous scenarios.

5.1.7 Scenario 1-7 – Beyond 2042 Recommendations

This scenario includes all water demands that are anticipated beyond the year 2042 and is not an incremental increase from the 2042 scenario. The timing of these future developments and water demands is currently unknown. This scenario is included in the analysis so that the recommended infrastructure is sized to account for these future known water demands. No additional upgrades are required beyond what has been indicated in previous scenarios.

5.2 Scenario 2 – Clarence-Rockland Plus Limoges

5.2.1 Scenario 2-1 – 2017 Recommendations

This scenario represents the existing conditions in the system with the addition of the 2017 Limoges demands. The following capacity and operational upgrades are recommended:

- New 400 mm watermain main from the Cheney ET to the existing Limoges WTP totaling approximately 9.8 km to connect Limoges to the Clarence-Rockland water system.
- New 300 mm diameter watermain on St. Jean St. from Patricia St. to Docteur Corbeil Blvd. Note that this watermain is not required to meet the design criteria for Scenario 2-1, but is needed for redundancy and to improve pressures in future scenarios. However, it will be built in the short-term due to the timing of work on the Morris development.
- New 450 mm watermain from the Caron BS to the Bouvier ET totaling approximately 9.3 km including pressure reducing valves to create sub-PZ-2A.
- New 450 mm watermain on Caron St. from Docteur Corbeil Blvd. to the Caron BS totaling approximately 0.2 km.
- Expand the Caron BS capacity from 3,975 m^3/d to 15,000 m^3/d.

5.2.2 Scenario 2-2 – 2022 Recommendations

This scenario is an incremental increase in water demands compared to the 2017 scenario. The following capacity upgrades are recommended:

- Increase the Rockland WTP treatment capacity from 13,500 m^3/d to 30,500 m^3/d to meet the Beyond 2042 scenario maximum day demand (assuming an extra 10% for filter backwashes). This includes land acquisition adjacent to the existing WTP for the expansion.
- Increase the Rockland WTP high lift pumping capacity from 13,500 m^3/d to 32,700 m^3/d to meet the Beyond 2042 scenario maximum day demand plus additional capacity to compensate for PZ-1 storage deficiency.
- Expand the Rockland WTP clearwell storage volume to meet the Beyond 2042 scenario storage requirements for PZ-1.
- Replace existing 300 mm Edwards St. watermain (east side of road) with new 500 mm watermain. Extent of replacement from the WTP to the south side of Highway 17.
- New 350 mm watermain from the Bouvier ET to the intersection of Bouvier and Lacroix totaling approximately 2.6 km.

5.2.3 Scenario 2-3 – 2027 Recommendations

This scenario is an incremental increase in water demands compared to the 2022 scenario. The following capacity upgrades are recommended:

- New watermain from the Bouvier and Lacroix to the Cheney ET totaling approximately 8.3 km. This includes approximately 3.0 km of 350 mm diameter watermain and 5.3 km of 300 mm diameter watermain.

5.2.4 Scenario 2-4 – 2032 Recommendations

This scenario is an incremental increase in water demands compared to the 2027 scenario. The following capacity upgrades are recommended:

- New Bouvier BS with a pumping capacity of 10,000 m^3/d located adjacent to the existing Bouvier ET.

5.2.5 Scenario 2-5 – 2037 Recommendations

This scenario is an incremental increase in water demands compared to the 2032 scenario. No additional upgrades are required beyond what has been indicated in previous scenarios.

5.2.6 Scenario 2-6 – 2042 Recommendations

This scenario is an incremental increase in water demands compared to the 2037 scenario. No additional upgrades are required beyond what has been indicated in previous scenarios.

5.2.7 Scenario 2-7 – Beyond 2042 Recommendations

This scenario includes all water demands that are anticipated beyond the year 2042 and is not an incremental increase from the 2042 scenario. The timing of these future developments and water demands is currently unknown. This scenario is included in the analysis so that the recommended infrastructure is sized to account for these future known water demands. No additional upgrades are required beyond what has been indicated in previous scenarios.

SECTION 6

6 Capital Works Plan

6.1 Infrastructure Costs

6.1.1 Recommended Infrastructure Upgrades – Scenario 1 – Clarence-Rockland Only

A Class D estimate was prepared for each recommended infrastructure upgrade for Scenario 1 from Section 5.1 and the estimated costs are shown in Table 6-3 and Table 6-2. The cost estimates in Table 6-3 and Table 6-2 are estimated using the two watermain unit price calculations shown in Section 6.1.4 (Conservative, and Aggressive unit cost estimates).

Table 6-1. Summary of Recommended Infrastructure Upgrade Costs – Scenario 1 – Conservative Cost Estimate

Infrastructure Recommendation Description	Estimated Base Cost ($ M)	Base Cost Markups[1] ($ M)	Subtotal ($ M)	Subtotal Markups[2] ($ M)	Total[3] ($ M)
Zone 1 - Rockland					
Rockland WTP Upgrades[4]	8.10	4.46	12.56	1.88	14.44
Replace Watermain – Edwards St: Rockland WTP to Highway 17 (east side pipe)	0.40	0.16	0.56	0.08	0.65
New Watermain – Caron St: Docteur Corbeil Blvd. to the Caron BS	0.14	0.06	0.20	0.03	0.23
New Watermain – St. Jean St: Patricia St. to Docteur Corbeil Blvd.	0.28	0.11	0.39	0.06	0.45
Zone 2 – Villages					
Caron BS Upgrades	1.23	0.67	1.90	0.28	2.18
New Watermain – Caron BS to Bouvier Rd. and Labonte St.	4.37	1.75	6.11	0.92	7.03
New Watermain – Bouvier Rd. and Labonte St. to Bouvier ET	2.52	1.01	3.52	0.53	4.05
Total	**17.04**	**8.22**	**25.24**	**3.78**	**29.03**

Notes:

1. Contractor's overhead, profit, mobilization, bonds, and insurance (15%), and design contingency (40% for facility upgrades, and 25% for watermain upgrades).
2. Construction contingency (5%), and average price escalation (10%).
3. Excludes HST.
4. The Rockland WTP Upgrades cost estimate includes low lift and high lift pumping and treatment capacity. It assumes that a new intake in the Ottawa River is not required.

