THE CITY OF DAWSON

COMMITTEE OF THE WHOLE MEETING #CW20-17

DATE: WEDNESDAY November 4, 2020
TIME: 7:00 PM
LOCATION: City of Dawson Council Chambers – Safe Spacing rules apply

1. **CALL TO ORDER**

2. **ACCEPTANCE OF ADDENDUM & ADOPTION OF AGENDA**
   a) Committee of Whole Agenda CW20-17

3. **DELEGATIONS AND GUESTS**
   a) Lambert- Waste Collection
   b) Lana Welchman-Tr'ondëk-Klondike World Heritage Nomination Bid

4. **MINUTES**
   a) Committee of Whole Meeting Minutes #CW20-16 of October 7, 2020

5. **BUSINESS ARISING FROM MINUTES**
   a) Committee of Whole Meeting Minutes #CW20-16 of October 7, 2020

6. **SPECIAL MEETING, COMMITTEE, AND DEPARTMENTAL REPORTS**
   a) KVA & AYC Appointments
   b) New Water Reservoirs
   c) Dome Road Master Planning Project Deliverables

7. **BYLAWS AND POLICIES**
   a) Official Community Plan Amendment No. 2 Bylaw (2019-14)
   b) Zoning Bylaw Amendment No. 5 Bylaw (2019-15)

8. **CORRESPONDENCE**
   a) KDO- Solar Panel Project
   b) Justin Ferbey, Deputy Minister of Economic Development- Invitation for Municipalities to Participate in the Immigration Strategy Engagement

9. **PUBLIC QUESTIONS**

10. **IN CAMERA**
    a) Land related matter

11. **ADJOURNMENT**

MINUTES OF COMMITTEE OF WHOLE MEETING CW20-1 of the Council of the City of Dawson called for 7:00 PM on Wednesday, October 7, 2020, City of Dawson Council Chambers

PRESENT:	Mayor	Wayne Potoroka
	Councillor	Stephen Johnson
	Councillor	Bill Kendrick
	Councillor	Natasha Ayoub
REGRETS:	Councillor	Molly Shore
ALSO PRESENT:	CAO	Cory Bellmore
	EA	Elizabeth Grenon
	PW A/Manager	Marc Richard
	Rec Manager	Paul Robitaille

Agenda Item: Call to Order

The Chair, Wayne Potoroka called the meeting to order at 7:00 p.m.

Agenda Item: Agenda

CW20-16-01 Moved by Mayor Potoroka, seconded by Councillor Kendrick that the agenda for Committee of the Whole meeting #CW20-16 be accepted as presented.
Carried 4-0

Agenda Item: Public Hearing

a) Subdivision Application RE: Lots 15 (S¼), 16 & 17 (N½), Block J, Ladue Estate

The Chair called for submissions.
The Chair called for submissions a second time.
The Chair called for submissions a third and final time, and hearing none declared the Public Hearing closed.

Agenda Item: Delegations & Guests

a) KDO- Proposed Solar Power Project for Lot 1029, Dome Road

Evelyn Pollock of KDO gave a presentation to update Council on their proposed plan for the installation of solar panels on Lot 1029, Dome Road. KDO was asking Council for possible funding of the project through the Development Incentives Policy. They had found other avenues of funding, however; most organizations had no money left until the next fiscal year. This would mean that the solar panels would not be able to be purchased until the summer and then installed in the fall of 2021.

Council is on board with the project, but it was decided that this project did not fit the intention of the Development Incentives Policy. There was discussion about various other ways that the City could help fund the project.

Agenda Item: Minutes

a) Committee of Whole Meeting Minutes CW20-15 of September 15, 2020

CW20-16-02 Moved by Councillor Kendrick, seconded by Councillor Ayoub that the minutes of Committee of the Whole meeting #CW20-15 of September 15, 2020 be accepted as presented.
Carried 4-0

Agenda Item: Business Arising from Minutes

a) Committee of Whole Meeting Minutes #CW20-15 of September 15, 2020

Pg2 Did Wayne talk to Helen about the ad in the Yearbook? He forgot but will make sure to reach out to her.

Pg2 Did Council ever get a definition of "recreational land" and a copy of the new Liquor Act? The EA emailed a link for the new Act to Council.
CAO requested feedback from TH, KVA and DCCC on any feedback regarding the liquor act changed and as yet, received no response.

Agenda Item: Special Meeting, Committee and Departmental Reports

a) Information Report- Lot 9 and 9-1, Block C, Ladue Estate

CW20-16-03 Moved by Councillor Kendrick, seconded by Councillor Ayoub that Committee of the Whole acknowledges receipt of Information Report: Lot 9 and 9-1, Block C, Ladue Estate.
Carried 4-0

Some questions were raised about taxes, future use of the lot and current ownership. It was pointed out that there were discrepancies of ownership on the submitted Development Permit (20-085). Page 1 of the application has Commissioner of Yukon, City of Dawson listed as the property owner and on page 4 it has just the City of Dawson as the owner.

b) Community and Recreation Grants

CW20-16-04 Moved by Councillor Kendrick, seconded by Mayor Potoroka that Committee of the Whole forward to Council to approve the following grants as recommended by the Community Grant Committee in the amount of $11,967.71 and the Level 2 Recreation Grants, as recommended by the Recreation Board in the amount of $5245.00.
Carried 4-0

Does the Industrial Arts and Technology Society Yukon (IATSY) have a Dawson component? Yes, the members are people from Dawson, and it is based out of Dawson.

Why did they receive such an unusual amount of money? Because IATSY was the last intake and the Community Grants Committee only had that amount of money left.

Is IATSY a non-profit and if so, can they receive Community Grants funding? They are not and you don't have to be a non-profit to receive money.

c) Winter Programming Rental Space

CW20-16-05 Moved by Councillor Ayoub, seconded by Councillor Kendrick that Committee of the Whole forward to Council approval for administration to enter into a lease agreement for

up to $3000 monthly to assist in the rental of an additional programming space for community use.
Carried 4-0

d) Water Metering Program Design Update & Presentation

CW20-16-06 Moved by Councillor Kendrick, seconded by Councillor Johnson that Committee of the Whole provide feedback on the Water Rate Review Report.
Carried 4-0

Pg4 It was felt that 400,000 m^3/year was a light number.

Pg5 (Last paragraph of Section 3) Council inquired why the recommendation was to not meter bleeder flows and asked that the consultant clarify their reasoning.

Pg10 (Table 6.1) It was questioned if the number of Service Connections in the Table were correct. Administration will confirm if the numbers are accurate.

Pg11 Council felt that the numbers in Table 6.2 did not match the numbers in Table 6.3. They felt that the math was incorrect and asked for clarification.

Pg12 (Second paragraph on the page) It was felt that it is incorrect to say that residential services are being subsidized by other rate classes, i.e. commercial, institutional, etc. Council wanted to get an explanation on that portion of the review.

Pg12 (Section 7) It was felt that the places that were chosen for comparison may not be comparable to Dawson.

Council wanted to know what the “hard cost” of providing water was, and if it was even possible to calculate. They discussed if there was a need for a base rate amount or not.

Next steps of the process are to finish working on the rate structure.

Agenda Item: Correspondence

CW20-16-07 Moved by Mayor Potoroka, seconded by Councillor Kendrick that Committee of the Whole acknowledges receipt of correspondence from
a) Kerri Scholz, Private Secretary to the Commissioner of Yukon RE: Order of Yukon Nomination
b) Amélie Morin, Manager, Dawson Designated Office, YESAB RE: Response to May 22 Letter-Oil Containers at Landfill
c) Stephen J. Mills, Deputy Minister, Executive Council Office RE: Seasonal Time Change in Yukon
d) John Streicker, Minister of Community Services RE: Property Assessment
provided for informational purposes.
Carried 4-0

a) It was asked if any of the Council members had anyone in mind they wanted to nominate and if so, did they want to put in a nomination together or individually.

b) Council was disappointed in the letter from YESAB. Council requested a follow-up letter be sent. Wayne will draft a letter up. Council also wanted confirmation from the Landfill Agreement on who can use the landfill.

d) Council requested a copy of the Yukon Property assessment overview booklet referenced in the letter. The letter indicated that the Property Assessment & Taxation Branch could arrange a presentation to Council. Council would like to take them up on their offer for the presentation.

Agenda Item: Adjournment

CW20-16-08 Moved by Councillor Kendrick, seconded by Councillor Johnson that Committee of the Whole meeting CW20-16 be adjourned at 9:18 p.m. with the next regular meeting of Committee of the Whole being November 4, 2020.
Carried 4-0

THE MINUTES OF COMMITTEE OF WHOLE MEETING CW20-16 WERE APPROVED BY COMMITTEE OF WHOLE RESOLUTION #CW20-17-__ AT COMMITTEE OF WHOLE MEETING CW20-17 OF NOVEMBER 4, 2020.

Wayne Potoroka, Chair

Cory Bellmore, CAO

Report to Council

[X] For Council Decision [ ] For Council Direction [ ] For Council Information

[ ] In Camera

SUBJECT:	KVA & AYC Appointments	
PREPARED BY:	Cory Bellmore, CAO	**ATTACHMENTS:**
DATE:	October 27, 2020	
RELEVANT BYLAWS / POLICY / LEGISLATION:		

RECOMMENDATIONS

That Committee of the Whole review Council appointments for KVA & AYC and forwards the following recommendation to Council:

That council hereby

- Appoint / reappoint Councillor _____ as Council's representative for the Klondike Visitors Association (KVA) Board for a one-year term.
- Appoint / reappoint Councillor _____ as Council's representative for the Association of Yukon Communities (AYC) Board for a one-year term.

ISSUE / PURPOSE

To review Council appointments for representatives to the KVA and the AYC.

BACKGROUND SUMMARY

Resolution passed by Council at the November 20, 2019 Council meeting:

C19-23-11 Moved by Mayor Potoroka, seconded by Councillor Ayoub that council hereby

- reappoints Councillor Kendrick as council's representative for the Klondike Visitors Association (KVA) Board for a one-year term;
- reappoints Councillor Shore as council's representative for the Association of Yukon Communities (AYC) Board for a one-year term;
- reappoints Colm Cairns as council's representative for the Klondike Development Organization Board.

Motion Carried 4-0

APPROVAL		
NAME:	Cory Bellmore, CAO	**SIGNATURE:** C Bellmore
DATE:	October 27, 2020	

Report to Council

[X] For Council Decision [ ] For Council Direction [ ] For Council Information

[ ] In Camera

AGENDA ITEM:	New Water Reservoirs	
PREPARED BY:	Marc Richard, Public Works Manager	**ATTACHMENTS:** • AE Report-City of Dawson Reservoir Replacement Conceptual Design
DATE:	October 22, 2020	
RELEVANT BYLAWS / POLICY / LEGISLATION:		

RECOMMENDATION

That Committee forward to Council to approve the recommendation from Associated Engineering on the location of the new reservoirs.

ISSUE / PURPOSE

To approve Associated Engineer's recommendation that the site for the new reservoirs be at the old Pump house site.

BACKGOUND SUMMARY

New reservoirs are needed to provide adequate storage for fire flow. The current reservoirs are under sized and are at the end of their lifecycle. This was an expected capital project following the construction of the new Water Treatment Plant

ANALYSIS / DISCUSSION

AE presented 2 options for location of the new reservoir :

Option 1 : to install reservoirs on the old pumphouse site .

Option 2 : to install 1 tank on Crocus Bluff and refurbish an existing reservoir for a clear well .

AE recommends option 1

APPROVAL		
NAME:	Cory Bellmore, CAO	**SIGNATURE:** C Bellmore
DATE:	October 30, 2020	

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

REPORT

Yukon Government
Community Services

City of Dawson
Reservoir Replacement Conceptual Design

JULY 2020

A Carbon Neutral Company

CANADA BEST MANAGED COMPANIES Platinum member

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1 INTRODUCTION

The City of Dawson (the City) has two aboveground bolted steel reservoirs on the existing Pumphouse site located at Fifth Avenue and Dugas Street. The reservoirs have a volume of 970 and 460 m^3 for a total storage volume of 1,430 m^3. The reservoirs provide equalization, fire storage, and disinfection contact time. Morrison Hershfield (2016) reported that the large reservoir is in good condition; however, the internal roof support had shifted in 2016. In July 2016, bracing to support the central column was installed to prevent future movement with the expectation that the reservoirs would be replaced in the next five to six years. The small reservoir is leaning but stable according to the City's geotechnical consultant (Morrison Hershfield, 2016). The tanks also do not contain baffles, which has resulted in short-circuiting through the reservoirs and reduced disinfection contact time. In addition, the reservoirs are undersized for the growing population of Dawson. The current storage of 1,430 m^3 is insufficient to meet the current storage requirements (FUS, 1999).

The City is considering reservoir storage either at the existing Pumphouse site or at a new raised reservoir on Crocus Bluff. In addition, the City is planning for future growth in the Klondike Valley and localized infill lots on Dome Road and requires a plan for servicing this area. Development on Dome Road is expected, and a water servicing plan including water storage for fire flow is required to develop these lots. **Figure 1-1** shows existing water infrastructure and proposed reservoir locations.

Associated Engineering was retained by the Government of Yukon Community Services Infrastructure Development Branch to conduct a conceptual design of new reservoirs in the City of Dawson. The Reservoir Replacement Conceptual Design project goals are summarized as follows:
Identify a new reservoir location that minimizes capital and ongoing operational costs, and
Identify infrastructure needs to service future lots on Dome Road.

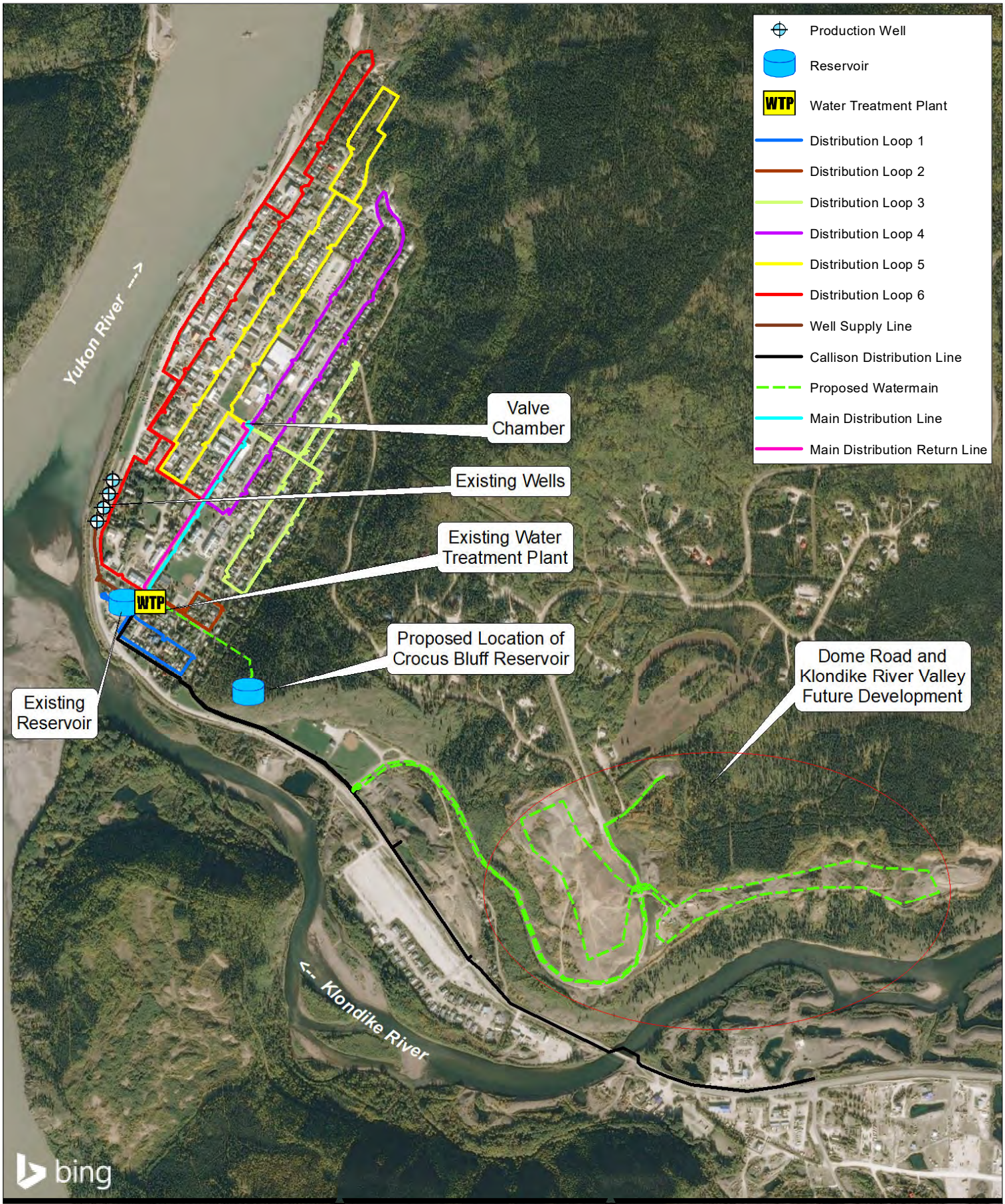
1.1 Scope of Work

To meet the project goals, our scope of work was as follows:

- Review background information;
- Update City of Dawson WaterCAD model to include upgrades since 2016;
- Conduct water modelling of Klondike Valley and Dome Road servicing;
- Identify potential sites for new reservoirs at either the Pumphouse site or Crocus Bluff;
- Identify major infrastructure upgrades for new reservoirs and Dome Road servicing;
- Prepare process flow diagrams and site layouts of proposed reservoir locations and Dome Road; and
- Prepare Class "D" cost estimates.

1.2 Background

Associated Engineering reviewed relevant background information prior to beginning the conceptual design of the reservoir replacement. **Table 1-1** provides a list of the background information reviewed and its relevance to the project.