Table 6-2. Summary of Recommended Infrastructure Upgrade Costs – Scenario 1 – Aggressive Cost Estimate

Infrastructure Recommendation Description	Estimated Base Cost ($ M)	Base Cost Markups[1] ($ M)	Subtotal ($ M)	Subtotal Markups[2] ($ M)	Total[3] ($ M)
Zone 1 - Rockland					
Rockland WTP Upgrades[4]	8.10	4.46	12.56	1.88	14.44
Replace Watermain – Edwards St: Rockland WTP to Highway 17 (east side pipe)	0.28	0.11	0.39	0.06	0.45
New Watermain – Caron St: Docteur Corbeil Blvd. to the Caron BS	0.10	0.04	0.15	0.02	0.17
New Watermain – St. Jean St: Patricia St. to Docteur Corbeil Blvd.	0.25	0.10	0.34	0.05	0.40
Zone 2 – Villages					
Caron BS Upgrades	1.23	0.67	1.90	0.28	2.18
New Watermain – Caron BS to Bouvier Rd. and Labonte St.	3.21	1.28	4.49	0.67	5.16
New Watermain – Bouvier Rd. and Labonte St. to Bouvier ET	1.85	0.74	2.59	0.39	2.97
Total	**15.02**	**7.40**	**22.42**	**3.35**	**25.77**

Notes:

1. Contractor's overhead, profit, mobilization, bonds, and insurance (15%), and design contingency (40% for facility upgrades, and 25% for watermain upgrades).
2. Construction contingency (5%), and average price escalation (10%).
3. Excludes HST.
4. The Rockland WTP Upgrades cost estimate includes low lift and high lift pumping and treatment capacity. It assumes that a new intake in the Ottawa River is not required.

6.1.2 Recommended Infrastructure Upgrades – Scenario 2 – Clarence-Rockland Plus Limoges

A Class D estimate was prepared for each recommended infrastructure upgrade for Scenario 2 from Section 5.2 and the estimated costs are shown in Table 6-3 and Table 6-4. The cost estimates in Table 6-3 and Table 6-4 are estimated using the two unit price calculation shown in Section 6.1.4.

Table 6-3. Summary of Recommended Infrastructure Upgrade Costs – Scenario 2 – Conservative Cost Estimate

Infrastructure Recommendation Description	Estimated Base Cost ($ M)	Base Cost Markups[1] ($ M)	Subtotal ($ M)	Subtotal Markups[2] ($ M)	Total[3] ($ M)
Zone 1 - Rockland					
Rockland WTP Upgrades[4]	8.40	4.62	13.02	1.95	14.97
Replace Watermain – Edwards St: Rockland WTP to Highway 17 (east side pipe)	0.40	0.16	0.56	0.08	0.65
Replace Watermain – Edwards St: Highway 17 (east side pipe) to McCall St.	0.21	0.08	0.29	0.04	0.34
New Watermain – Caron St: Docteur Corbeil Blvd. to the Caron BS	0.14	0.06	0.20	0.03	0.23
New Watermain – St. Jean St: Patricia St. to Docteur Corbeil Blvd.	0.28	0.11	0.39	0.06	0.45
Replace Watermain – St. Joseph St: Patricia St. to Des Pins Ave.	0.08	0.03	0.12	0.02	0.14
Zone 2 – Villages					
Caron BS Upgrades	1.23	0.67	1.90	0.28	2.18
New Bouvier BS	1.78	0.98	2.76	0.41	3.17
New Watermain – Caron BS to Bouvier Rd. and Labonte St.	4.37	1.75	6.11	0.92	7.03
New Watermain – Bouvier Rd. and Labonte St. to Bouvier ET	2.52	1.01	3.52	0.53	4.05
New Watermain – Bouvier BS to Cheney ET	6.84	2.74	9.58	1.44	11.02
New Watermain – Cheney ET to Limoges	6.34	2.56	8.94	1.34	10.28
Total	**32.59**	**14.77**	**47.39**	**7.10**	**54.52**

Notes:

1. Contractor's overhead, profit, mobilization, bonds, and insurance (15%), and design contingency (40% for facility upgrades, and 25% for watermain upgrades).
2. Construction contingency (5%), and average price escalation (10%).
3. Excludes HST.
4. The Rockland WTP Upgrades cost estimate includes low lift and high lift pumping and treatment capacity. It assumes that a new intake in the Ottawa River is not required.

Table 6-4. Summary of Recommended Infrastructure Upgrade Costs – Scenario 2 – Aggressive Cost Estimate

Infrastructure Recommendation Description	Estimated Base Cost ($ M)	Base Cost Markups[1] ($ M)	Subtotal ($ M)	Subtotal Markups[2] ($ M)	Total[3] ($ M)
Zone 1 - Rockland					
Rockland WTP Upgrades[4]	8.40	4.62	13.02	1.95	14.97
Replace Watermain – Edwards St: Rockland WTP to Highway 17 (east side pipe)	0.28	0.11	0.39	0.06	0.45
Replace Watermain – Edwards St: Highway 17 (east side pipe) to McCall St.	0.14	0.06	0.20	0.03	0.23
New Watermain – Caron St: Docteur Corbeil Blvd. to the Caron BS	0.10	0.04	0.15	0.02	0.17
New Watermain – St. Jean St: Patricia St. to Docteur Corbeil Blvd.	0.25	0.10	0.34	0.05	0.40
Replace Watermain – St. Joseph St: Patricia St. to Des Pins Ave.	0.07	0.03	0.09	0.01	0.11
Zone 2 – Villages					
Caron BS Upgrades	1.23	0.67	1.90	0.28	2.18
New Bouvier BS	1.78	0.98	2.76	0.41	3.17
New Watermain – Caron BS to Bouvier Rd. and Labonte St.	3.21	1.28	4.49	0.67	5.16
New Watermain – Bouvier Rd. and Labonte St. to Bouvier ET	1.85	0.74	2.59	0.39	2.97
New Watermain – Bouvier BS to Cheney ET	5.74	2.30	8.04	1.21	9.25
New Watermain – Cheney ET to Limoges	5.15	2.06	7.21	1.08	8.29
Total	**28.20**	**12.99**	**41.18**	**6.16**	**47.36**

Notes:

1. Contractor's overhead, profit, mobilization, bonds, and insurance (15%), and design contingency (40% for facility upgrades, and 25% for watermain upgrades).
2. Construction contingency (5%), and average price escalation (10%).
3. Excludes HST.
4. The Rockland WTP Upgrades cost estimate includes low lift and high lift pumping and treatment capacity. It assumes that a new intake in the Ottawa River is not required.