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Associated Engineering

PROJECT NO.: 2019-2794.000.000
DATE: July 2020
DRAWN BY: DA

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FIGURE 1-1 EXISTING WATER DISTRIBUTION SYSTEM AND FUTURE PLANNING AREAS

Government of Yukon

City of Dawson Reservoir Replacement

Table 1-1
Background Information Reviewed

Title	Author	Relevance
City of Dawson – Water Distribution System Model Report	Stantec (2016a)	Used as reference for typical operation of the City's water system, as well as a reference for standard criteria of the water system and water demands.
City of Dawson WaterCAD Model	Stantec / YG (2016b)	Used as a reference for operation of the City's water system and water demands. Also used as basis to create updated model for future development scenarios.
Dawson City WTP Report	Associated Engineering (2017)	Used as a reference for the operation and capacity of the City's new Water Treatment Plant (WTP) commissioned in 2020. Used as a reference to update the water model to reflect the new WTP infrastructure.
Dawson City WTP – IFC Drawings	Associated Engineering (2018)	Used as a reference to update the water model to reflect the new WTP infrastructure.
GeoYukon mapping application	YG (2020)	Provided aerial photography of site locations of proposed infrastructure. Provided elevation data from a 2018 LiDAR surface of City of Dawson.
YG Housing Projections for Dome Road Development	YG (2020)	Used to project future total demands in the City of Dawson (specifically the Klondike Valley and Dome Road area developments).
Dawson City WTP Upgrades Feasibility Assessment	Morrison Hershfield (2016)	Conceptual design of new steel or concrete reservoir used as a reference. Alternate locations to construct treatment improvements were considered. Reservoir sizing was conducted.

1.3 Existing Water System Overview

The existing raw water system includes four groundwater wells under direct influence of surface water (GUDI) and submersible well pumps. The well pumps transfer raw water to the new WTP on Fifth Avenue and Turner Street and into the existing reservoirs at the Pumphouse site across the street from the new WTP on Fifth Avenue. The treatment train consists of 5- and 1-micron cartridge filtration followed by ultraviolet (UV) disinfection. Chlorine is injected downstream of the UV reactors and heated water is added to the flow stream. Water transfers to two insulated aboveground bolted steel tanks on the Pumphouse site. Distribution pumps within the WTP draw water from the reservoirs and out to distribution. To maintain flow in the distribution lines and prevent freezing, there are six watermain loops that return to the WTP. A separate Callison water supply line and truck fill line are provided from the WTP. Water is heated during winter in two locations: firstly prior to entering the storage reservoirs and secondly prior to entering the distribution system.

A new electric fire pump was installed in the new WTP. The fire pump operates when the pressure in the distribution system drops below 70 psi and water is directed to both ends of each distribution loop when the fire pump is operating.

2 DESIGN CRITERIA

Reservoir sizing was based on projected water demand according to population growth over a 20-year design horizon. Design criteria was developed based on Yukon Bureau of Statistics (YBS) data and conversations with City staff.

2.1 Water Demand

Service population design criteria was based on YBS Population Report Fourth Quarter 2019 (YBS, 2019). The population in the City of Dawson was 2,291 on December 31, 2019. The YBS conducted population projections in 2016 (YBS, 2016) and 2018 (YBS, 2018). In 2016, the annual average growth rate in Yukon was 1.3%, and in 2018 the growth rate has risen to 1.6%. YBS projects that the population of Dawson will reach 3,480 in 2040, which is higher than Stantec's projection of 2,711 by year 2036 (Stantec, 2016a). Higher population growth means water demand will be higher in 2040 than previously projected in other reports.

The highest flows occur in winter when bleeders are online, with flows peaking in April when the City is steaming the underground utilities. Stantec (2016a) analyzed seasonal water use between 2009 and 2016 and confirmed that the highest water usage occurred in April despite the large tourist population in summer of nearly 4,000 in 2016. In April 2020, City of Dawson Operations reported a maximum hourly flow of 48 L/s with two bleeders running (personal communication, April 27, 2020). The City considered this low as only two of the four bleeders were online. Flows as high as 60 L/s typically occur when the water truck is filling. The City recorded a peak flow of 70 L/s in April 2016.

To estimate current and future water demand, Associated Engineering used criteria shown in **Table 2-1**, which was developed by Stantec (2016a) for the 2016 Water Model Study. Average Day Demand (ADD) was estimated using per capital usage of 1,200 L/cap/day and 1,625 L/cap/day in summer and winter, respectively. Peaking factors were calculated using historical water usage between 2006 and 2016. Peaking factors for maximum day demand (MDD) and peak hourly demand (PHD) were calculated to be 1.6 and 2.4, respectively. These peaking factors are less than the City of Whitehorse Servicing Standards Manual (SSM) (City of Whitehorse, 2007) of 2 MDD and 3 PHD, though the SSM's water demand per capita is estimated to be 500 L/capita/day. Peaking factors derived from data for the City of Dawson are considered more representative.

Table 2-2 presents the projected water demand in 2040. The 2040 MDD is projected to be 77 L/s.

Table 2-1
Water Demand Design Criteria

Criteria	Value
Per capita usage (ADD average)	1,200 L/cap/day
Per capital usage (ADD winter)	1,625 L/cap/day
MDD	1.6 x ADD
PHD	2.4 x ADD

Table 2-2
Population and Water Demand Projections

Criteria	2020	2040
Population	2,291	3,480
ADD (summer) (L/s)	32	48
ADD (winter) (L/s)	43	65
MDD (L/s)	51	77
PHD (L/s)	76	116

2.2 Storage

Potable water reservoirs are typically sized for equalization storage, fire storage, and emergency storage and are calculated based on a percentage of MDD. Associated Engineering used storage design criteria developed by the Master Municipal Construction Documents Association (MMCDA) (MMCDA, 2014).

According to 2014 MMCDA Design Guidelines, the following equation is used to calculate the size of the reservoir:

$$S(m^3) = A + B + C$$

With:
S: Total volume of the reservoir
A: Volume of water for fire protection
B: Equalization storage (25% of projected MDD)
C: Emergency storage (25% of A+B)

The reservoirs in the City of Dawson are also used to meet disinfection requirements for virus inactivation. Other Yukon communities with disinfection contact time requirements without clearwells use the contact time volume in the reservoir as the emergency storage. The benefit is that the reservoir is smaller, resulting in better water quality and less heat loss in winter. We propose this approach for the City of Dawson and the following revised equation:

$$S(m^3) = A + B + (greater\ of\ C\ or\ D)$$

With:
S: Total volume of the reservoir
A: Volume of water for fire protection
B: Equalization storage (25% of projected MDD)
C: Emergency storage (25% of A+B)
D: Disinfection storage

In the event of an emergency where the reservoir level drops below the emergency/disinfection storage volume, there will be insufficient volume to meet disinfection requirements. In this instance, either the chlorine dose must be increased, or the City must enact a Boil Water Advisory. A standard Operating Procedure in this instance is required.

2.2.1 Fire Flow Requirements

Fire flow requirements should be designed in accordance with the 1999 Water Supply for Public Fire Protection (FUS, 1999). The FUS is used by the Canadian insurance industry to assess a municipality's risk during a fire. If the FUS is not met, the owner can expect higher insurance premiums.

For planning purposes, minimum fire flow requirements set out by the MMCDA (2014) are used. **Table 2-3** provides MMCDA (2014) minimum fire flow requirements according to development type. Stantec's Water Distribution System Model Report proposed fire flows of 75 L/s for residential and 155 L/s for mixed/commercial/industrial, which exceed the minimum fire flow requirements set out in MMCDA (2014). Stantec (2016a) reported the proposed fire fighting flows were confirmed with the Office of the Fire Marshall. As of April 2020, the City of Dawson Fire Department has two pumper trucks sized for 107 L/s (1700 gpm) and 82 L/s (1300 gpm) for a total of 189 L/s.

Morrison Hershfield (2016) conducted a preliminary FUS (1999) fire flow calculation for the City of Dawson Hospital. The FUS (1999) fire flow calculation considered occupancy type, floor area, construction material, and setbacks from other buildings, among other criteria. The estimated fire flow was 142 L/s, which was less that the MMCDA (2014) and Stantec (2016a) proposed fire flows.

Associated Engineering used the proposed fire flow of 155 L/s for two hours for mixed/commercial/industrial development to size the reservoir. This fire flow was accepted by the Fire Marshall in 2016 and is higher than the minimum MMCDA (2014) requirement. The total fire storage required in 2040 is 1,120 m^3. Actual fire flow requirements for existing or proposed buildings should be calculated according to FUS (1999) in later stages of design to confirm this assumption.

Table 2-3
MMCDA (2014) Minimum Fire Flow Requirements by Development Type

Development Type	MMCDA (2014) Minimum Fire Flow (L/s)	Stantec (2016a) Proposed Fire Flow (L/s)	Duration of Fire Flow (hours)
Single-Family Residential	60	75	1.5
Apartments, Townhouses	90		2.0
Commercial, Institutional	150	155	2.0
Industrial	225		3.0

2.2.2 Emergency/Disinfection Volume

Disinfection volume is determined using contact time calculations to ensure 4-log inactivation of virus before distribution. Contact time is estimated for worst case scenario when the water temperature is the lowest and the maximum pumping rate from the storage reservoir is in effect. Similar to other reservoirs in the territory, the proposed reservoir will have a baffled inlet and one intra-basin baffle. The proposed hydraulic efficiency is estimated to be 0.2.

The following parameters were used to estimate contact time:

- pH of 8.09 in raw water wells (raw water quality samples between Nov 8/15 and Sep 21/16);

- Temperature of 3.5°C is the average minimum temperature before starting the heat exchanger and recirculation lines;
- 2040 peak hour demand of 116 L/s is maximum pumping rate from storage reservoir without a fire;
- Hydraulic efficiency of reservoir of 0.2 (between unbaffled and poor baffling); and
- 170 m of plug flow (hydraulic efficiency of 1.0) between WTP and the reservoirs at the existing reservoir site (if alternate reservoir location further from WTP is used, contact time will improve).

To achieve 4-log inactivation of virus in this worst-case scenario, Volume D must be 655 m^3. Detailed log removal calculations are provided in **Appendix A**.

Emergency volume of 697 m^3 is 25% of fire storage plus equalization storage. Since emergency storage is greater than disinfection volume, emergency storage will be used to calculate total storage requirements.

2.2.3 Reservoir Sizing

The total volume required for the potable water storage in 2040 is 3,500 m^3 (**Table 2-4**). The existing two bolted steel tank reservoirs have capacities of 970 m^3 and 460 m^3 for a total of 1,430 m^3. The 2040 storage requirements exceed the existing storage capacity by 2,070 m^3. The new reservoir will be sized to provide storage for 2040 demand, including demand in the Klondike Valley and Dome Road area.

Table 2-4
2040 Potable Water Storage Requirements

	Volume (m^3)
Fire Storage	1,120
Equalization Storage	1,670
Emergency Storage / Disinfection Contact Volume	697
Total Storage	3,483
Total Storage (rounded)	**3,500**

3 KLONDIKE VALLEY AND DOME ROAD WATER MODELLING

The City of Dawson expects that the majority of new development will be centered around the end of the Callison watermain in the Klondike Valley and in the Dome Road area. Two servicing options for these areas were analyzed and the required infrastructure for each option is outlined in subsequent sections. The City of Dawson water model, provided by the Yukon Government, was updated to match the current infrastructure and incorporates the City's new WTP infrastructure. With the updated model, two future scenarios were created showing potential conceptual design options for servicing the proposed developments. The model update and future scenario development is outlined in the *Water Model Development* Technical Memorandum provided in **Appendix B.**

3.1 Development Areas and Servicing Requirements

The future development in the Klondike Valley and Dome Road areas is divided into four new subdivisions: Areas A, C, D and F, as shown on the map in **Appendix C**. The total probable yield of housing lots to be serviced is 300, as shown in **Table 3-1** (Yukon Government 2020b).

Table 3-1
Proposed Klondike Valley and Dome Road Development Areas and Housing Units

Area	Total Size (ha)	Developable Area (ha)	Housing Units (Probable Yield)
A	8.2	5.7	114
C	7.0	4.9	98
D	1.2	1.2	24
F	3.2	3.2	64
		Total	**300**

The City is expecting an additional 15 lots at the north end of the city to be developed in the future, which is reflected in the future modelled scenario demands. The existing water model provided by YG used "per lot" demands at service nodes as follows:

- ADD (summer): 0.020 L/s
- MDD: 0.086 L/s
- PHD: 0.130 L/s
- ADD (winter): 0.054 L/s

The total system demands were left unchanged when updating the existing model but were adjusted in the future scenarios to reflect the expected development per **Table 3-1** rather than the previously expected demand projections. **Table 3-2** summarizes the total system demands for each scenario. The future 2040 MDD modelled demand of 83.2 L/s slightly exceeds the projected 2040 MDD of 77 L/s and is therefore considered conservative. Note that the future 2040 Winter ADD modelled demand of 57.7 L/s is below the projected 2040 Winter ADD of 65 L/s.

Table 3-2
Total System Demands in Model

	2020 Base Scenario	2040 Future Scenarios
ADD (L/s)	13	19.3
WinterADD (L/s)	40.8	57.7
MDD (L/s)	56.2	83.2
PHD (L/s)	84.7	125.6

3.2 Analysis Methods

The proposed future scenarios were evaluated against varying demand conditions, as follows:

- Average Day Demand (ADD), to analyze minimum pipe velocities and maximum service pressures, as well as water quality concerns;
- Peak Hour Demand (PHD), to analyze maximum pipe velocities and minimum service pressures;
- Maximum Day Demand plus Fire Flow (MDD+FF), to analyze fire flow requirements; and
- Winter Average Day Demand (WinterADD), to analyze thermal performance of the system.

Steady-state analyses were performed for the ADD, PHD and MDD+FF conditions, and an Extended Period Simulation (EPS) analysis was run for the WinterADD and ADD conditions to perform simplified thermal and water quality analyses, discussed in subsequent sections.

3.2.1 Thermal Analysis

A simplified approach was used to evaluate the thermal performance of each proposed future scenario. This involved using the Water Age physical property from the WaterCAD model and calibrating it to temperature loss field data from the City's Operations staff. With observed temperature loss data from the field and Water Age output from the updated water model, coefficients for temperature loss per hour of Water Age were determined. Separate coefficients were determined for temperature loss through reservoirs, as well as temperature loss through pipe flow, summarized in **Tables 3-3** and **Table 3-4.**

Table 3-3
Reservoir Flow Temperature Loss Coefficient

Temp. Drop Through Existing Reservoirs (from field under WinterADD conditions)	Average Water Age Difference Upstream and Downstream of Existing Reservoirs (from WinterADD scenario of model)	Reservoir Temperature Drop Coefficient (Deg/hr)
1.5°C	17 hours	**0.088**

Table 3-4
Pipe Flow Temperature Loss Coefficient

Temp. Drop From WTP to Callison Bleeder (from field during MDD conditions)	Minimum Water Age Difference Between WTP and Callison Bleeder (from MDD scenario of model)	Pipe Temperature Drop Coefficient (Deg/hr)
4°C	9.7 hours	0.41

As a confirmation of the pipe temperature drop coefficient, the same methods were used to calculate the coefficients of the other distribution loops within the City's system. Available return temperature data with the model showed that the other loops had similar coefficients in the range of 0.40 to 0.50.

With these temperature loss coefficients established, temperature loss through the proposed future infrastructure could be approximated based on the Water Age output from the updated model under WinterADD conditions.

3.2.2 Water Quality Analysis

Similar to the thermal analysis, a simplified approach was used to evaluate water quality for both options. The Water Age physical property from the WaterCAD model was used to calibrate chlorine residual levels throughout the system, measured in the field by City Operations staff. With observed residual levels from the field, and Water Age output from the updated model under ADD conditions, a coefficient for chlorine residual drop per hour of Water Age was determined. It is important to note that unlike the thermal analysis, only one coefficient was established, instead of having separate coefficients for pipe flow and reservoir flow. Chlorine levels entering and exiting the existing reservoir are not available, so a separate reservoir coefficient could not be estimated. **Table 3-5** summarizes the data used in establishing the coefficient.

Table 3-5
Chlorine Residual Drop Coefficient

Chlorine Residual Leaving WTP (from field)	Chlorine Residual at End of Callison Line (from field during ADD conditions)	Minimum Water Age Difference Between WTP and End of Callison Line (from ADD scenario of model)	Residual Drop Coefficient
0.40 – 0.50 mg/L	0.33 mg/L	72 hours	0.0023

4 RESERVOIR CONCEPTUAL DESIGN

Two locations were considered for the new reservoirs: the existing Pumphouse site and Crocus Bluff (**Figure 1-1**). Reservoir general details are described in Sections 4.1 and 4.2. A conceptual design for either a bolted steel tank or a concrete reservoir is provided in Sections 4.3 and 4.4.

4.1 Reservoir Configuration

The proposed reservoirs will have two cells in series, either two individual bolted steel tanks or two cells within a concrete reservoir. Two cells provide redundancy in the event a cell (or tank) must be taken offline for maintenance and/or cleaning.

The water flow path will remain the same as the existing configuration. In normal operation, water will flow into the first tank then into the second tank before retuning back to the WTP for distribution. In the event a reservoir cell is offline, all cells will have isolation and bypass valves to bypass the offline cell.

4.2 New Reservoir Construction

The following descriptions of bolted steel tanks and reinforced concrete reservoirs include construction type, ground preparation, level control, insulation, baffles, and heritage considerations.

4.2.1 Construction Type

The proposed types of reservoirs (bolted steel tank and reinforced concrete) both exist in Yukon, including bolted steel tanks in Mayo and Faro and concrete reservoirs in Whitehorse and Watson Lake. In general, bolted steel tanks are less expensive than concrete reservoirs as transporting concrete to a remote community in Yukon is often cost-prohibitive; however, Dawson has a concrete plant and concrete supply is feasible for this work.