6.1.3 Compensation for Use of Existing Infrastructure – Scenario 2 Clarence-Rockland Plus Limoges

In Sections 6.1.1 and 6.1.2, the costs for the recommended new infrastructure are broken down. However, in Scenario 2 – Clarence-Rockland Plus Limoges, servicing Limoges also uses capacity within existing infrastructure that does not require upgrading. Spare capacity in the existing network of watermains in Rockland that conveys water from the Rockland WTP to the Caron BS is being used to service Limoges. The main flow paths from the Rockland WTP to Limoges were identified and are shown in Figure 6-1, and Figure 6-2. The flow paths in PZ-2 were examined between the Caron BS and the Cheney ET. Due to the proposed system modifications between the Caron BS, and the Bouvier ET, there is no existing infrastructure being used to service Limoges in that section (only the new transmission main is used here). However, from the Bouvier ET, to the Cheney ET, some of the existing infrastructure is used, and this is shown in Figure 6-2.

Figure 6-1. Pressure Zone 1 Main Flow Paths from Rockland WTP to Caron BS

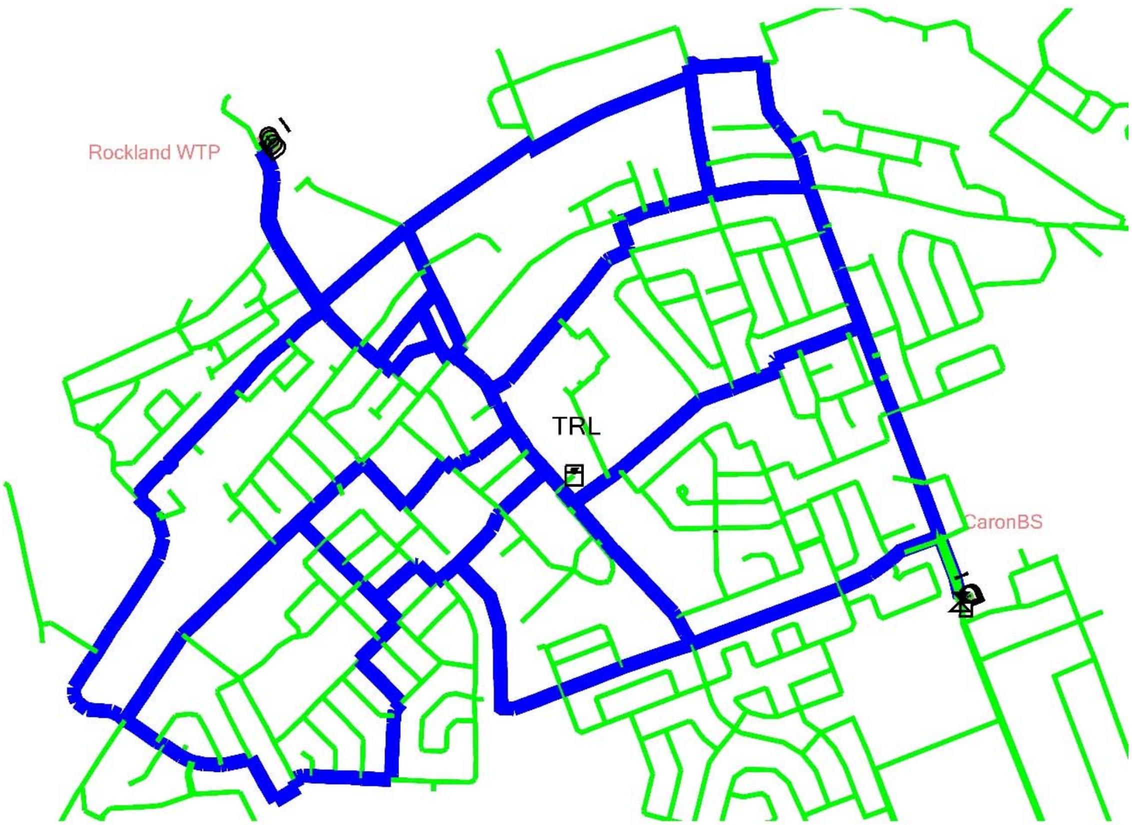
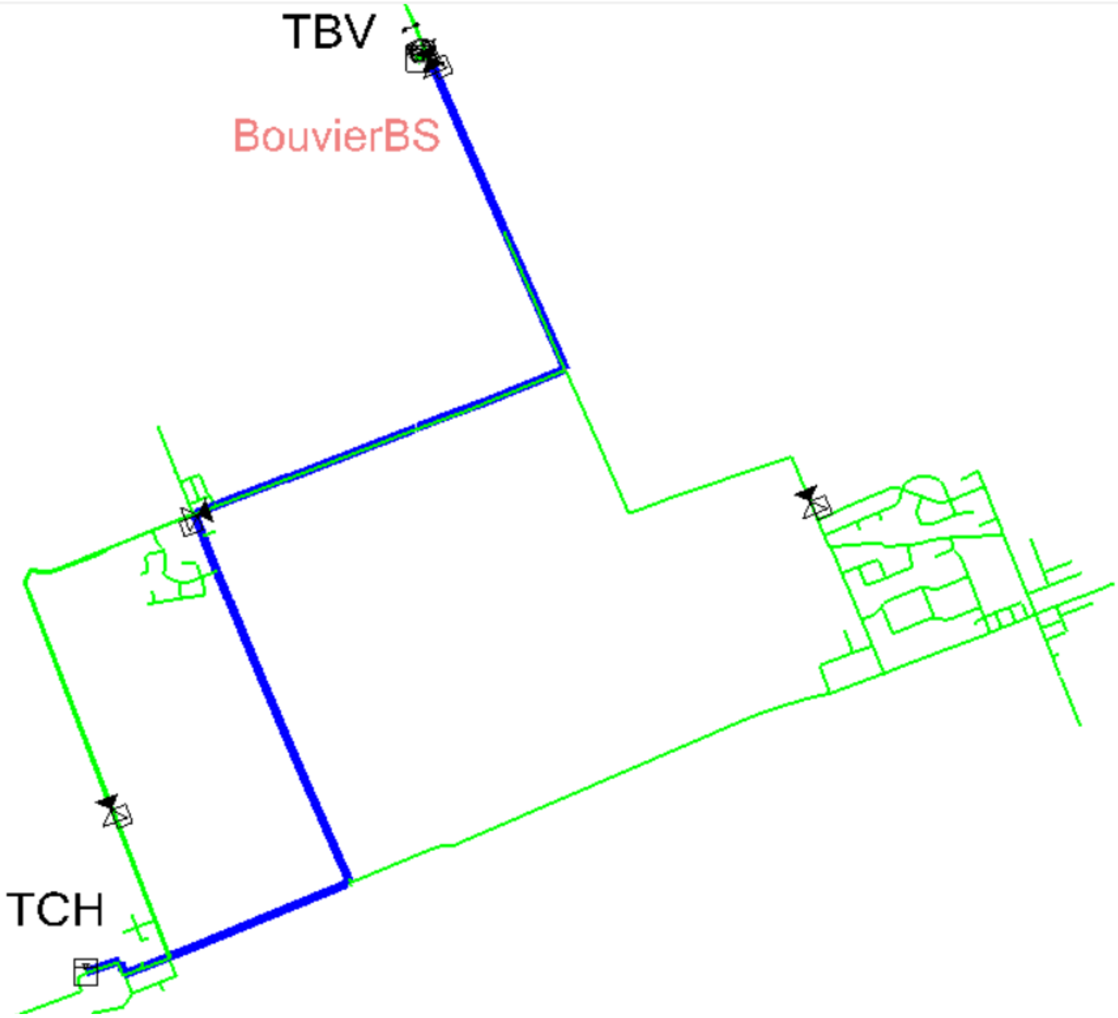


Figure 6-2. Pressure Zone 2/3 Main Flow Paths from Bouvier BS to Limoges



The watermains along the flow path, and their estimated replacement costs are summarized in Table 6-5. The total costs in Table 6-5 are calculated using the watermain unit costs in Table 6-6 and the scaled length of the watermain in the hydraulic model. The segments of watermain along the flow paths that require replacement are included in the new infrastructure tables in Section 6.1.2 and are therefore not included in Table 6-5. Since the full capacity of the existing watermains are not being used, the total replacement cost was scaled to reflect the percent of the total capacity that is currently being used. The maximum flow capacity for each pipe was calculated by assuming the maximum velocity of 2 m/s and the Hazen-Williams friction factors of 100 for 150 mm diameter pipe, 110 for 200 mm and 250 mm diameter pipes, and 120 for 300 mm and 400 mm diameter pipes. The maximum flow modelled in the Beyond 2042 scenario was used to determine the percent of the total capacity that is being used in this scenario. The percent of capacity used was multiplied by the total replacement cost to determine the scaled cost to be used in the cost share analysis.

Table 6-5. Existing Infrastructure Replacement Costs

Watermain Location	Total Replacement Cost ($ M)	Percent of Capacity Used[1]	Scaled Cost (Based on Capacity Used)[2] ($ M)
Edwards St. – Rockland WTP to Highway 17 (west side pipe) Highway 17 – Edwards St. to Pouliotte St.	0.81	72.3%	0.59
Highway 17 – Pouliotte St. to Notre Dame St.	0.93	66.4%	0.62
Poulliotte St. – Highway 17 to Wllace St.	0.17	24.6%	0.04

Watermain Location	Total Replacement Cost ($ M)	Percent of Capacity Used[1]	Scaled Cost (Based on Capacity Used)[2] ($ M)
Hwy 17 from Edwards St to Chamberland St	0.67	39.8%	0.27
Wallace St. – Edwards St. to Poulliotte St. Edwards -Wallace to McCall St McCall St. – Edwards St. to Gareau St. Gareau St. – Wallace St. to Laurier St.	0.66	36.2%	0.24
St. Joseph St. – Laurier St. to Chene St.	0.27	53.6%	0.15
Poulliotte St. – Wallace St. to Laurier St. Laurier St. – Gareau St. to Poulliotte St.	0.17	51.0%	0.09
Highway 17 – Notre Dame St. to Caron St.	0.24	51.4%	0.13
Chamberland St from Hwy 17 to Laporte St Laporte St from Chamberland St to Laurier St	0.82	64.8%	0.53
Laurier St from Laprte St to Laviolette St	0.74	27.9%	0.21
Notre Dame St. – Highway 17 to Laurier St.	0.32	31.7%	0.10
Caron /Nathalie St. – Highway 17 to Laurier St.	0.38	21.4%	0.08
Laurier St. – Notre Dame St. to Caron St.	0.28	38.8%	0.11
du Parc Ave. – St Joeph St to Lawrence St Lawrence St. – du Parc Ave to Laurier St Laurier St. – Lawrence St to Caron St	0.91	35.2%	0.32
Laurier St. – Laviolette St to St Jean St St Jean St. – Laviolette St to Hudon St Hudon St. – St Jean St to Giroux St Giroux St. – Hudon St. to Chene St. Chene St. – Giroux St. to St. Joseph St.	0.82	25.5%	0.21
Lavioellete St – Laurier St to Iberville St	0.30	27.2%	0.08
Iberville St – Laviolette St to St Jacues St St Jacque St – Iberville St to Patricia St	0.30	50.2%	0.15
Laporte St – Laurier St to Sylvain St Sylvain St – Laprote St to Heritage Dr Heritage – Sylvain to St Jacques St St Jacques – Heritage to St Denis St Denis – St Jacques to Andre Andre – St Denis to Patricia Patricia – Andre to Laviolette Laviolette – Patricia to Iberville	1.54	22.3%	0.34
Patricia St from Iberville St to St Joseph St	0.36	27.0%	0.10
St Joseph St from du Parc Ave to Patricia St	0.16	79.7%	0.12
St. Joseph St. – Silver Ln to Docteur Corbeil Blvd.	0.61	50.5%	0.31
St Jean St from Patricia St to Dr. Corbeil Blvd	1.01	35.8%	0.36
Caron St. – Laurier St to Dalrymple Dr.	0.42	37.8%	0.16
Des Pins Ave from St Joseph St to Dalrymple Dr Delrymple Dr from Des Pins Ave to Caron St	0.99	33.5%	0.33
Caron St. – Dalrymple Dr to Docteur Corbeil Blvd.	0.63	45.7%	0.29
Docteur Corbeil Blvd. – St. Joseph St. to Caron St.	0.83	42.2%	0.35
Caron St. from Dr. Corbeil Blvd to Pump Station	0.18	37.5%	0.07
Bouvier Rd. – Bouvier Tower to Lacroix Rd.	2.57	12.4%	0.32
Lacroix Rd. – Bouvier Rd. to Gendron Rd. Gendron Rd. – Lacroix Rd. to Russell Rd. Russell Rd. – Gendron Rd. to Cheney Tower	7.16	15.2%	1.09
Total	**25.26**	**30.7%**	**7.75**

Notes:

1. Percent of capacity used in the Beyond 2042 scenario.
2. Excludes HST.

6.1.4 Unit Cost Assumptions

The cost estimates for the watermain upgrade recommendations, and for compensation costs discussed in previous sections are based on the watermain unit costs indicated in Table 6-6, and **Error! Reference source not found.**.