Bolted steel tanks are designed by specialist structural engineers and are typically designed, supplied, and installed by the manufacturer. Bolted steel tanks must conform with the following standards:

- American Water Works Association (AWWA) Standard D-103: Factory-Coated Bolted Steel Tanks for Water Storage, and
- The National Fire Protection Agency (NFPA) 22, Standard for Water Tanks for Private Fire Protection.

Bolted tanks are made up of factory coated panels and assembled on site. Typical factory coatings are glass-fused-to-steel (GFS) or epoxy. GFS coatings have longer life expectancies and are comparable in price to epoxy coated tanks for large tank diameter. The anticipated life of the bolted tank is dependent on the coating and cathodic protection system. AWWA (2013) states the anticipated life expectancy of bolted tanks is more than 30 years, whereas the tank supplier Greatario believes a GFS tank will last 40 to 50 years. Bolted tanks can be constructed on a concrete slab where the concrete slab serves as the tank bottom, or a steel bottom may be erected on either a concrete ring beam or a gravel pad foundation.

Concrete reservoirs are cast *in situ* and reinforced with rebar. Concrete reservoirs are proven for safe, durable potable water storage with an expected life span of 75 years; however, concrete reservoirs are more difficult to construct. Whereas bolted tanks can be fabricated in 10 weeks and erected in 6 weeks, concrete reservoirs can take up to 4 months. Advantages and disadvantages of bolted tanks and concrete reservoirs are provided in **Table 4-1**.

Table 4-1
Bolted Steel Tank Versus Concrete Reservoir

	Advantages	Disadvantages
Bolted Steel Tank	• Lower capital cost • Easier assembly • Repairs possible by removing steel panels • Mobile • Recyclable material after decommissioning • Less susceptible to mold growth • Similar construction to existing reservoirs	• Shorter anticipated life • Galvanized steel rusts and corrodes over time • Regular corrosion inspection required for warranty • Larger tank required to account for seismic requirements, must account for sloshing against tank walls
Reinforced Concrete	• Proven for safe, durable potable water storage • Readily available materials • Local economic opportunity for concrete supply • Longer lifetime	• Higher capital cost • Weather-dependent construction • Reinforcing steel within concrete may corrode, causing concrete cracking over time

4.2.2 Ground Preparation for New Tanks

Tank foundations are an important aspect of tank design. Adequate soil investigation by a qualified geotechnical engineer is required and must include the following (AWWA, 2009):

- Determine permafrost depth;
- Recommend type of foundation;
- Determine depth of foundation;
- Specify sub-base materials and compaction requirements, and
- Determine design soil-bearing pressure.

The ground under structures in Dawson is normally treated to prevent frost heave. Past experiences in Dawson, Mayo, and Faro have required the existing native ground to be excavated and filled.

Bolted steel tanks with steel bottoms (as opposed to concrete bottoms) are most common in the territory. Steel-bottom tanks may be supported by either a concrete ringwall, concrete slab, or structurally compacted granular berm (AWWA, 2009). Bolted steel tanks in Mayo and Faro were constructed on gravel pads to reduce capital costs as concrete was not readily available. Tanks supported on gravel pads must be self-anchoring, whereas tanks that require anchor bolts may only be supported on a concrete ringwall or concrete slab. For this conceptual design, we assumed gravel foundations with concrete ringwalls for proposed bolted tanks, as concrete is readily available in Dawson. Similarly, a concrete reservoir may be cast on a granular building pad with a buried insulation skirt around the base of the reservoir. This ground treatment is typical of many buildings in this part of Dawson. The tanks that contain water above freezing and a buried insulation skirt will prevent the ground below the tanks from freezing.

Other foundation considerations include flooding and reservoir elevation:

- Flooding at the Pumphouse site must be considered in later stages of design. A geotechnical investigation is required to determine depth of base course and bearing capacity of the pad in flooded conditions.
- The base of the reservoir may only be as low as the top of the inlet piping to the distribution pumps to ensure the inlet to the distribution pumps and fire pump is always flooded. If new reservoirs are installed on the existing Pumphouse site, the lowest reservoir base elevation is 319.7 m[1].

4.2.3 Level Control

A new level measurement instrument will be added in the new reservoirs. The level measurement will control when the well pumps setpoints and provide a signal to the existing plant programmable logic controller (PLC) for level control and alarms. The existing reservoirs have Rosemount 2088 pressure transducers installed as part of the WTP Upgrade. Typically, Associated Engineering uses ultrasonic level devices for long-term reliability; however, either an ultrasonic or pressure transducer is suitable for potable water reservoirs. A level sensor will be included in each reservoir in the event one reservoir is offline.

4.2.4 Insulation

A thermal wrap will be necessary to avoid freezing conditions on either a concrete or bolted steel reservoir. Both the tank sidewalls and roof of bolted steel tanks will have insulation and cladding. The insulation shall be closed cell XPS extruded polystyrene foam board, with minimum thickness of 100 mm in total. Thermal modelling can be done to optimize the insulation design. If using two or more layers of insulation, all the joints will be staggered. XPS prevents water penetration to the structure of the insulation board and provides long-term strength and durability. The over cladding is not watertight, so a closed cell should prevent external water from getting to the tank and prevent corrosion.

Assuming the concrete tank is over clad, aboveground, and protected by weather by cladding and a false roof, a lower specification insulation board can be used. Expanded polystyrene foam or dense mineral wool would be best for this purpose.

4.2.5 Baffles

Baffle walls or curtains within reservoirs are used to direct flow between the inlet and the outlet to increase the detention time within the reservoir and to reduce short circuiting (dead zones). Concrete baffle walls or curtain walls may be installed in concrete reservoirs, whereas curtain walls are installed in bolted steel tanks. Curtain walls are less robust that concrete baffle walls, though they are easier to install. Curtain walls are reinforced geomembranes around 0.75 mm thick and are NSF 61 certified for potable water. Curtain walls are anchored to the sidewalls using battens, angles and compression bars. At least one intra-basin baffle curtain is recommended in bolted steel tanks, whereas superior baffling can be achieved in concrete tanks to create serpentine flow.

[1] WTP top of slab elevation is 319.300 m.

4.2.6 Heritage Considerations

Buildings designed in the City's core area (Downtown Heritage Management Are) are subject to heritage design guidelines according to the City of Dawson Bylaw No. 2019-04 (Heritage Bylaw) (City of Dawson, 2019). Though the reservoirs are not buildings, we assume the new reservoir must meet the Heritage Committee requirements to blend in with the heritage style façade.

The WTP design team included Kobayashi + Zedda Architects (KZA) to ensure that the WTP adhered to the Heritage Bylaw. As per the WTP Design Report (Associated Engineering, 2017), the Heritage Bylaw asks proponents to consider replicating the external design of any building that may have existed on that site during the Gold Rush period. KZA identified in the WTP Design Report that there is no evidence of a WTP in Dawson during the Gold Rush. We propose that an architect with experience in local heritage design be involved in future design phases to ensure the new reservoirs match the WTP design and meet the Heritage By-law.

4.3 Concept Design for New Reservoir at Pumphouse Site

The existing reservoirs are located on Lots 5, 6, and 7 of Block 14 between First and Fifth Avenues, which comprise 0.139 ha. The lots are designated as C1 (core commercial) according to The City of Dawson Zoning Bylaw (City of Dawson, 2018). Buildings on C1 zone parcels must have minimum setback of 1.52 m from the rear. The bylaw does not have minimum setback requirements for buildings on C1 parcels from the front, interior side, or exterior sides. The minimum 1.52 m setback from the rear will be used for new reservoirs.

Other site constraints are powerline easement on the front and interior sides of the Pumphouse lot:

- 4 m setback on front side, and
- 2.09 m setback on interior side.

C1 zones are subject to minimum building heights of 13.72 m; however, reservoirs are not buildings and since this site is already used for reservoirs, we do not consider this a risk to the project. This assumption should be confirmed with the City's Council.

The maximum area for building east of the existing reservoirs is 413 m^2 from the setbacks on the north, east, and south sides and 4 m from the existing tanks. A new communications building was installed as part of the WTP project; however, as-built information is not available for this building. The building is located a few metres north of the large reservoir, though the entire site should be surveyed in later stages of design.

The site contains the two existing reservoirs and the old Pumphouse. The existing reservoirs must remain operational during construction; however, the old Pumphouse is no longer in use and must be demolished to make room on the site for new reservoirs. A hazardous building material assessment conducted in August 2019 (Tetra Tech, 2020) identified hazardous materials within the Pumphouse. The foundations for the Pumphouse consist of four strip footings at depth. A geotechnical investigation is required to determine site conditions and reservoir pad requirements.

The Pumphouse site is advantageous for the following reasons:

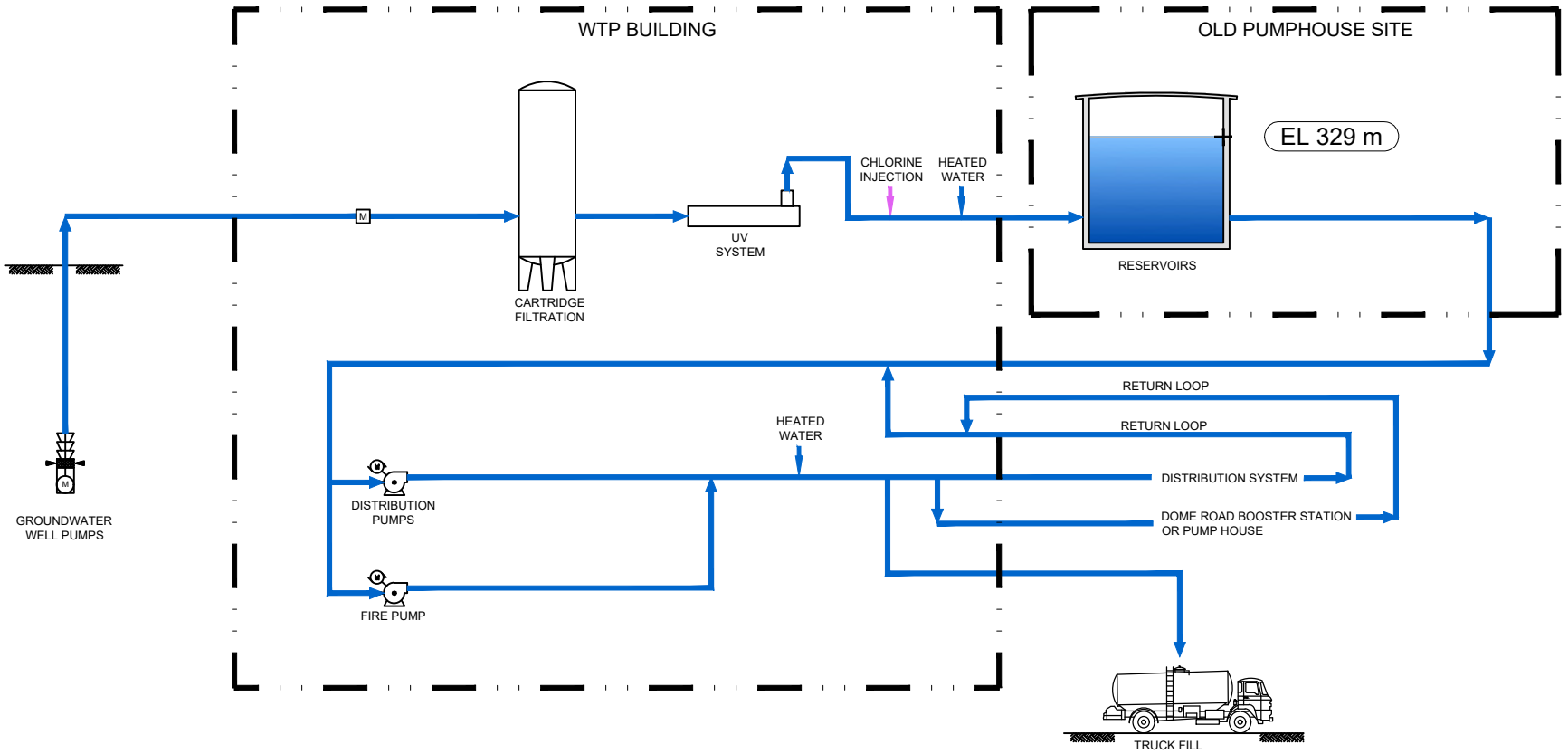
- The site is already in use for public service use.
- WTP tie-ins already exist on this site, and forcemain construction is not required.
- Community acceptance of site for storage reservoirs already exists.

4.3.1 Operational Philosophy

The new reservoirs will operate similarly to the existing system: the well pumps will feed the reservoirs through the WTP. Well pumps will be called to run when the reservoir level drops below the fill level set point, and the well pumps will shut off when the reservoir level exceeds the full level set point. A reservoir high-level alarm will prevent the well pumps from turning on. Water will flow from the reservoirs back to the WTP, and distribution pumps will provide pressure required in the distribution system.

Variable frequency drive (VFD) controlled distribution pumps located in the WTP maintain water pressure in the distribution system based on an operator adjustable pressure transmitter. The fire pump will provide fire flow to both ends of the looped distribution system if pressure in the distribution system drops below 70 psi (i.e., when a hydrant is opened). There is a circulating line to and from the reservoirs that can be heated if required.

No changes to the distribution system are required if new reservoirs are located at the existing Pumphouse site. Refer to **Figure 4-1** for process flow diagram of reservoirs at the Pumphouse site.



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AE PROJECT No.	2019-2794
SCALE	NTS
APPROVED	A. MCCLINTOCK
DATE	2020MAY20
REV	A
DESCRIPTION	CONCEPT DESIGN

FIGURE 4-1

PROCESS FLOW DIAGRAM RESERVOIRS AT PUMPHOUSE SITE

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CITY OF DAWSON RESERVOIR REPLACEMENT

4.3.2 Design Considerations

Design considerations for the Pumphouse site included the following:

- Existing site conditions;
- Site layout;
- Connection to existing system;
- Overflow drainage;
- Site servicing; and
- Electrical and communication.

Major infrastructure upgrades for new reservoirs at the Pumphouse site are listed in **Table 4-2** and described in subsequent sections.

Table 4-2
Infrastructure Upgrades for Reservoirs at the Pumphouse Site

Infrastructure	Description/Quantity
Reservoirs	Either one two-celled concrete tank or two bolted steel tanks. Volume=3,500 m^3.
Process piping and valves	Aboveground stainless steel insulated and heat traced tie-ins to existing piping.
Overflow	300 mm diameter HDPE overflow to de-chlorination maintenance chamber on the Pumphouse site.
Level transducers	Two ultrasonic level transducers, one for each reservoir.

4.3.2.1 Existing Site Conditions

The existing site has two steel cylinder tanks and the existing Pumphouse. The large steel tank is 0.6 m on the north side from the Pumphouse and 2.6 m on the east side from the Pumphouse. A chlorine treatment building addition to the Fifth Avenue side of the site extended the deep foundations in that area. The small steel tank is on the boundary to the south side adjacent to Dugas Road. We understand that the site to the west has not been developed.

The existing reservoirs are on the west side of the site and though we do not have foundation record drawings, we believe the foundations are gravel base. The City has not reported ground issues aside from the small tank leaning though it is considered stable. Future settlement is considered unlikely. A reservoir constructed on the west side of site will require a gravel pad with concrete ringwall. A geotechnical investigation is required to determine thickness of structural fill (refer to Section 4.2.2 for scope of geotechnical investigation).

On the east side of site, the existing Pumphouse must be demolished. The base foundations, backfill, and piers connecting the Pumphouse slab to the foundation may not support loads associated with either bolted steel tanks or a concrete reservoir. The construction technique and backfill compaction are unknown; therefore, we recommend that the site is prepared in accordance with a geotechnical engineer's recommendations. The old continuous foundations can be left *in situ*. Assuming 2 m of fill is needed, the excavation and fill would need to cover the footprint of the new tanks plus 2 m beyond to allow for the new tank loads to spread the water load into the native soils beneath. For concept design, we assumed a site strip and fill for the west site boundary.

The existing tanks must remain online during construction. As well, construction of the new reservoirs may not undermine the existing tanks. Any pad excavation adjacent to the existing tanks must have a safe slope of 1:1 from the edge of the existing pad to prevent ground failure. This safe angle of repose must be verified by geotechnical investigation at later stages of design. It would be very expensive to shore the excavation around the existing tank to gain a larger tank footprint to the area near the Pumphouse. An L-shaped tank would be better in this situation.

The existing Pumphouse site is suitable for new reservoir construction provided the above-mentioned subgrade improvements are accounted for.

4.3.2.2 Bolted Steel Tank Site Layout

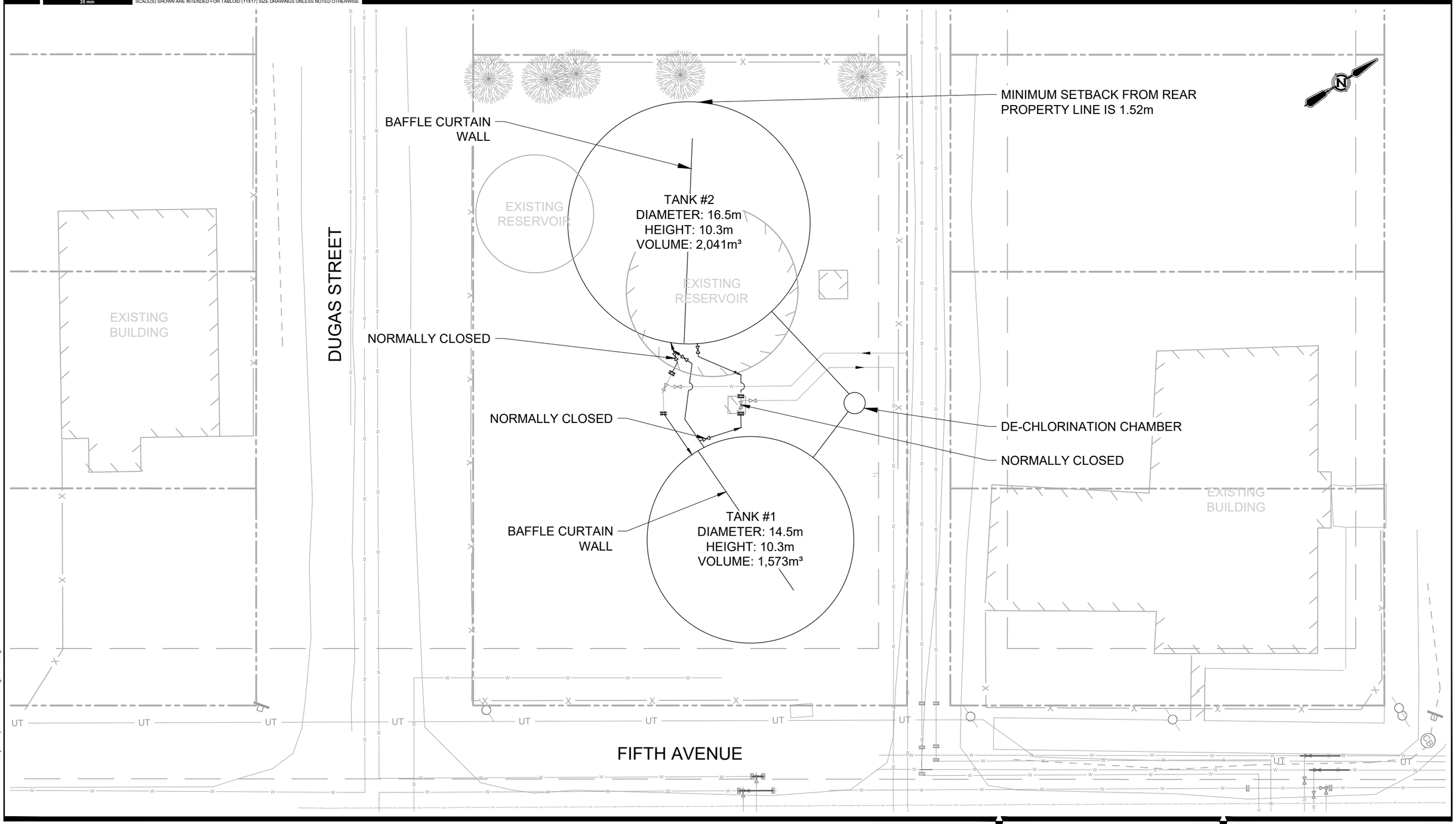
The proposed layout for two bolted steel tanks will be one tank on the east side of the existing reservoirs and one on the west side. The largest bolted steel tank diameter that will fit on the east side of site is 14.6 m (plus insulation and cladding). At this size, the tank will be 4 m from the existing large tank and aligned with the front property line. The usable volume will be 1,486 m^3 and including 0.6 m freeboard, the tank height will be 10.3 m. A second tank on the west side of site will store the remaining storage volume. The west tank will be 17 m in diameter (plus insulation and cladding) with usable volume of 2,212 m^3. **Table 4-3** summarizes the proposed bolted steel tank specifications. Together, the two tanks will provide more than the required 3,500 m^3 storage requirement. The proposed tanks are taller than the existing tanks of around 9 m.

The large existing reservoir must be demolished to install the west tank. We propose installing the west tank in the same location as the existing tank to reuse process piping and valves on the supply and return lines. Refer to **Figure 4-2** for bolted steel tank site layout.

Table 4-3
Bolted Steel Tank Specifications

Tank	Diameter (m)	Height to Tank Eave (m)	Freeboard (m)	Volume (nominal) (m^3)
Tank #1	14.5	10.3	0.61	1,573
Tank #2	16.5	10.3	0.61	2,041
			Total	**3,615**

IF NOT 25 mm ADJUST SCALES
25 mm
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



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REV	0
DESCRIPTION	ISSUED FOR CONCEPTUAL REPORT

FIGURE 4-2

PUMPHOUSE SITE LAYOUT
BOLTED STEEL TANK

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CITY OF DAWSON RESERVOIR REPLACEMENT

As part of the WTP upgrade, a new 250 mm diameter HDPE reservoir supply line was brought to the Pumphouse site. The reservoir return line is 450 mm diameter HDPE watermain. We propose reusing the new infrastructure and keeping all piping above ground, insulated, and heat-traced.

The new reservoirs will have inlet and outlet pipes and interconnecting pipes between cells. The inlet pipe will bring water from the WTP to Tank #1, and the outlet line will bring the water from Tank #2 to the WTP distribution pumps. Tanks #1 and #2 will have interconnecting piping and bypass piping and isolation valves. Each tank will have an overflow and a level transducer. The level transducer communication lines will be brought to the Communications Building at the Pumphouse site to communicate with the WTP.

Construction sequencing should proceed as follows:

- Install the first bolted tank on the east side of site and bring online;
- Take both existing reservoirs offline;
- Demolish both existing reservoirs and
- Install second bolted tank on west side of site and bring online.

During the period when only the new Tank #1 (14.5 m diameter) is online, the City will have 1,573 m^3 of storage; however, this is more than the existing reservoir storage capacity of 1,430 m^3.

4.3.2.3 Concrete Reservoir Site Layout and Operating Philosophy

One large concrete reservoir with two cells is proposed on the east side of the Pumphouse lot. Maintaining 4 m offset from the large existing reservoir, the reservoir is adjacent to the property boundary (offsets considered) on the north, east, and south sides of the lot to reduce the height of the reservoir. The proposed concrete reservoir is 28.5 m long by 14.5 m wide and 11 m tall (including freeboard) to achieve the 3,500 m^3 storage requirement[2].

We propose abandoning the existing aboveground piping; the new concrete reservoir inlet will connect to the existing 250 mm HDPE watermain from the WTP underground in the alley on the east side of the proposed reservoir. The inlet pipe will transition from HDPE to stainless steel and rise to above grade from underneath Cell 1. Baffles within the reservoir cells will create serpentine flow through Cell 1 and through Cell 2. The outlet will exit the reservoir through the base slab and tie into the existing 450 mm diameter HDPE reservoir return line. The transition from stainless steel to HDPE will occur outside the reservoir.

Both Cell 1 and Cell 2 cells may be bypassed for maintenance. Refer to **Figure 4-3** for proposed concrete reservoir layout, interconnecting piping, and isolation valves. Like bolted steel tanks, each cell will have a level transducer and overflow and drain. All isolation and bypass valves will be direct buried. Access ladders and hatches to each cell will be provided for access to each cell.

All tie-ins could be hot tapped to eliminate system downtime, or a temporary bypass will be required. Once the new reservoir is online, the existing reservoirs and aboveground piping may be demolished. Once existing infrastructure is removed, the west side of site will be vacant and may be used for other needs.

[2] Sizing estimate based on 500 mm base and wall thickness and 275 mm roof thickness.

IF NOT 25 mm ADJUST SCALES
25 mm
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

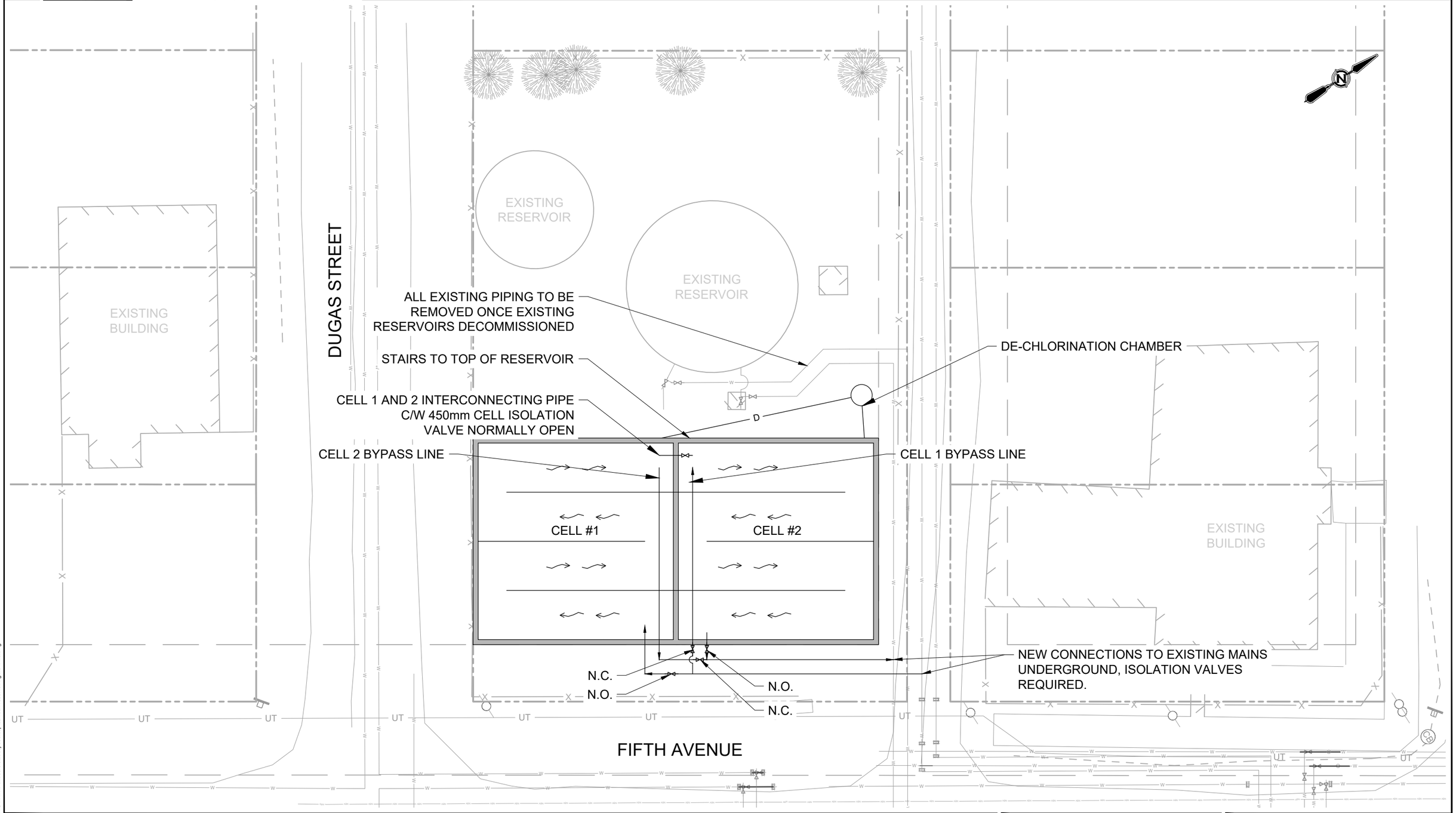

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FIGURE 4-3

PUMPHOUSE SITE LAYOUT
CONCRETE RESEVOIR

YUKON GOVERNMENT
CITY OF DAWSON RESERVOIR REPLACEMENT

4.3.2.4 Overflow Drainage

The proposed reservoirs will have overflow drains in the event the well pumps do not turn off when requested to stop pumping. The overflow drain shall be sized for worst-case scenario of 77 L/s MDD from one overflow drain. Overflow can be diverted away from the site in three ways:

1. Overland flow;
2. Sanitary sewer; and
3. Stormwater sewer.

The reservoir volume must be dechlorinated before discharged to the environment. The overflows and drains will tie into a dechlorination maintenance hole to be treated with bags of dechlorinating chemical before discharging either overland or to a sewer. Drainage planning for the reservoirs is beyond the scope of this conceptual design; however, the following should be considered for the Pumphouse site in later stages of design:

- Sanitary sewer lines exist on Dugas Street and on Fifth Avenue. Sanitary sewer upgrades on Fifth Avenue are under construction in summer 2020. The limiting sanitary sewer section is between the Pumphouse site and the WTP between sanitary maintenance hole S-109 and S-110 (Associated Engineering, 2019). The capacity of this 300 mm HDPE sanitary main is 51 L/s and is less than the overflow of 77 L/s. Without upgrades, the sanitary system is not sized to handle the reservoir overflow. As well, the WTP will likely be replaced with a lagoon and require lift stations to pump wastewater from downtown Dawson to the lagoon site. A future lift station must be sized to pump at least the overflow of 77 L/, which may not be cost effective.
- A stormwater sewer is under construction along Turner Street in summer 2020 and may have capacity to handle the reservoir overflow; however, Associated Engineering does not know the capacity of this stormwater sewer. A dechlorination maintenance hole upstream of the river is required to reduce chlorine concentration to below acceptable levels to discharge in the Yukon River. If the new stormwater sewer does not have capacity for the reservoir overflow, a new overflow sewer line with dechlorination maintenance hole could be constructed along the inner lot boundary.

Associated Engineering considered a new dechlorination maintenance hole on the Pumphouse site but did not price for additional stormwater or wastewater infrastructure upgrades.

4.3.3 Site Servicing

Site access will be from Dugas Street. According to the Zoning Bylaw, one off-street parking space for every 150.04 m^2 is required for lots with industrial uses. In either site layout, there is sufficient space to provide on-site parking. The number of spaces shall be determined at later stages of design.

The site will be graded to blend into the existing terrain and allow for positive drainage away from the reservoirs and structures.

4.3.3.1 Electrical and Communication Requirements

A new communications building was installed at the Pumphouse site during the WTP construction project. This communications building is heated, and houses Panel D. Panel D was installed as part of the WTP upgrades and was intended for electrical servicing of the new reservoirs. The communications building has an ethernet switch, radios and a fibre optic connection to the WTP control panel. The new level control instrumentation will be housed in the communications building and will communicate with the WTP via fibre optic.

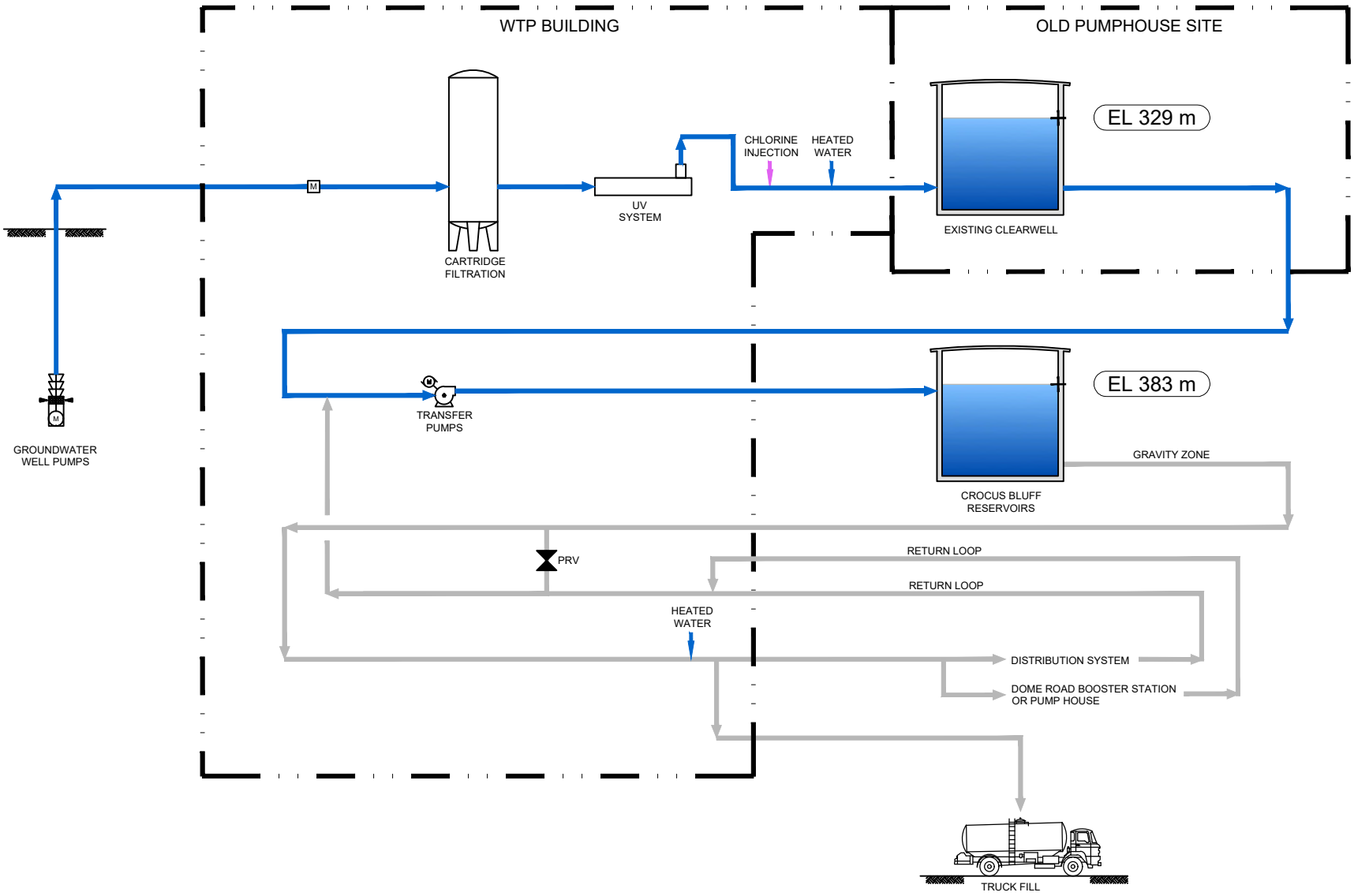
4.4 Concept Design for New Reservoir at Crocus Bluff

The City is considering locating the reservoir on Crocus Bluff as it relies on gravity flow rather than pumps to meet peak demand. FUS (1999) recommends fire flow be delivered by a gravity system without the use of pumps as it is more reliable. A new reservoir on Crocus Bluff would be accessed from Dome Road.