The conservative unit price calculations were derived using the cost data in the City of Ottawa June 20, 2016 Unit Spec Code List document. The following unit items were referenced: G030.03 (200 mm), G030.04 (250 mm), G030.05 (300 mm), and G030.06 (400 mm). The 350 mm diameter cost was interpolated between the 300 mm and 400 mm costs. The 450 mm, and 500 mm diameter costs were extrapolated from the costs for the other sizes.

Table 6-6. Unit Costs for Watermains – Conservative Calculations

Diameter (mm)	Base Cost[1]	Subtotal[2]	Total[3]
200	$ 443.15	$ 620.41	$ 713.47
250	$ 504.19	$ 705.87	$ 811.75
300	$ 571.12	$ 799.57	$ 919.50
350	$ 595.65	$ 833.91	$ 959.00
400	$ 620.18	$ 868.25	$ 998.49
450	$ 680.50	$ 952.70	$1,095.61
500	$ 725.05	$ 1,015.07	$1,167.33

Notes:
1. The base cost includes the pipe material and installation cost, trench reinstatement, and valves.
2. The subtotal includes a 40% markup on the base cost for contractor's overhead, profit, mobilization, bonds, and insurance (15%), and design contingency (25%).
3. The total includes a 15% markup on the subtotal for construction contingency (5%) and average price escalation (10%). Excludes HST.

The aggressive cost estimates were calculated using a base unit price of $500/m provided by EXP, for the installation of new transmission watermains.

6.2 Cost Sharing – Scenario 2 – Clarence-Rockland Plus Limoges

6.2.1 Methodology and Options

The hydraulic model was used to determine the proportion of Clarence-Rockland and Limoges demands supplied by the infrastructure being recommended for upgrade.

The Beyond 2042 scenario was selected for the cost sharing analysis. Using the hydraulic model, source trace simulations were completed to determine the percentage of water at all junctions in the system that came from a specific source (reservoir, tank, pump, watermain) that was recommended for upgrading.

6.2.2 Options Summary

Two options were considered to determine the possible share of costs for the proposed infrastructure upgrades:

- Option 1: This option involves individually apportioning the cost for each piece of infrastructure requiring upgrades based on the proportion of Clarence-Rockland and Limoges demands the infrastructure supplies. Source trace simulations were completed to determine the percentage of total demands in Clarence-Rockland and Limoges are supplied by each piece of infrastructure requiring upgrades.
- Option 2: This option involves taking the total system wide Clarence-Rockland and Limoges demands supplied by Clarence-Rockland and using the same overall ratio to apportioning the cost for all infrastructure requiring upgrades.

6.2.3 Option 1 – Apportioned Costs by Recommended Infrastructure Upgrade

The first cost sharing method examined involves individually apportioning the cost of each infrastructure upgrade based on the proportion of Clarence-Rockland and Limoges demands each piece of infrastructure supplies. Source trace simulations (described in Section 6.2.1) were completed to determine the percentage of total demands in Clarence-Rockland and Limoges that are supplied by each piece of infrastructure requiring upgrades. The total demands supplied in Clarence-Rockland and Limoges by each piece of infrastructure were summed and the ratio of total Clarence-Rockland and Limoges demands to the total demands supplied was used to determine the demand split percentage. The demand split percentage was used to apportion the cost between Clarence-Rockland and Limoges for each upgrade recommendation.

6.2.3.1 Recommended Infrastructure Upgrades

The cost share breakdown for the recommended infrastructure upgrades are presented in Table 6-7 using the conservative calculations, and Table 6-9 using the aggressive calculations.

Table 6-7. Cost Share Option 1 Summary – Recommended Infrastructure Upgrades – Conservative Calculations

Infrastructure Upgrade	Demands (m^3/d)		Cost Share Percentage		Total Cost	Cost Share	
	CR	Limoges	CR	Limoges		CR	Limoges
Rockland WTP Upgrades	13,087	6,798	66%	34%	$14.97	$9.85	$5.12
Caron BS Upgrades	7,168	6,994	51%	49%	$2.18	$1.11	$1.08
New Bouvier BS	2,047	6,992	23%	77%	$3.17	$0.72	$2.45

Infrastructure Upgrade	Demands (m^3/d)		Cost Share Percentage		Total Cost	Cost Share	
	CR	Limoges	CR	Limoges		CR	Limoges
New Watermain – Caron BS to Bouvier Rd. and Labonte St.	4,265	6,987	38%	62%	$7.03	$2.66	$4.37
New Watermain – Bouvier Rd. and Labonte St. to Bouvier ET	4,265	6,987	38%	62%	$4.05	$1.53	$2.51
New Watermain – Bouvier BS to Cheney ET	313	6,257	5%	95%	$11.02	$0.52	$10.49
New Watermain – Cheney ET to Limoges	313	6,257	5%	95%	$10.28	$0.49	$9.79
Replace Watermain – Zone 1 – Edwards St: Rockland WTP to County Road 17 (East Pipe)	9,785	2,987	77%	23%	$0.65	$0.50	$0.15
New Watermain: Zone 1, St. Jean between Patricia and Dr. Corbeil	2,140	1,552	58%	42%	$0.46	$0.26	$0.19
Replace Watermain – Zone 1 – Caron St: Dr. Corbeil to Caron BS	5,233	5,095	51%	49%	$0.23	$0.12	$0.11
Replace Watermain – Edwards St: Hwy 17 to McCall St.	8,381	4,769	64%	36%	$0.34	$0.21	$0.12
Replace Watermain – St. Joseph St.: Patricia St. to Des Pins Ave.	2,917	2,392	55%	45%	$0.14	$ 0.08	$0.06
Totals					**$54.52**	**$18.06**	**$36.46**
Percentages					**100%**	33%	67%

Table 6-8. Cost Share Option 1 Summary – Recommended Infrastructure Upgrades – Aggressive Calculations

Infrastructure Upgrade	Demands (m^3/d)		Cost Share Percentage		Total Cost	Cost Share	
	CR	Limoges	CR	Limoges		CR	Limoges
Rockland WTP Upgrades	13,087	6,798	66%	34%	$ 14.97	$ 9.85	$ 5.12
Caron BS Upgrades	7,168	6,994	51%	49%	$ 2.18	$ 1.11	$ 1.08
New Bouvier BS	2,047	6,992	23%	77%	$ 3.17	$ 0.72	$ 2.45
New Watermain – Caron BS to Bouvier Rd. and Labonte St.	4,265	6,987	38%	62%	$ 5.17	$ 1.96	$ 3.21

Infrastructure Upgrade	Demands (m^3/d)		Cost Share Percentage		Total Cost	Cost Share	
	CR	Limoges	CR	Limoges		CR	Limoges
New Watermain – Bouvier Rd. and Labonte St. to Bouvier ET	4,265	6,987	38%	62%	$ 2.97	$ 1.13	$ 1.85
New Watermain – Bouvier BS to Cheney ET	313	6,257	5%	95%	$ 9.25	$ 0.44	$ 8.81
New Watermain – Cheney ET to Limoges	313	6,257	5%	95%	$ 8.29	$ 0.40	$ 7.90
Replace Watermain – Zone 1 – Edwards St: Rockland WTP to County Road 17 (East Pipe)	9,785	2,987	77%	23%	$ 0.45	$ 0.34	$ 0.10
New Watermain – St. Jean between Patricia and Dr. Corbeil	2,140	1,552	58%	42%	$ 0.40	$ 0.23	$ 0.17
Replace Watermain – Caron St: Dr. Corbeil to Caron BS	5,233	5,095	51%	49%	$ 0.17	$ 0.09	$ 0.08
Replace Watermain – Edwards St: Hwy 17 to McCall St.	8,381	4,769	64%	36%	$ 0.34	$ 0.21	$ 0.12
Replace Watermain – St. Joseph St.: Patricia St. to Des Pins Ave.	2,917	2,392	55%	45%	$ 0.14	$ 0.08	$ 0.06
Totals					**$ 47.50**	**$ 16.55**	**$ 30.95**
Percentages					100%	35%	65%

6.2.3.2 Compensation for Use of Existing Infrastructure

The cost share breakdown for the compensation of the use of existing infrastructure is presented in Table 6-9. The CR portion of the weighted costs are zero for each segment since the CR portion has already been paid in the original construction of this infrastructure. The compensation for use of existing infrastructure uses the conservative calculations for the cost estimating due to this infrastructure being located mostly in Rockland, and therefore would be costlier to build in an urban area.

Table 6-9. Cost Share Option 1 Summary – Compensation for Use of Existing Infrastructure – Conservative Calculations

Infrastructure Upgrade	Demands (m^3/d)		Cost Share Percentage		Scaled Cost[1]($M)	Weighted Cost Share ($M)	
	CR	Limoges	CR	Limoges		CR	Limoges
Edwards St. – Rockland WTP to Highway 17 (west side pipe) Highway 17 – Edwards St. to Pouliotte St.	**3,301**	**361**	90%	10%	0.59	0.00	0.06
Highway 17 – Pouliotte St. to Notre Dame St.	**6,339**	**509**	93%	7%	0.62	0.00	0.05
Poulliotte St. – Highway 17 to Wllace St.	**1,638**	**708**	70%	30%	0.04	0.00	0.01
Hwy 17 – Edwards St to Chamberland St	**2,042**	**722**	74%	26%	0.27	0.00	0.07

Infrastructure Upgrade	Demands (m³/d)		Cost Share Percentage		Scaled Cost[1] ($M)	Weighted Cost Share ($M)	
	CR	Limoges	CR	Limoges		CR	Limoges
Wallace St. – Edwards St. to Poulliotte St. Edwards – Wallace to McCall St McCall St. – Edwards St. to Gareau St. Gareau St. – Wallace St. to Laurier St.	**3,244**	**1,939**	63%	37%	0.24	0.00	0.09
St. Joseph St. – Laurier St. to Chene St.	**3,901**	**2,278**	63%	37%	0.15	0.00	0.05
Poulliotte St. – Wallace St. to Laurier St. Laurier St. – Gareau St. to Poulliotte St.	**2,350**	**1,019**	70%	30%	0.09	0.00	0.03
Highway 17 – Notre Dame St. to Caron St.	**4,573**	**71**	98%	2%	0.13	0.00	0.00
Chamberland St. – Hwy 17 to Laporte St Laporte St. – Chamberland St to Laurier St	**4,314**	**1,543**	74%	26%	0.53	0.00	0.14
Laurier St. – Laprte St to Laviolette St	**1,232**	**665**	65%	35%	0.21	0.00	0.07
Notre Dame St. – Highway 17 to Laurier St.	**1,630**	**439**	79%	21%	0.10	0.00	0.02
Caron /Nathalie St. – Highway 17 to Laurier St.	**856**	**71**	92%	8%	0.08	0.00	0.01
Laurier St. – Notre Dame St. to Caron St.	**2,709**	**870**	76%	24%	0.11	0.00	0.03
du Parc Ave. – St Joseph St to Lawrence St Lawrence St – du Parc Ave to Laurier St Laurier St – Lawrence St to Caron St	**765**	**276**	74%	26%	0.32	0.00	0.08
Laurier St – Laviolette St to St Jean St St Jean St –Laviolette St to Hudon St Hudon St – St Jean St to Giroux St Giroux – Hudon to Chane Chane – Giroux to St Josef	**1,891**	**1,465**	56%	44%	0.21	0.00	0.09
Lavioellete St – Laurier St to Iberville St	**1,402**	**814**	63%	37%	0.08	0.00	0.03
Iberville St – Laviolette St to St Jacues St St Jacque St – Iberville St to Patricia St	**2,418**	**1,429**	63%	37%	0.15	0.00	0.06
Laporte St – Laurier St to Sylvain St Sylvain St – Laprote St to Heritage Dr Heritage – Sylvain to St Jacques St St Jacques – Heritage to St Denis St Denis – St Jacques to Andre Andre – St Denis to Patricia Patricia – Andre to Laviolette Laviolette – Patricia to Iberville	**999**	**573**	64%	36%	0.34	0.00	0.12
Patricia St – Iberville St to St Joseph St	**577**	**389**	60%	40%	0.10	0.00	0.04
St Joseph St – du Parc Ave to Patricia St	**2,917**	**2,392**	55%	45%	0.12	0.00	0.06
St. Joseph St. – Silver Ln to Docteur Corbeil Blvd.	**3,345**	**2,852**	54%	46%	0.31	0.00	0.14
St Jean St – Patricia St to Dr. Corbeil Blvd	**2,859**	**1,670**	63%	37%	0.36	0.00	0.13
Caron St. – Laurier St to Dalrymple Dr.	**1,395**	**998**	58%	42%	0.16	0.00	0.07
Des Pins Ave – St Joseph St to Dalrymple Dr Delrymple Dr – Des Pins Ave to Caron St	**1,003**	**708**	59%	41%	0.33	0.00	0.14
Caron St. – Dalrymple Dr to Docteur Corbeil Blvd.	**1,742**	**1,635**	52%	48%	0.29	0.00	0.14
Docteur Corbeil Blvd. – St. Joseph St. to Caron St.	**3,295**	**389**	89%	11%	0.35	0.00	0.04
Caron St. – Dr. Corbeil Blvd to Pump Station	**1,988**	**1,911**	51%	49%	0.07	0.00	0.03