A proposed reservoir located on Crocus Bluff would rely on gravity flow to distribute water and fire flow through the distribution system as shown in **Figure 4-4.** A site layout it shown in **Figure 4-5.** Treated water will be sent to the existing large reservoir on the Pumphouse site, which would be repurposed as a treated water clearwell. This would allow the raw water pumps and treatment system to function as they currently do and provide a hydraulic break between the treated water flows and pressures and the distribution pumps, both of which can vary significantly. Water would be conveyed from the existing distribution pumps up to the new Crocus Bluff reservoirs via a new 300 mm diameter HDPE reservoir supply main. The reservoir volume would be 3,500 m^3 (like the Pumphouse site reservoir) and would have two concrete cells or two separate bolted steel tanks. The reservoir return line would follow the same alignment as the supply line and be tied into the WTP piping. This is required to allow for distribution heating and to tie the fire flow supply into both ends of the looped distribution system. Upgrades to the piping within the WTP are required. The existing fire pump would no longer be required in this scenario as fire flow would be supplied by gravity flow.

Watermain tie-ins in the WTP would require a new pipe to penetrate the building on the north side of the WTP building and would require additional piping and automated valving to tie into the existing plant piping. The feature of providing fire flow to both ends of each looped distribution main would need to be maintained while the existing fire pump would be removed.

A detailed geotechnical investigation will be required in the next phase of design if this reservoir location is pursued as there is no site information.



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SCALE	NTS
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REV	A
DESCRIPTION	CONCEPT DESIGN

FIGURE 4-4

PROCESS FLOW DIAGRAM
CROCUS BLUFF RESERVOIR

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CITY OF DAWSON RESERVOIR REPLACEMENT


Clearwell
(existing reservoir)
<-- Klondike River
Proposed Reservoir
TWL: 383m
Volume: 3500 m3
Reservoir
Distribution Main
Transmission Main
Existing System
Associated Engineering
PROJECT NO.: 2019-2794.000.000
DATE: May 2020
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FIGURE 4-5: CROCUS BLUFF RESERVOIR SITE LAYOUT
Government of Yukon
City of Dawson Reservoir Replacement
Crocus bluff.mxd / 7/3/2020 / 1:26:30 PM

Major infrastructure upgrades for a reservoir at Crocus Bluff are listed in **Table 4-4**.

Table 4-4
Infrastructure Upgrades for Crocus Bluff Reservoir

Infrastructure	Description/Quantity
Clearwell (existing)	Existing large reservoir on Pumphouse site to be refurbished as a clearwell.
Reservoirs	Concrete or two bolted steel tanks. Volume=3,500 m^3
Reservoir building	New building at Crocus Bluff site to house level transmitters, an electrical service and communication equipment. Dome Road has overhead electrical power available that could be used for establishing an electrical service for the instruments, building heat and lighting.
Level transducers	Two 4-16 ultrasonic level transducers, one for either cell or each bolted tank. Radio communication would be required between the reservoir and WTP.
Transmission main	475 m x 300 mm diameter HDPE transmission main (pumped) between the WTP and the Crocus Bluff reservoir.
Return main	475 m x 450 mm diameter HDPE return main (gravity flow) from the Crocus Bluff reservoir to the WTP.
Overflow pipe and drainage	An overflow pipe approximately 250 mm diameter, running down the bluff, parallel with transmission and return mains.
Transfer pumps (existing)	Existing distribution pumps to be reused as transfer pumps.
Water treatment tie-ins	Additional underground and aboveground piping, valves and fittings. A pressure reducing valve with custom pilot tubing to simulate the fire flow pump operation.

4.4.1 Operational Philosophy

The well pumps will be called to run when the clearwell level drops below the fill level set point and the well pumps will shut off when the clearwell level exceeds the full level set point. A high-level alarm in the clearwell will prevent the well pumps from turning on.

Water will be transferred from the clearwell to the reservoir on Crocus Bluff via transfer pumps (i.e., repurposed existing distribution pumps) located in the WTP. The transfer pumps will be called to run when the Crocus Bluff reservoir level drops below the reservoir fill level set point and the transfer pumps will shut off when the reservoir level exceeds the full level set point. Water will flow by gravity from the Crocus Bluff reservoir back to the WTP and will be heated prior to distribution.

4.4.2 Design Considerations

There are considerable additional infrastructure requirements for this option as well as higher heating requirements since both a clearwell and a reservoir are required as well as almost a kilometre of additional watermain, all of which would lose heat while conveying water. This conceptual design has not allowed for additional heating equipment since this would not be required initially, but the need for a fourth boiler will be accelerated compared to if the new reservoirs are located at the Pumphouse site.

The selected location of the proposed reservoir is located on flat topography to eliminate difficult and costly civil ground preparation, but a detailed geotechnical investigation would be required for this option. An access road from Dome Road would be required and follow a mild grade. Clearing and grubbing of the access road and reservoir site would be required. The estimate site size is 2,000 m^2.

The advantage of this option is that it uses gravity flow to distribute water through the distribution system and for fire flow. The top water level of the reservoir was selected to ensure maximum system pressure of approximately 90 psi. This is a set pressure that could not be changed in the future and would provide a steady operating pressure to the system.

An overflow pipe must be routed to an acceptable overland flow area, which would likely require a new pipe that would daylight at the base of the Crocus Bluff hill. We assume a 250 mm pipe will be routed along the same alignment as the supply main; however, an overflow routing assessment and existing storm capacity is required in future design phases.

4.4.3 Site Servicing

The Crocus Bluff site will be accessed from Dome Road and a new BST road will be constructed. Perimeter fencing will be provided, and on-site parking provided for operators. The site will be graded to blend into the existing terrain and allow for positive drainage away from the reservoirs and structures.

The tank overflows will have a dedicated drain line from the Crocus Bluff site down to existing storm or sanitary sewer system at the bottom of the hill. Capacity of the existing stormwater or sanitary system was not assessed as part of this Conceptual Design and must be done at later stages of design.

4.4.4 Electrical and Communication Site Servicing

Basic infrastructure such as level measurement and radios at the Crocus Bluff site can potentially be serviced with off-grid power supplies. There are various options available for small capacity off-grid power supplies including solar, wind, and methanol fuel cells. In the most basic form these systems consist only of a control panel mounted at the reservoir location. However, in the sub-arctic climate of Dawson, it is desirable to provide a small building enclosure to house such equipment, in which case more conventional power supply is required at the site to provide heat and power to the building.

A standard 100 A 120/240 V single phase power supply will be adequate for a small equipment building located at the reservoir site. The nearest power line is located along Eighth Avenue with a straight distance of approximately 300 m to the reservoir location. A single-phase overhead line along Dugas Street and up the hill is feasible and cost effective.

The reservoir location has a clear line-of-sight to the WTP, and radio communication to transmit reservoir level information is feasible.

4.5 Reservoir Option Evaluation

Table 4-5 provides advantages and disadvantages for the proposed reservoir locations. The proposed reservoir is significantly larger than the existing reservoirs. The advantage of locating the reservoirs at the existing Pumphouse site is that the water treatment process and distribution system remain unchanged and it is the best use of existing infrastructure. Construction on an existing site is challenging, and there is risk of impacting the existing water system during demolition and construction; whereas construction will be simpler on a greenfield site such as Crocus Bluff.

The elevated Crocus Bluff reservoir will provide gravity flow, which has the advantage of not relying on a fire pump during an emergency situation. In addition, a raised reservoir eliminates maintenance of the fire pump. However, the Crocus Bluff reservoir requires almost 1 km of transmission main up a hill that will be challenging to construct and will increase water heat loss compared to reservoirs at the Pumphouse site.

Bolted steel tanks and reinforced concrete tanks are proven potable water storage systems in Yukon. Concrete reservoirs have longer life expectancies, though they are more challenging to build and require longer construction seasons. For example, the Watson Lake reservoir required two construction seasons to build. The aesthetics of bolted steel versus concrete should be considered: bolted steel tanks come with cladding, whereas a concrete reservoir in the downtown core likely requires extensive architectural design to meet the Heritage Committee requirements.

Qualitative factors listed in **Table 4-5** in conjunction with life cycle costs should be used to select the reservoir location and type.

Table 4-5
Reservoir Upgrade Comparison

Location	Advantages	Disadvantages
Pumphouse Site w/ Bolted Steel Tanks	• Community acceptance • Best use of existing infrastructure and no change to WTP/distribution system process • Shortest construction timeline	• Shorter life span • Existing infrastructure will cause challenging demolition and construction • Construction sequencing required to maintain existing tanks online
Pumphouse Site w/Concrete Tank	• Longest lifespan • Existing tanks may remain online during construction • Once existing tanks decommissioned, large space maintained on west side of site • No change to WTP/distribution system process • Economic opportunity for local concrete plant	• Existing infrastructure will cause challenging demolition and construction • Higher architectural costs to meet Heritage Committee Requirements • Large concrete tank may be an eye sore • Longer construction timeline

Location	Advantages	Disadvantages
Crocus Bluff (Bolted Steel or Concrete)	• Improved fire system reliability • Greenfield construction rather than retrofit • Eliminates fire pump O&M	• Higher capital cost • Additional water heating requirements • Shortens timeframe for future boiler installation • Reservoir building increases O&M • Difficult forcemain construction • Newly installed fire pump in WTP becomes obsolete

5 KLONDIKE VALLEY AND DOME ROAD CONCEPTUAL DESIGN

To service the proposed development in the Klondike Valley and Dome Road areas (Areas A, C, D and F), two potential design options were modelled: (1) Booster Station and Reservoir on Dome Road, and (2) Distribution Pumphouse. **Table 5-1** outlines the proposed development of each Area and their corresponding water demands. The following sections describe the proposed infrastructure required for each option, as well as the considerations and assumptions made when developing the conceptual designs of each option.

Table 5-1
Planned Housing Units for each Area and Corresponding Flows

Area	Housing Units (Probable Yield)	ADD (L/s)	WinterADD (L/s)	MDD (L/s)	PHD (L/s)
A	114	2.28	6.16	9.80	14.82
C	98	1.96	5.29	8.43	12.74
D	24	0.48	1.30	2.06	3.12
F	64	1.28	3.46	5.50	8.32
Total	**300**	**6.00**	**16.20**	**25.80**	**39.00**

5.1 Option 1 – Booster Station and Reservoir on Dome Road

Option 1 involves the placement of a reservoir up Dome Road on Moose Mountain Road, fed by a booster station near the intersection of Dome Road and Highway 2. A dedicated transmission main that ties into the existing Callison watermain runs up Dome Road to supply the reservoir. The reservoir would then gravity feed Areas A and C directly, and then return to the WTP to create looped flow. **Figure 5-1** and **Figure 5-2** show the overall concept layout and process flow diagram of Option 1, respectively. **Table 5-2** provides a detailed list of the required infrastructure.

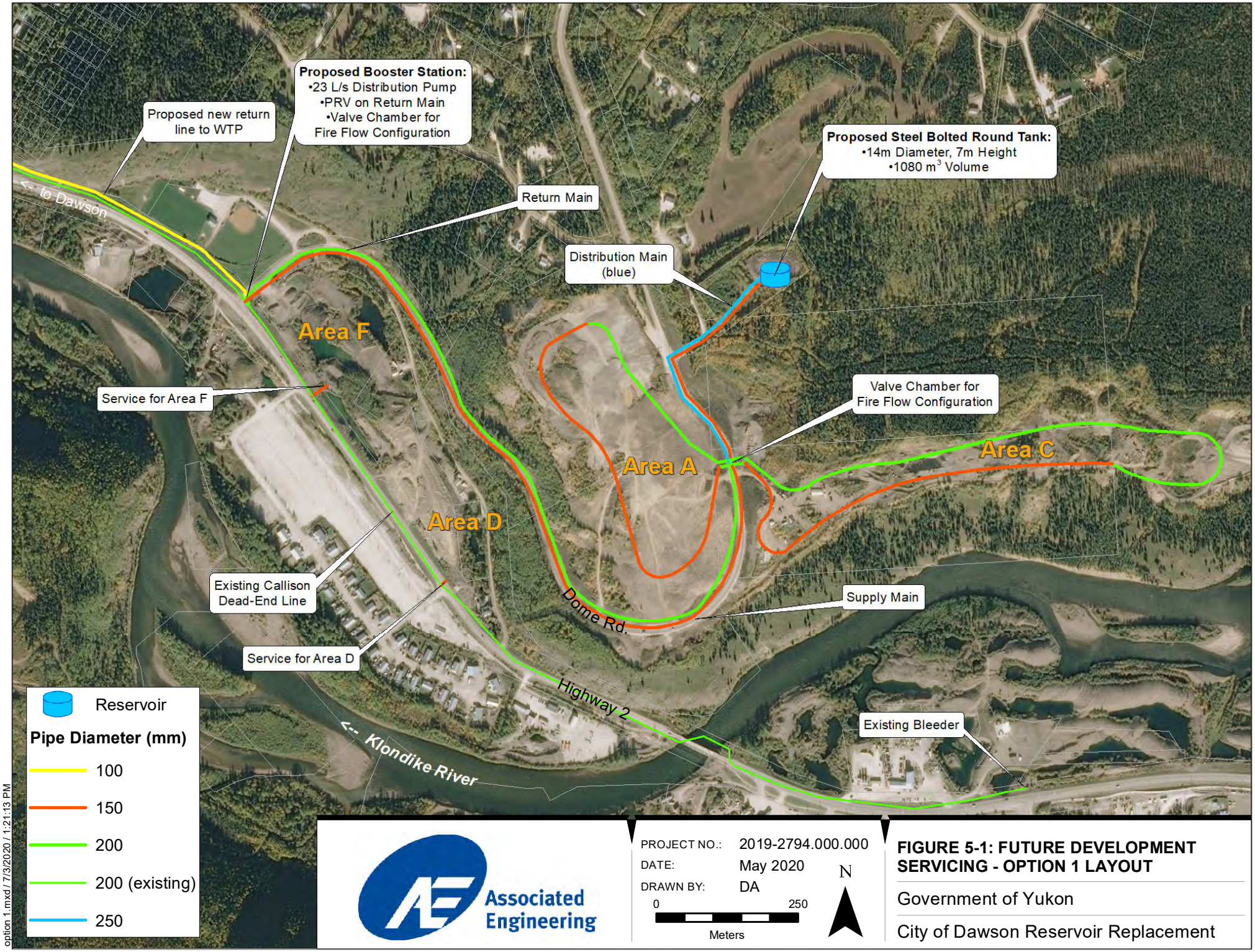
Proposed Booster Station:
•23 L/s Distribution Pump
•PRV on Return Main
•Valve Chamber for Fire Flow Configuration
Proposed new return line to WTP
Proposed Steel Bolted Round Tank:
•14m Diameter, 7m Height
•1080 m3 Volume
<-- to Dawson
Return Main
Distribution Main (blue)
Area F
Service for Area F
Valve Chamber for Fire Flow Configuration
Area A
Area C
Area D
Existing Callison Dead-End Line
Dome Rd.
Supply Main
Service for Area D
Highway 2
Existing Bleeder
<-- Klondike River
Reservoir
Pipe Diameter (mm)
100
150
200
200 (existing)
250
Associated Engineering
PROJECT NO.: 2019-2794.000.000
DATE: May 2020
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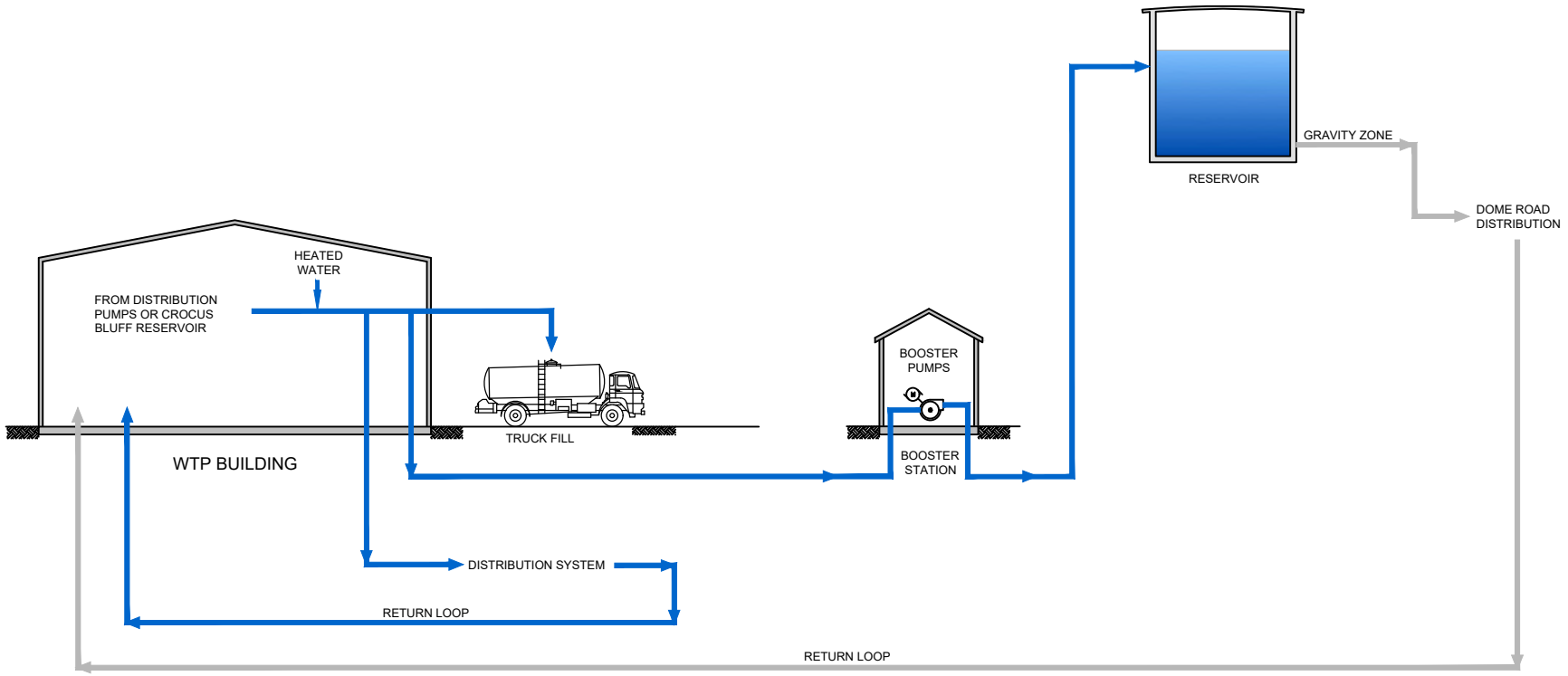
FIGURE 5-1: FUTURE DEVELOPMENT SERVICING - OPTION 1 LAYOUT
Government of Yukon
City of Dawson Reservoir Replacement
option 1.mxd / 7/3/2020 / 1:21:13 PM



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BEST MANAGED COMPANIES

AE PROJECT No.	2019-2794
SCALE	NTS
APPROVED	A. MCCLINTOCK
DATE	2020MAY20
REV	A
DESCRIPTION	CONCEPT DESIGN

FIGURE 5-2

OPTION 1 PROCESS FLOW DIAGRAM

GOVERNMENT OF YUKON
CITY OF DAWSON RESERVOIR REPLACEMENT

Table 5-2
Infrastructure Required for Option 1 Servicing

Infrastructure	Description / Quantity
Transmission main	1,950 m x 150 mm insulated HDPE pipe from the tie-in location at the Callison dead-end watermain to the reservoir on Moose Mountain Road.
Distribution main	450 m x 250 mm insulated HDPE pipe from the reservoir to Areas A and C.
Local distribution main	1,650 m x 200 mm insulated HDPE pipe and 1750 m of 150mm insulated HDPE pipe servicing Areas A and C locally.
Return main	1,500 m x 200 mm insulated HDPE pipe and 1050 m of 100 mm insulated HDPE pipe returning flow from Areas A and C to the WTP.
Flow control valve	1 x 100 mm diameter flow control valve on the return main at the WTP with a flow setting of 4 L/s.
Booster pump station	Booster station located near the intersection of Dome Road and Highway 2. The pump station houses a 23 L/s distribution pump and a PRV to regulate the pressures on the return main. Separate fire flow PRV to allow backflow into the suction side of the pump station and provide fire flow to the existing Callison line.
Reservoir	7 m high, 14 m diameter round bolted steel tank reservoir on Moose Mountain Road.
Valve chambers	1 valve chamber, located on Dome Road between Areas A and C to ensure optimal fire flow provision.