Infrastructure Upgrade	Demands (m^3/d)		Cost Share Percentage		Scaled Cost[1]($M)	Weighted Cost Share ($M)	
	CR	Limoges	CR	Limoges		CR	Limoges
Bouvier Rd. – Bouvier Tower to Lacroix Rd.	**1,740**	**771**	69%	31%	0.32	0.00	0.10
Lacroix Rd. – Bouvier Rd. to Gendron Rd. Gendron Rd. – Lacroix Rd. to Russell Rd. Russell Rd. – Gendron Rd. to Cheney Tower	**367**	**736**	33%	67%	1.09	0.00	0.73
Total					**7.75**	**0.00**	**2.62**
Percentages					**100%**	**0.00%**	**33.84%**

Notes:
1. See Table 6-5 for breakdown of total and scaled costs

This option provides an equitable breakdown of the cost of infrastructure based on the amount to which each municipality benefits from each piece of infrastructure.

6.2.4 Option 2 – Apportioned Costs by Overall Demands

The second cost sharing method examined uses the total system wide Clarence-Rockland and Limoges maximum day demands supplied by the Clarence-Rockland water system. The total Beyond 2042 demands for Clarence-Rockland, Limoges and for the overall system from Table 2-8 were used to determine the portion of the infrastructure costs to be paid by each municipality. The total demands supplied to each municipality, the resulting cost share percentages, and share of the total costs for each municipality are summarized in Table 6-10 using the conservative unit costs and in Table 6-11 using the aggressive unit costs indicated in section 6.1.4. This table includes the recommended infrastructure upgrades from Table 6-3, and the recommended compensation for use of existing infrastructure Table 6-5.

Table 6-10. Cost Share Option 2 Summary – Conservative Calculations

Jurisdiction	Demands (m^3/d)	Cost Share Percentage	Cost Share		Total
			New Infrastructure	Existing Infrastructure	
Clarence-Rockland	20,306.3	74 %	$ 40.43 M	-	$ 40.43 M
Limoges	7,076.0	26 %	$ 14.09 M	$ 2.00 M	$ 16.09 M
Total	27,382.3	100 %	$ 54.52 M	$ 2.00 M	$ 56.52 M

Table 6-11. Cost Share Option 2 Summary – Aggressive Calculations

Jurisdiction	Demands (m^3/d)	Cost Share Percentage	Cost Share		Total
			New Infrastructure	Existing Infrastructure	
Clarence-Rockland	20,306.3	74 %	$ 34.87 M	-	$ 34.87 M
Limoges	7,076.0	26 %	$ 12.15 M	$ 2.00 M	$ 14.15 M
Total	27,382.3	100 %	$ 47.02 M	$ 2.00 M	$ 49.02 M

This option uses all system demands in Clarence-Rockland in determination of the cost share split. However, most of the Clarence-Rockland demands are in PZ-1 and not in PZ-2 and PZ-3 where the majority of the new infrastructure recommendations are located. Therefore, this option does not provide an equitable cost sharing arrangement between the municipalities and is not recommended.

6.2.5 Summary of Cost Sharing Options and Costs

The calculated cost contributions for both Clarence-Rockland and Limoges are summarized for cost sharing Option 1, and Option 2. The total estimated costs (using conservative unit costs) is $57.14 million for Option 1, and $56.52 million for Option 2. The cost breakdown using the conservative unit costs is shown in Table 6-12. The total estimated costs (using aggressive unit costs) for the recommended infrastructure is $49.65 million for Option 1, and $49.02 million for Option 2. The cost breakdown using the aggressive unit costs is shown in Table 6-13. The Option 1 cost sharing method is a more equitable method to determine the benefits and cost to each municipality for the proposed infrastructure. It is recommended that the cost sharing simulations be revisited and updated as new infrastructure and water demands are added to the system and at a minimum every 5 years.

Table 6-12. Cost Share Options Summary – Conservative Calculations

Jurisdiction	Cost Share			
	Option 1		Option 2	
New Infrastructure				
Clarence-Rockland	$18.06 M	33 %	$ 40.43 M	74 %
Limoges	$36.46 M	67 %	$14.09 M	26 %
Subtotal	$54.52 M	100 %	$ 54.52 M	100 %
Existing Infrastructure				
Limoges	$2.62 M	34 %	$ 2.00 M	26 %
Summary				
Clarence-Rockland	$ 18.06 M		$ 40.43 M	
Limoges	$ 39.08 M		$ 16.09 M	
Totals	$ 57.14 M		$ 56.52 M	

Table 6-13. Cost Share Options Summary – Aggressive Calculations

Jurisdiction	Cost Share			
	Option 1		Option 2	
New Infrastructure				
Clarence-Rockland	$16.26 M	35 %	$ 34.87 M	74 %
Limoges	$30.77 M	65 %	$12.15 M	26 %
Subtotal	$47.02 M	100 %	$ 47.02 M	100 %
Existing Infrastructure				
Limoges	$2.62 M	34 %	$ 2.00 M	26 %
Summary				
Clarence-Rockland	$16.26 M		$ 34.87 M	
Limoges	$ 33.39 M		$ 14.15 M	
Totals	$ 49.65 M		$ 49.02 M	

6.3 Implementation Schedule of Costs

Based on the recommendations in Section 5.0 and the estimated costs in Section 6.1, an infrastructure upgrade implementation schedule of costs for the Option 1 cost sharing method was developed. The compensation for use of existing infrastructure indicated in Table 6-9 has been spread evenly throughout the 30-year period.