5.1.1 Operational Philosophy

Option 1 services Areas and C directly using gravity flow from the proposed reservoir on Moose Mountain Road. A proposed transmission main ties into the existing Callison Line of the City's system, and water is pumped through this main to the reservoir by a proposed booster pump. After servicing Areas A and C, water is returned to the existing WTP through a proposed dedicated return main, with flow controlled by a flow control valve, similar to the existing distribution loops in the City's system.

Operation of the proposed booster pump is controlled by the water level of the proposed reservoir. The maximum required flow of the booster pump is equivalent to the MDD of Areas A and C, plus the required flow returning to the WTP. The reservoir can service the Peak Hour Demands of Areas A and C, as well as fire flows in the vicinity of the new development. It is important to note that Option 1 does not service Areas D and F directly, meaning the reservoir does not service those areas. Instead, Areas D and F can be serviced off the existing Callison line.

In fire flow scenarios, two connections are proposed to optimize the provision of larger flows. One connection, housed in a valve chamber on Dome Road between Areas A and C, would connect the transmission main and return main. This would allow fire flow to be provided from the reservoir through both mains, increasing capacity, as well as allowing flow in both directions of the local Area A and C distribution loops. This connection would be controlled based on pressure sensed in the Dome Road system. For example, if a fire flow were to occur, pressure would drop and the connection would open. The other connection in the proposed booster station near the intersection of Dome Road and Highway 2, would connect the return main to the existing Callison watermain to allow for fire flow from the reservoir to service the existing Callison area, which currently does not satisfy fire flow requirements under existing conditions. This connection between the return main and the Callison watermain would be made through a check valve, only allowing flow in the direction from the return main to the Callison watermain. This connection would be

controlled by pressure sensed in the Callison watermain. For example, if a fire were to occur somewhere along the Callison watermain, the connection would open and the proposed reservoir could provide fire flow into Callison. With these connections in place, adequate fire flow is available during Maximum Day Demand conditions in Areas A and C, as well as along the Callison line.

5.1.2 Design Considerations

Design considerations for Option 1 included the following key components:

- Sizing and location of proposed reservoir;
- Sizing of booster pump;
- Sizing of pipes;
- Fire flow requirements;
- Thermal requirements; and
- Electrical, instrumentations and control requirements.

5.1.2.1 Reservoir

The proposed site of the reservoir was selected using the Government of Yukon's GeoYukon application (2020a). A location with an approximate base elevation of 448 m was selected using the application's Elevation Finder tool. The proposed site is located on a parcel of land owned by the City.

The proposed reservoir was sized to provide fire, equalization, and emergency storage to Areas A and C only. **Table 5-3** outlines the volume required for the proposed reservoir.

Table 5-3
Proposed Reservoir Volume Required

Areas	Description	Volume (m^3)
A (Fire Storage)	75 L/s for 1.7 hours as per City of Dawson Residential FF requirements	459
B (Equalization Storage)	25% of Projected MDD (Areas A and C only)	394
C (Emergency Storage)	25% of (A+B)	213
	Total	**1,066**

To provide the required volume, the proposed reservoir was designed as a 7-metre-high cylindrical reservoir with a diameter of 14 m. With a height of 7 m and a base elevation of 448 m, the Top Water Level of the reservoir was set at 455 m. This water level was selected to provide a range of static pressures between 50 and 80 psi to the proposed development lots within Areas A and C.

Although this option provides additional storage to the system, it is not recommended that the proposed WTP reservoir be reduced in size due to the unknown timing of the Klondike Valley/Dome Road development completion.

5.1.2.2 Booster Pump

The proposed booster pump was sized to deliver a flow of approximately 23 L/s to the reservoir. This is equivalent to the MDD of Areas A and C only, plus the required return flow to the WTP. The required head of the pump is approximately 105 m, to move water from the hydraulic grade line in the existing Callison line to the top water level of the reservoir during MDD flow conditions.

5.1.2.3 Pipe Sizing

The size of the proposed watermain was designed to optimize the performance of the system in the following ways:

- Maintain the highest possible velocities in pipes during low demand conditions, while not exceeding maximum acceptable velocities of 1.5 m/s in pipes during peak hour demands or 4 m/s in fire flow scenarios;
- Maintain service pressures between 40 and 90 psi at all local nodes in Areas A and C; and
- Maintain acceptable fire flows with residual pressure above 20 psi to all service nodes in Areas A and C and the surrounding area.

5.1.2.4 Fire Flow Provision

The provision of fire flow to not only Areas A and C, but also Areas D and F and the remainder of the Callison line was an important consideration. Under existing conditions, the final (approximately) 1350 m of the Callison line does not receive the required 75 L/s fire flow, so effort was made to improve these conditions with the proposed design. This included designing connections between the transmission and distribution mains near Areas A and C, as well as at the tie-in location at the Callison line, as described in Section 5.1.1.

5.1.2.5 Thermal Requirements

To prevent freezing of water in the pipes in winter, consideration was made to maintain flow and minimize the residence time of water in the pipes. Two options were considered: 1) using a return line that would carry a fixed flow back to the WTP, thus creating a loop, and 2) using a bleeder to discharge flow downstream of Areas A and C. The preliminary analysis determined that a bleeder rate of over 4.5 L/s would be required to maintain warm enough temperatures in the pipes. This was deemed too large of a bleeder flow, so the option to use a return line to the WTP was pursued. This return line does add capital cost to the project, as well as the additional O&M costs required to heat the increased amount of outgoing flow from the plant.

It should be noted however that significant baseline water heating costs should be expected with future development, as the output flow from the WTP increases. The existing boiler at the WTP that heats water leaving to Callison does not have sufficient capacity to heat the expected increase in flows. As such, upgrades to the heating system at the WTP will be required for this option.

5.1.2.6 Electrical, Instrumentation and Controls

The proposed booster pump station will require a 3-phase power supply with voltage appropriate for the specific pump sizes. The proposed location of the booster station is adjacent to the existing overhead distribution line along the Klondike Hwy. Yukon Energy Corporation (Yukon Energy) can install a new pole-mounted transformer in this location for the power feed to the new booster pump station.

There are no existing power lines in the immediate vicinity of the reservoir site, with the shortest realistic route for a power line of approximately 1 km. If Yukon Energy chooses to service this location from a route along Dome Road, the power line would be approximately 2 km.

A basic reservoir location can potentially be serviced with off-grid power supplies as there is only a need for level measurement and radios to communicate this information to the WTP. There are various options available for small capacity off-grid power supplies, including solar, wind, and methanol fuel cells. In the most basic form, these systems consist only of a control panel mounted at the reservoir location. However, in the sub-arctic climate of Dawson, it is desirable to provide a small building enclosure to house such equipment, in which case more conventional power supply is required at the site to provide heat and power to the building.

A standard 100A 120/240V single phase power supply will be adequate for a small equipment building located at the reservoir site.

Neither the booster pump station nor the reservoir site has a realistic line of sight with the WTP that will allow radio communications; however, the booster pump station and the reservoir site have clear lines of sight, making radio communications between those two sites feasible.

Alternative options to provide communications between the booster pump station and the WTP are as follows:

- Cellular modem.
- Dedicated optic fibre cable routed along existing power poles adjacent to the Klondike Highway. This will require an agreement with Yukon Energy, similar to the agreement they have with NorthWestel.
- Dedicated optic fibre cable routed with the proposed pipeline.

Capital cost estimates assumed a fibre optic line route followed Yukon Energy poles between the WTP and the booster station, and radio communication between the booster station and the reservoir site.

5.2 Option 2 – Distribution Pumphouse

Option 2 involves the placement of a wet well underneath the proposed booster pump at the intersection of Dome Road and Highway 2, that directly services Areas A and C. A new transmission main that ties in to the existing Callison dead-end watermain would convey water from the booster pump up Dome Road to Areas A and C. After servicing Areas A and C, the water would then return to the WTP to create looped flow. **Figure 5-3** and **Figure 5-4** show the overall concept layout and process flow diagram of Option 2, respectively. **Table 5-4** includes a detailed list of the required infrastructure.

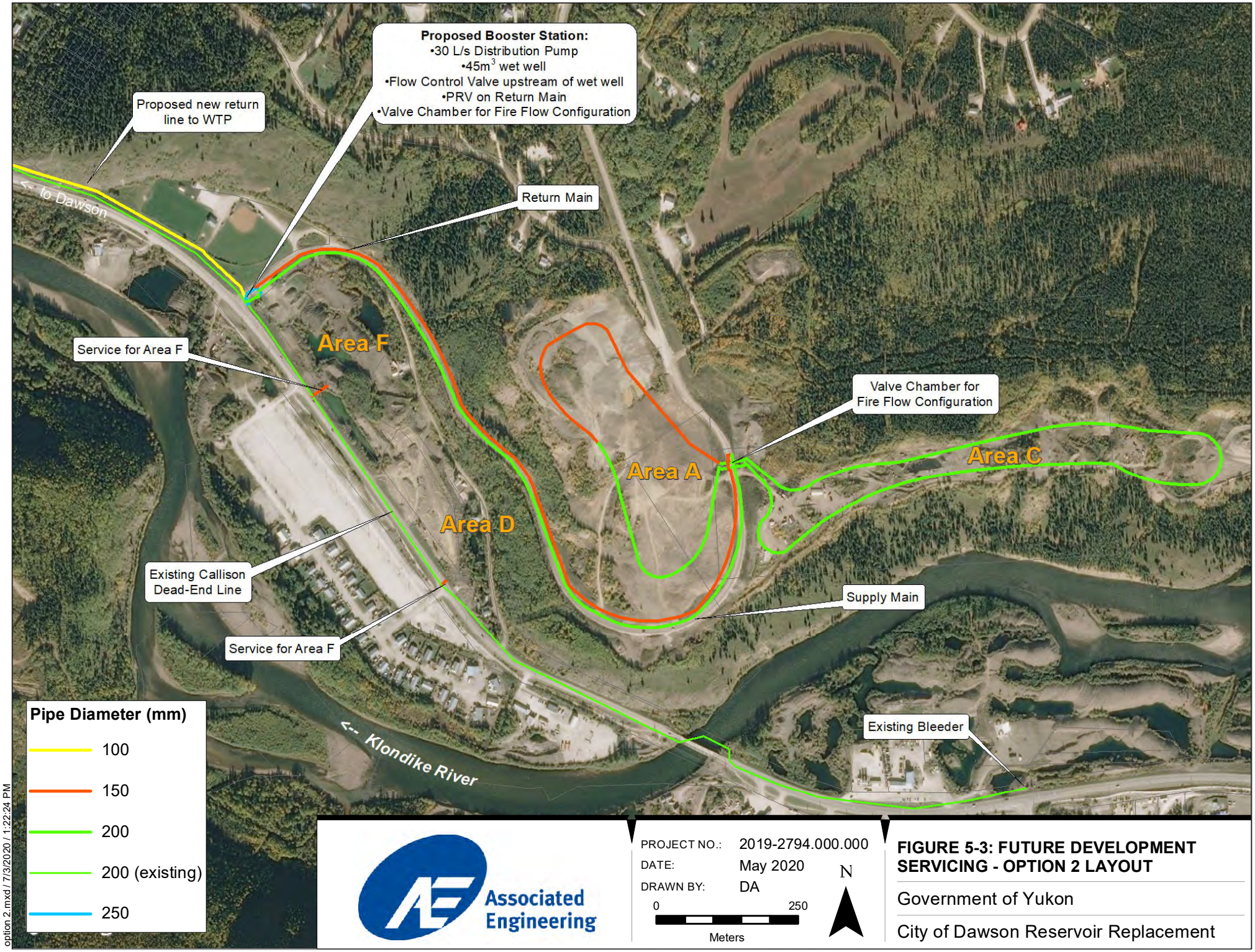
Proposed Booster Station:
•30 L/s Distribution Pump
•45m3 wet well
•Flow Control Valve upstream of wet well
•PRV on Return Main
•Valve Chamber for Fire Flow Configuration
Proposed new return line to WTP
<-- to Dawson
Return Main
Service for Area F
Area F
Valve Chamber for Fire Flow Configuration
Area A
Area C
Area D
Existing Callison Dead-End Line
Supply Main
Service for Area F
<-- Klondike River
Existing Bleeder
Pipe Diameter (mm)
100
150
200
200 (existing)
250
Associated Engineering
PROJECT NO.: 2019-2794.000.000
DATE: May 2020
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FIGURE 5-3: FUTURE DEVELOPMENT SERVICING - OPTION 2 LAYOUT
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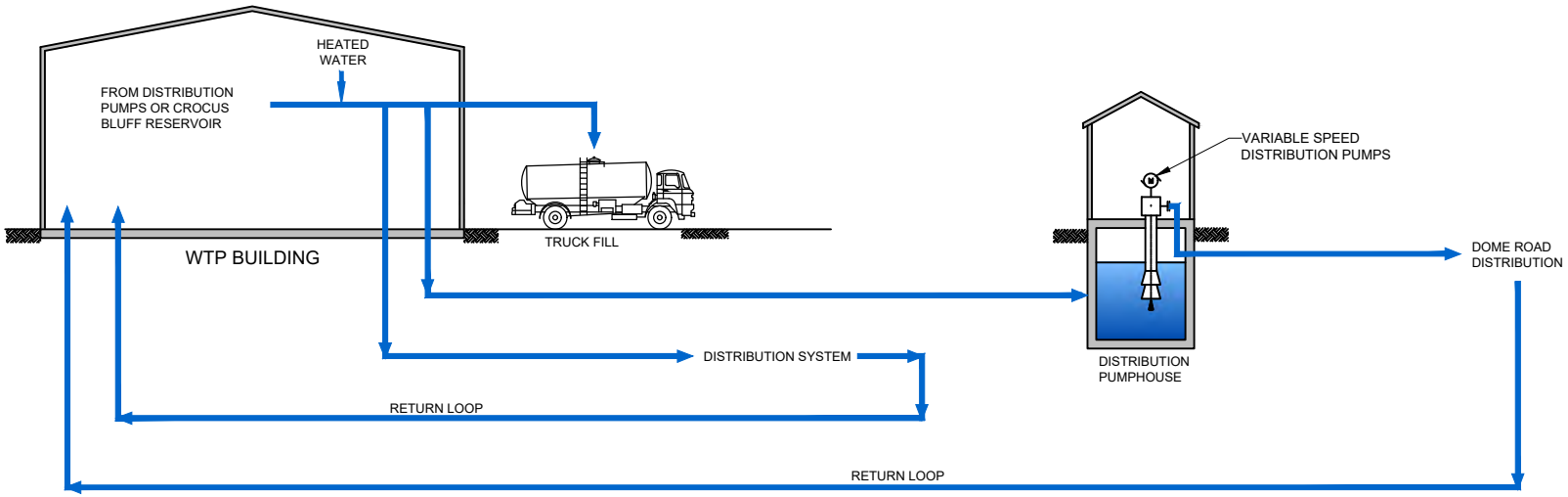
City of Dawson Reservoir Replacement
option 2.mxd / 7/3/2020 / 1:22:24 PM



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AE PROJECT No.	2019-2794
SCALE	NTS
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DESCRIPTION	CONCEPT DESIGN

FIGURE 5-4

PROCESS FLOW DIAGRAM OPTION 2

GOVERNMENT OF YUKON
CITY OF DAWSON RESERVOIR REPLACEMENT

Table 5-4
Infrastructure Required for Option 2 Servicing

Infrastructure	Description / Quantity
Distribution main	1500 m x 200 mm insulated HDPE from the Callison tie-in location to Areas A and C.
Local distribution main	2750 m x 200 mm insulated HDPE pipe and 700 m of 150 mm insulated HDPE pipe servicing Areas A and C locally.
Return main	1500 m x 150 mm insulated HDPE pipe and 1050 m of 100 mm insulated HDPE pipe returning flow from Areas A and C to the WTP
Flow control valve	1 x 100 mm diameter flow control valve on the return main at the WTP with a flow setting of 2 L/s.
Booster pump station	1 x Booster station located near the intersection of Dome Road and Highway 2. The pump station houses the following: • 30 L/s distribution pump on variable speed drive • 95 L/s fire pump, vertical turbine style pump mounted above wetwell • 45 m^3 wet well • Flow control valve to control the water level of the wet well • PRV to regulate the pressures on the return main • PRV for fire flow to provide additional pressure to the end of the Callison line
Valve chambers	1 valve chamber located on Dome Road between Areas A and C to ensure optimal fire flow provision.

5.2.1 Operational Philosophy

Option 2 services Areas A and C directly from a proposed booster pump station housing a wet well. The booster station is located near the intersection of Dome Road and Highway 2, and the wet well is fed by the existing Callison line. A proposed transmission main carries the pumped water up Dome Road to Areas A and C, then water is returned to the WTP through a dedicated return main. Flow returning to the WTP is controlled by a flow control valve, similar to the existing distribution loops in the City's system.

The proposed booster pump is continuously pumping water to Areas A and C, while the levels in the wet well are maintained through a flow control valve. This flow control valve "breaks the head" of the incoming water to the wet well and allows a continuous flow into the wet well. The booster pump has a variable speed drive to provide varying demands to Areas A and C. It is important to note that Option 2 also does not service Areas D and F directly. Instead, Areas D and F can be serviced off the existing Callison line.

In fire flow scenarios, a fire pump housed in the proposed booster pump station services Areas A and C, as well as parts of the surrounding area. Like Option 1, a connection on Dome Road between Areas A and C is proposed to allow flow in both directions of the local Area A and C distribution loops. This connection would be controlled based on pressure sensed in the Dome Road system. For example, if a fire flow were to occur, pressure would drop and the connection would open. The other connection is in the proposed booster station near the intersection of Dome Road and Highway 2 and would connect the fire pump discharge to the existing Callison watermain via the return main. This connection between the fire pump and the Callison watermain would be made through a check valve, only allowing flow in the direction from the return main to the Callison watermain. A check valve is also required on the existing

portion of the Callison watermain between the suction side of the Dome Road development and the return main tie-in location. These two check valves ensure no short circuiting occurs through the connection. This connection would be controlled by pressure sensed in the portion of the Callison watermain that is downstream (east) of the Dome Road development. For example, if a fire were to occur along the east portion of the Callison watermain, the connection would open and the proposed fire pump could provide fire flow. The connection would not open if a fire event were to occur along the Callison line upstream (west) of the Dome Road development; this area would still be serviced by the fire pump in the existing WTP. With these connections in place, adequate fire flow is available during Maximum Day Demand conditions in Areas A and C, as well as along the Callison line.

5.2.2 Design Considerations

Design considerations for Option 2 included the following key components:

- Sizing of booster pump and fire pump;
- Sizing of wet well;
- Sizing of pipes;
- Fire flow requirements;
- Thermal requirements; and
- Electrical, instrumentations and control requirements.

5.2.2.1 Booster and Fire Pump

The proposed booster pump was sized to deliver a flow of approximately 30 L/s. This is equivalent to the Peak Hour Demand of Areas A and C only, plus the required return flow to the WTP. To accommodate the varying demands of Areas A and C, the proposed booster pump has been designed with a variable speed drive. The required head of the pump is approximately 140 m (compared to 105 m in Option 1), to move water from the open atmosphere hydraulic grade line in the wet well to serviceable levels in Areas A and C. The proposed fire pump was sized to deliver a flow of approximately 95 L/s, which is equivalent to the required fire flow (75 L/s) and the MDD of Areas A and C.

5.2.2.2 Wet Well

The proposed wet well contained in the booster station was sized to provide 10 minutes of fire flow volume, which is equivalent to 45 m^3. The wet well was added to the design to allow time for the WTP fire pump to start once the new Dome Road fire pump was operational. Including a wet well will alleviate the problems such as surging and water hammer in the distribution system that may occur if two large fire pumps were connected hydraulically in series. This scenario is avoided by adding a wet well to attenuate the differences in flow rates.

5.2.2.3 Pipe Sizing

The size of the proposed watermain was designed to optimize the performance of the system in the following ways:

- Maintain the highest possible velocities in pipes during low demand conditions, while not exceeding maximum acceptable velocities of 1.5 m/s in pipes during peak hour demands or 4 m/s in fire flow scenarios.
- Maintain service pressures between 50 and 90 psi at all local nodes in Areas A and C, and
- Maintain the provision of acceptable fire flows and residual pressure above 20 psi to all service nodes in Areas A and C and the surrounding area.

5.2.2.4 Fire Flow Provision

The provision of fire flow to Areas A and C, as well as Areas D and F and the surrounding area was an important design consideration. This included designing connections near Areas A and C, as well as at the tie-in location at the Callison line, as described in Section 5.2.1.

5.2.2.5 Thermal Requirements

Similar considerations were made for thermal performance as in Option 1, with two of the same options considered: 1) using a return line that would carry a fixed flow back to the WTP, creating a loop, and 2) using a bleeder to discharge flow downstream of Areas A and C. A preliminary analysis determined that a bleeder rate of over 1.5 L/s would be required to maintain warm enough temperatures in the pipes. This was deemed too large of a bleeder flow, so the option to use a return line was also pursued in Option 2. Again, having a return line and additional flow return to the plant has significant cost implications.

It should be noted however that significant baseline water heating costs should be expected with future development, as the output flow from the WTP increases. The existing boiler at the WTP that heats water leaving to Callison does not have sufficient capacity to heat the expected increase in flows. As such, upgrades to the heating system at the WTP will be required for this option.

5.2.2.6 Electrical, Instrumentation and Controls

The proposed booster pump station will require a 3-phase power supply with voltage appropriate for the specific pump sizes. The proposed location of the booster station is adjacent to the existing overhead distribution line along the Klondike Hwy. Yukon Energy can install a new pole-mounted transformer in this location for the power feed to the new booster pump station.

In this option, the pump station must provide fire flows in the case of a power failure, and the pump station will need an emergency generator suitably sized to operate the fire pump and distribution pumps. The generator should be located outside the pump station in a walk-in weatherproof enclosure.

The booster pump station does not have a realistic line of sight with the WTP that will allow radio communications.

The following options provide communications between the booster pump station and the WTP:

- Cellular modem.
- Dedicated optic fibre cable routed along existing power poles adjacent to the Klondike Highway. This will require an agreement with Yukon Energy, similar to the agreement they have with NorthWestel.
- Dedicated optic fibre cable routed with the propose pipeline.

Dedicated optic fibre cable routed along the existing Yukon Energy poles was used for cost estimating.

5.3 Flow Modelling

The WaterCAD model was used to evaluate fire flow, winter flow, and water quality to evaluate the performance of Options 1 and 2. The following sections describe the results of these analyses.

5.3.1 Fire Flow

Figure 5-5 and **Figure 5-6** indicate the total available fire flow at each node in Option 1 and Option 2, respectively. It should be noted that each option provides adequate fire flow to all nodes in Areas A, C, D and F, as well as all nodes on the existing Callison line. As previously mentioned, the final (approximately) 1,350 m of the Callison line does not receive adequate fire flow under existing conditions, and each option would alleviate those issues.

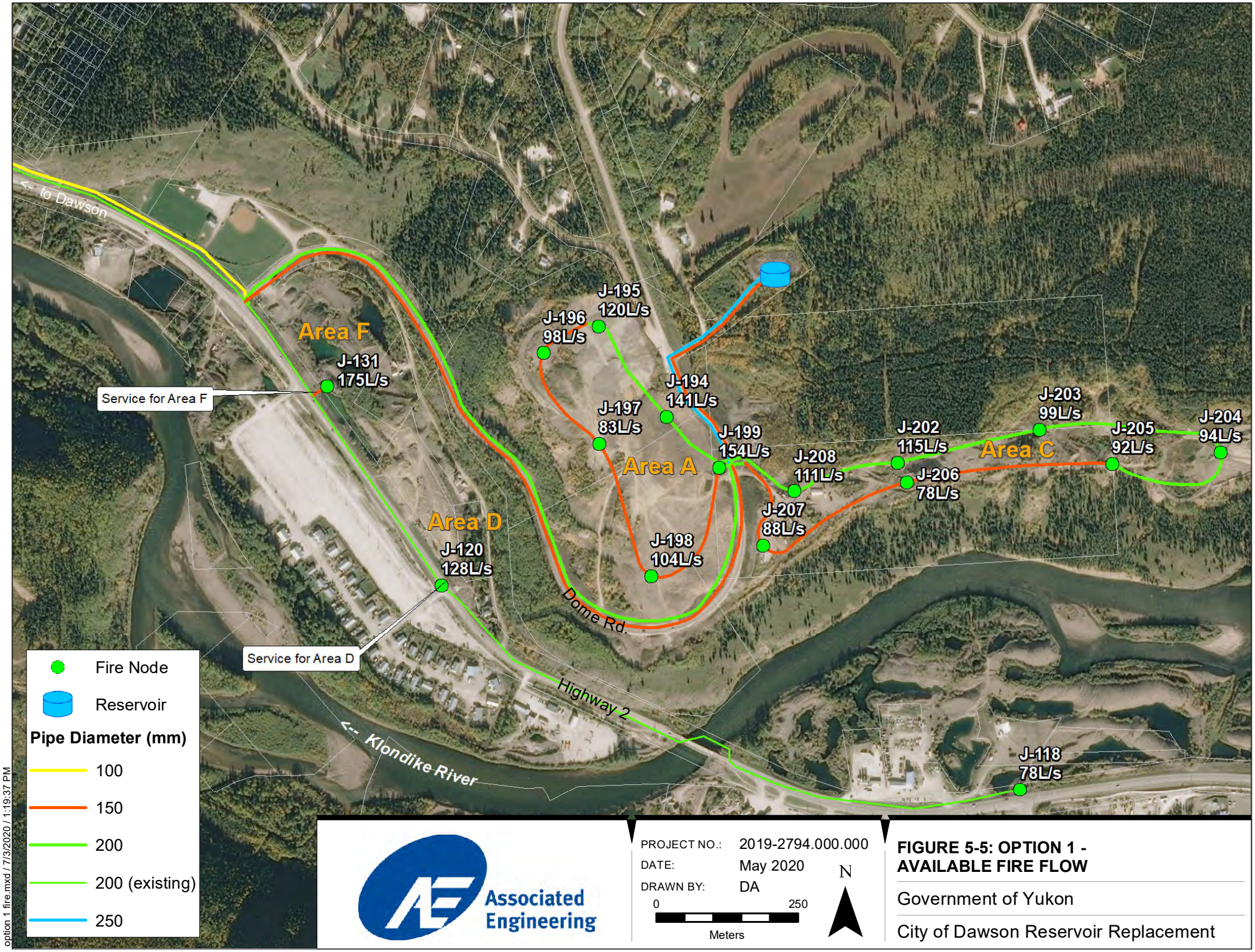
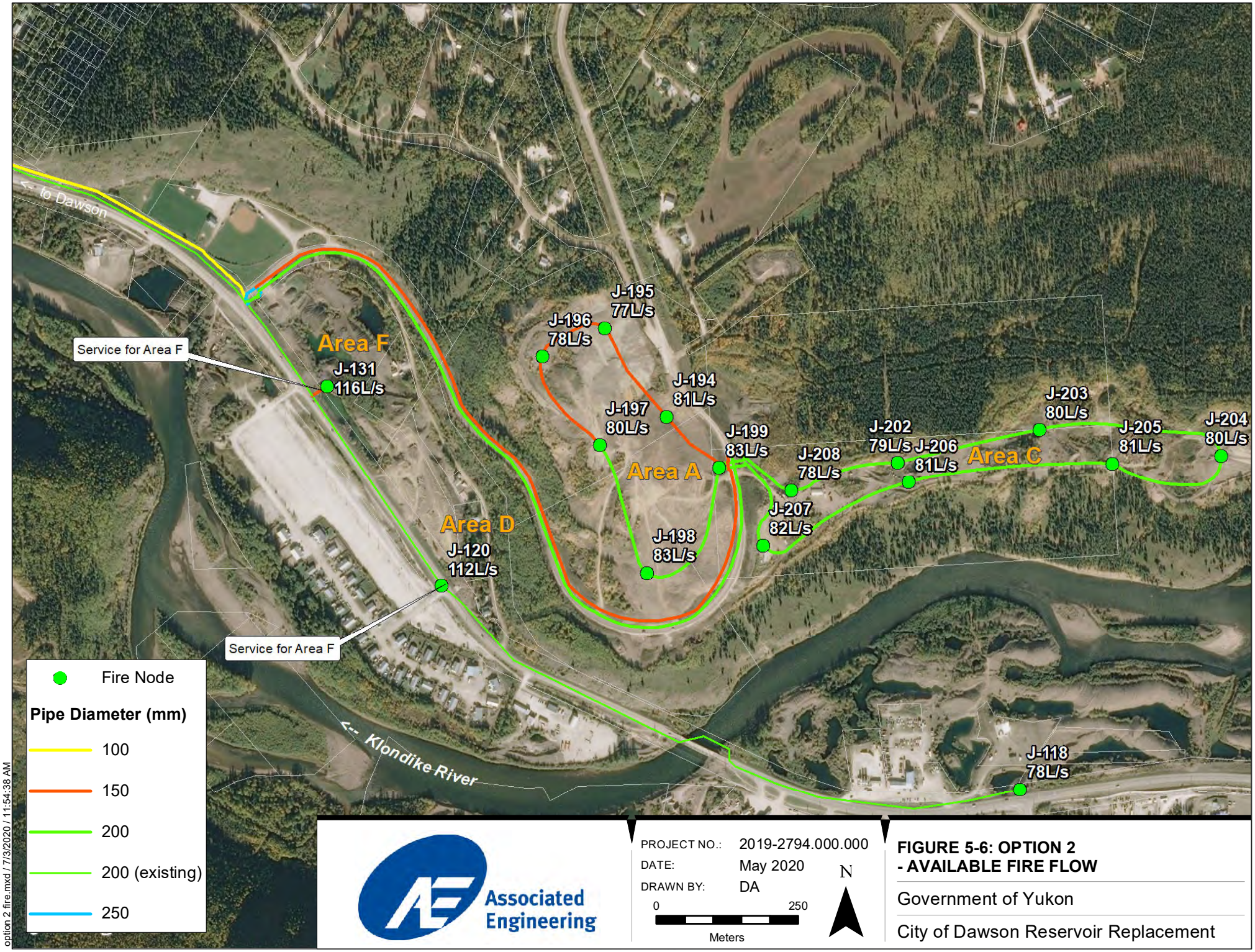


FIGURE 5-5: OPTION 1 - AVAILABLE FIRE FLOW

Government of Yukon

City of Dawson Reservoir Replacement


<-- to Dawson
Service for Area F
Area F
J-131
116L/s
J-195
77L/s
J-196
78L/s
J-194
81L/s
J-197
80L/s
J-199
83L/s
Area A
J-208
78L/s
J-202
79L/s
J-206
81L/s
J-203
80L/s
Area C
J-205
81L/s
J-204
80L/s
J-207
82L/s
Area D
J-120
112L/s
J-198
83L/s
Service for Area F
<-- Klondike River
J-118
78L/s
Fire Node
Pipe Diameter (mm)
100
150
200
200 (existing)
250
Associated Engineering
PROJECT NO.: 2019-2794.000.000
DATE: May 2020
DRAWN BY: DA
0
250
Meters
N
FIGURE 5-6: OPTION 2
- AVAILABLE FIRE FLOW
Government of Yukon
City of Dawson Reservoir Replacement
option 2 fire.mxd / 7/3/2020 / 11:54:38 AM