6.3.1 Implementation Schedule – Scenario 1 – Clarence-Rockland Only

The schedule of costs for Scenario 1 – Clarence-Rockland Only is shown on the following pages in Table 6-14 using the conservative calculations, and

Table 6-15 using the aggressive calculations. This scenario doesn't include Limoges and so the Limoges costs are zero.

6.3.2 Implementation Schedule – Scenario 2 – Clarence-Rockland Plus Limoges

The schedule of costs for Scenario 2 – Clarence-Rockland Plus Limoges is shown on the following pages in

Table 6-16 using the conservative calculations, and

Table 6-17 using the aggressive calculations.

Table 6-14. Infrastructure Implementation Schedule – Scenario 1 – Conservative Calculations

Time Period	Estimated Cost			Projects
	Total	Clarence-Rockland	Limoges	
2017-2022	$ 0.46	$ 0.46	$ -	• New Watermain: St. Jean St. (Zone 1) – Patricia St. to Dr. Corbeil Blvd.
2023-2027	$ 22.12	$ 22.12	$ -	• Rockland WTP Upgrades • New Watermain: Caron BS to Bouvier Rd. and Labonte St. • Replace Watermain: Edwards St. (Zone 1) – Rockland WTP to County Road 17 (East Pipe)
2028-2032	$ -	$ -	$ -	-
2033-2037	$ -	$ -	$ -	-
2038-2042	$ -	$ -	$ -	-
Beyond 2042	$ 6.46	$ 6.46	$ -	• Caron BS Upgrades • New Watermain: Bouvier Rd. and Labonte St. to Bouvier ET • Replace Watermain: Caron St. (Zone 1) – Dr. Corbeil Blvd. to Caron BS
Total	$ 29.04	$ 29.04	$ -	

Table 6-15. Infrastructure Implementation Schedule – Scenario 1 – Aggressive Calculations

Time Period	Estimated Cost			Projects
	Total	Clarence-Rockland	Limoges	
2017-2022	$ 0.40	$ 0.40	$ -	• New Watermain: St. Jean St. (Zone 1) – Patricia St. to Dr. Corbeil Blvd.
2023-2027	$ 20.05	$ 20.05	$ -	• Rockland WTP Upgrades • New Watermain: Caron BS to Bouvier Rd. and Labonte St. • Replace Watermain: Edwards St. (Zone 1) – Rockland WTP to County Road 17 (East Pipe)
2028-2032	$ -	$ -	$ -	-
2033-2037	$ -	$ -	$ -	-
2038-2042	$ -	$ -	$ -	-
Beyond 2042	$ 5.33	$ 5.33	$ -	• Caron BS Upgrades • New Watermain: Bouvier Rd. and Labonte St. to Bouvier ET • Replace Watermain: Caron St. (Zone 1) – Dr. Corbeil Blvd. to Caron BS
Total	$ 25.77	$ 25.77	$ -	

Table 6-16. Infrastructure Implementation Schedule – Scenario 2 – Conservative Calculations

Time Period	Estimated Cost			Projects
	Total	Clarence-Rockland	Limoges	
2017-2022	$ 24.67	$ 6.18	$ 18.49	• Caron BS Upgrades • New Watermain: Various Roads (Zone 2) – Caron BS to Bouvier Rd. and Labonte St. • New Watermain: Bouvier Rd. (Zone 2) – Labonte St. to Bouvier ET • New Watermain: Various Roads (Zone 2) – Cheney ET to Limoges Reservoir • New Watermain: St. Jean St. (Zone 1) – Patricia St. to Dr. Corbeil Blvd. • Replace Watermain: Caron St. (Zone 1) – Dr. Corbeil Blvd. to Caron BS
2023-2027	$ 16.06	$ 10.35	$ 5.71	• Rockland WTP Upgrades • Replace Watermain: Edwards St (Zone 1) – Rockland WTP to County Road 17 (East Pipe)
2028-2032	$ 3.61	$ 0.72	$ 2.89	• New Bouvier BS
2033-2037	$ 11.45	$ 0.52	$ 10.93	• New Watermain: Various Roads (Zone 2) – Bouvier BS to Cheney ET
2038-2042	$ 0.44	$ -	$ 0.44	-
Beyond 2042	$ 0.44	$ -	$ 0.44	-
Total	$ 56.66	$ 17.77	$ 38.89	

Table 6-17. Infrastructure Implementation Schedule – Scenario 2 – Aggressive Calculations

Time Period	Estimated Cost			Projects
	Total	Clarence-Rockland	Limoges	
2017-2022	$ 19.62	$ 4.90	$ 14.72	• Caron BS Upgrades • New Watermain: Various Roads (Zone 2) – Caron BS to Bouvier Rd. and Labonte St. • New Watermain: Bouvier Rd. (Zone 2) – Labonte St. to Bouvier ET • New Watermain: Various Roads (Zone 2) – Cheney ET to Limoges Reservoir • New Watermain: St. Jean St. (Zone 1) – Patricia St. to Dr. Corbeil Blvd. • Replace Watermain: Caron St. (Zone 1) – Dr. Corbeil Blvd. to Caron BS
2023-2027	$ 15.86	$ 10.20	$ 5.66	• Rockland WTP Upgrades • Replace Watermain: Edwards St (Zone 1) – Rockland WTP to County Road 17 (East Pipe)
2028-2032	$ 3.61	$ 0.72	$ 2.89	• New Bouvier BS
2033-2037	$ 9.68	$ 0.44	$ 9.24	• New Watermain: Various Roads (Zone 2) – Bouvier BS to Cheney ET
2038-2042	$ 0.44	$ -	$ 0.44	-
Beyond 2042	$ 0.44	$ -	$ 0.44	-
Total	$ 49.64	$ 16.26	$ 33.39	

7 References

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