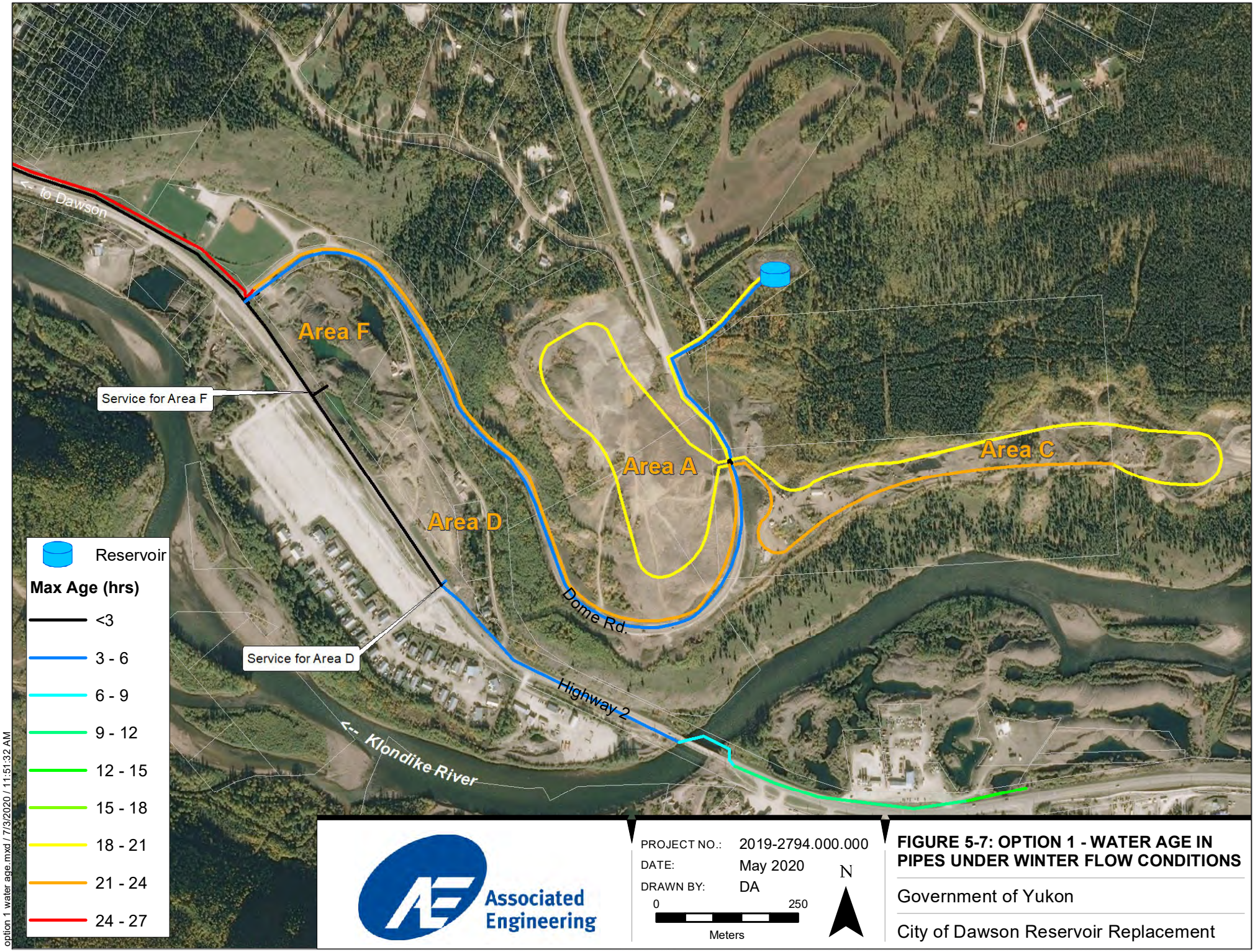
5.3.2 Winter Flow

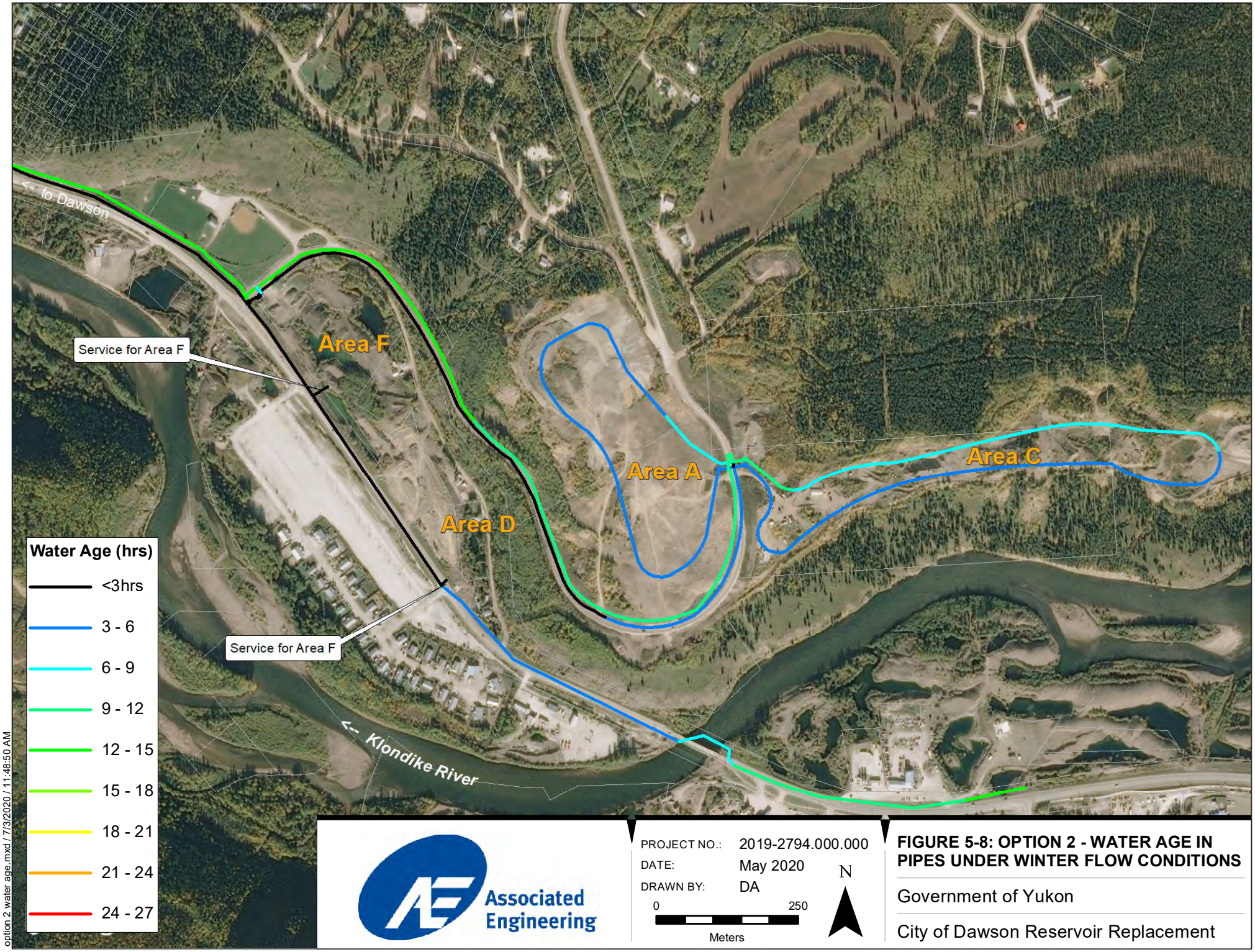
Figure 5-7 and **Figure 5-8** show the maximum water age in pipes under winter flow conditions (WinterADD) for Option 1 and Option 2, respectively. To perform the thermal analysis of each option, Water Age was used as an indicator to attribute temperature drop through the proposed water systems. The methodology used to perform the thermal analysis is described in Section 3.2.1.

The thermal analyses of both options were used to determine the required return flow rate to the WTP through the proposed dedicated return main. Using an iterative process, the minimum required return flow was determined using the model and the following assumptions:

- Water leaving the WTP destined for the Callison line was heated to 10 degrees Celsius. This was based on field measurements confirmed by City Operations staff.
- The minimum required temperature in the water returning to the WTP must be no less than 2.5 degrees Celsius.

Based on these assumptions, the minimum return flow rate required is 4.5 L/s Option 1 and 1.5 L/s for Option 2. **Table 5-5** and **Table 5-6** outline the expected temperature at key locations with these return flow rates along the proposed distribution loops of Options 1 and 2, respectively.


<-- to Dawson
Area F
Service for Area F
Area A
Area C
Area D
Dome Rd.
Service for Area D
Highway 2
<-- Klondike River
Reservoir
Max Age (hrs)
<3
3 - 6
6 - 9
9 - 12
12 - 15
15 - 18
18 - 21
21 - 24
24 - 27
option 1 water age.mxd / 7/3/2020 / 11:51:32 AM
Associated Engineering
PROJECT NO.: 2019-2794.000.000
DATE: May 2020
DRAWN BY: DA
0
250
Meters
N
FIGURE 5-7: OPTION 1 - WATER AGE IN PIPES UNDER WINTER FLOW CONDITIONS
Government of Yukon
City of Dawson Reservoir Replacement



option 2 water age.mxd / 7/3/2020 / 11:48:50 AM

Associated Engineering

PROJECT NO.: 2019-2794.000.000
DATE: May 2020
DRAWN BY: DA

0 250
Meters

N

FIGURE 5-8: OPTION 2 - WATER AGE IN PIPES UNDER WINTER FLOW CONDITIONS

Government of Yukon

City of Dawson Reservoir Replacement

Table 5-5
Expected Temperatures Throughout Option 1 Loop

	Maximum Travel Time	Estimated Temp. Drop Based on Travel Time	Initial Temperature	Final Temperature
WTP to reservoir	4.5 hours	1.9°C	10.0°C	8.1°C
Through reservoir	15.5 hours*	1.4°C	8.1°C	6.7°C
Reservoir to end of Areas A and C loops	4.4 hours	1.8°C	6.7°C	4.9°C
Areas A and C to WTP through return main	5.4 hours	2.2°C	4.9°C	2.7°C

**Travel time through reservoir was taken as an average travel time over the course of the extended period simulation, instead of a maximum time as in others.*

Table 5-6
Expected Temperatures Throughout Option 2 Loop

	Maximum Travel Time	Estimated Temp. Drop Based on Travel Time	Initial Temperature	Final Temperature
WTP to wet well	0.6 hours	0.3°C	10.0°C	9.7°C
Through wet well	0.9 hours*	0.1°C	9.7°C	9.6°C
Wet well to end of Areas A and C loops	8.3 hours	3.4°C	9.6°C	6.2°C
Areas A and C to WTP through return main	8.9 hours	3.7°C	6.2°C	2.5°C

**Travel time through reservoir was taken as an average travel time over the course of the extended period simulation, instead of a maximum time as in others.*

5.3.3 Water Quality Analysis

To perform the water quality analyses of Options 1 and 2, Water Age was again used as an indicator to attribute chlorine decay through the proposed water systems. The methodology used to perform the water quality analysis is described in Section 3.2.2.

The water quality analyses were performed to ensure each option provided adequate water quality to the new development. The following assumptions and criteria were used to evaluate the water quality in the new systems:

- The chlorine residual leaving the WTP ranges from 0.40 to 0.5 mg/L as confirmed by City Operations staff. When performing the water quality analysis, a chlorine residual of 0.40 mg/L leaving the plant was used to be conservative.
- The minimum chlorine residual in the distribution system must be at least 0.20 mg/L as per the Drinking Water Regulation (O.I.C 2007/139).

The estimated minimum residual chlorine concentrations at Areas A, C, D, F and returning to the WTP for both Options 1 and 2 are outlined in **Table 5-7.** In all cases, the chlorine residual is acceptable during the average winter flows through the service area.

Table 5-7
Chlorine Residuals in Areas A – F with 0.4 mg/L dosing at WTP

Option	Chlorine Residual				
	Area A	Area C	Area D	Area F	Return at WTP
Option 1	0.32 mg/L	0.31 mg/L	0.37 mg/L	0.38 mg/L	0.31 mg/L
Option 2	0.37 mg/L	0.36 mg/L	0.38 mg/L	0.39 mg/L	0.35 mg/L

5.4 Option Comparison

Table 5-8 presents a comparison of key components and considerations of each option.

Table 5-8
Comparison of Options 1 and 2

Component	Option 1	Option 2
Watermain Infrastructure	1050 m of 100 mm Pipe 3700 m of 150 mm Pipe 3150 m of 200 mm Pipe 450 m of 250 mm Pipe	1050 m of 100 mm Pipe 2200 m of 150 mm Pipe 4250 m of 200 mm Pipe
Storage	1,080 m^3 Bolted Steel Tank Reservoir	45 m^3 wet well (housed in Booster Station)
Pumping	23 L/s distribution pump system with direct on-line starter. Pump turns on/off to feed reservoir. Housed in Booster Station.	30 L/s distribution pump system with variable speed drive. Pump continuously on to feed distribution. Housed in Booster Station.
Valving	PRV (housed in Booster Station) required to regulate pressures on return main. Flow control valve (housed in WTP) to maintain return flows to the WTP.	PRV (housed in Booster Station) required to regulate pressures on return main. Flow control valve (housed in WTP) to maintain return flows to the WTP. Flow control valve (housed in Booster Station) to control levels in wet well.
Electrical	2 km power line supplying 3-phase power at booster pump station site. 100 kw Emergency Generator. Optic fibre cable between WTP and booster station. Radio communication between Booster Station and Reservoir.	3-phase power supply for booster station. 450 kw Emergency Generator. Optic fibre cable between booster pump station and the WTP.
Instrumentation & Controls	Communication required between proposed reservoir and proposed distribution pump.	Communication required between proposed wet well and proposed distribution pump.
Fire Flow	Reservoir provides fire flow to new development and existing Callison line. Valve chamber required to provide pipe	95 L/s vertical turbine fire pump (housed in Booster Station) with variable speed drive provides fire flow to new development and

Component	Option 1	Option 2
	configuration changes for fire flow, additional PRV housed in the Booster Station.	existing Callison line. Valve chamber required to provide pipe configuration changes for fire flow, additional PRV housed in the Booster Station.
Thermal	Return flow of 4.5 L/s is required to ensure temperatures remain above 2.5°C in system. This will be added to the flow that is heated leaving the WTP, meaning more heating required.	Return flow of 1.5 L/s is required to ensure temperatures remain above 2.5°C in system. This will be added to the flow that is heated leaving the WTP, meaning more heating required.
Water Quality	If chlorine residuals leaving the WTP remain in their current operating range of 0.40 – 0.50 mg/L, minimum chlorine residuals in the distribution system are 0.31 mg/L.	If chlorine residuals leaving the WTP remain in their current operating range of 0.40 – 0.50 mg/L, minimum chlorine residuals in the distribution system are 0.35 mg/L.
O&M	Reservoir cleaning, booster station maintenance (includes pump and valve maintenance), and pumping costs.	Booster station maintenance (includes pump and valve maintenance, and wet well cleaning). Additional fire pump and backup generator to regularly test and fill with fuel.

6 COST ESTIMATE

Class "D[3]" Capital and operation and maintenance (O&M) costs were calculated for the concepts developed in Sections 4 and 5. The confidence limit for Class D estimates is defined as ±50%. These cost estimates are intended for planning purposes.

6.1 Capital Cost Estimates

Capital cost estimates include major civil, structural, process mechanical, and electrical costs based on budgetary quotes from vendors and on quotations from other projects of similar scope and size. A 40% contingency was added to each cost estimate to account for uncertainties and risks not known at the time the estimate was developed but which will likely occur during the life of the project. In addition, a 15% engineering fee was added to the total capital cost for each concept. Capital cost estimates do not include land purchasing costs for either Crocus Bluff or Klondike Valley and Dome Road sites. Only bolted steel tank reservoirs were considered at Crocus Bluff for cost estimating purposes. Refer to **Appendix E f**or capital cost breakdowns.

Table 6-1
Capital Cost Estimates Reservoir Upgrades

Item	Pumphouse Site Bolted Steel Tank	Pumphouse Site Concrete Tank	Crocus Bluff Bolted Steel Tank
General	$657,401	$785,979	$770,540
Site Services	$1,075,406	$920,893	$1,266,100
Tanks	$1,901,600	$2,669,000	$1,901,600
Architectural	$190,160	$533,800	$160,000
Mechanical	$120,000	$150,000	$255,000
Electrical	$40,000	$40,000	$130,000
Total	**$3,984,568**	**$5,099,671**	**$4,483,240**
40% Contingency	**$1,195,370**	**$1,529,901**	**$1,793,296**
Construction Total	**$5,179,938**	**$6,629,572**	**$6,276,536**
15% Engineering	**$776,991**	**$994,436**	**$941,480**
Total (Rounded)	**$6,400,000**	**$8,300,000**	**$7,300,000**

[3] Class "D" (±50% accuracy) is a preliminary estimate which, due to little or no site information, indicates the approximate magnitude of cost of the proposed project, based on the client's broad requirements. This overall cost estimate may be derived from lump sum or unit costs for a similar project. It may be used in developing long-term capital plans and for preliminary discussion of proposed capital projects (CEBC, 2009).

Table 6-2
Capital Cost Estimates Klondike Valley and Dome Road Servicing

Item	Option 1	Option 2
General	$1,770,750	$1,523,800
Site Services	$4,262,250	$3,831,000
Reservoir	$1,669,000	
Mechanical	$2,292,500	$2,938,000
Electrical	$330,000	$550,000
Total	**$10,324,500**	**$8,842,800**
40% Contingency	**$4,129,800**	**$3,537,120**
Construction Total	**$14,454,300**	**$12,379,920**
15% Engineering	**$2,168,145**	**$1,856,988**
Total (Rounded)	**$16,700,000**	**$14,300,000**

6.2 Annual O&M Cost Estimates

6.2.1 Reservoir O&M

Annual operation and maintenance (O&M) costs for assets include maintenance costs, energy costs, and unplanned costs. O&M costs for each reservoir option were developed; however, only costs that were not already accounted for in the WTP O&M costs were considered. For example, distribution pumping costs were not accounted for.

The following reservoir maintenance is recommended by AWWA (1998):

- Periodic inspection and maintenance of controls (i.e., level transducers).
- Exterior inspection by operator (e.g., foundations, leaks, corrosion, ladders, platforms, vents).
- Tank washout and internal inspection by qualified professional.

AWWA (1998) recommends draining and washing out accumulated sediment on the tank bottom every three years, or more frequently if the water has high sediment content. The tank may be inspected by an experience commercial diver with experience in water tank design without draining the tank; however, a more thorough inspection is conducted when the tank is emptied, and sediment removed.

Bolted steel tanks have cathodic protection systems to protect steel from corrosion if the coating has deficiencies. Bolted tank manufacturers recommend conducting cathodic protection tests at the same time as the internal inspection. In addition, the anodes must be replaced every 10 years. The cost to replace anodes is $6,000 per tank.

Whereas the Crocus Bluff reservoir does not require a fire pump, reservoirs at the Pumphouse site require the existing fire pump be maintained in the WTP. According to the NFPA, fire pumps require annual inspections. The annual inspection must be performed by a qualified professional, at an estimated cost of $2,500.

Lastly, more heat loss is expected for the reservoir located at Crocus Bluff, as there is an additional clearwell and additional 1 km of watermain. The expected additional heat loss compared the reservoirs at the Pumphouse site is 1°C. The average flow rate over the next 20 years (2030 ADD of 53 L/s) was used to estimate fuel consumption for additional heating for 6 months of the year. The estimated fuel consumption is 91,200 L per year. The cost of fuel is assumed to be 1$/L.

The estimated annual O&M costs are provided in **Table 6-3**. Reservoir maintenance was estimated to be 0.5% of tank capital cost per year, and road maintenance at the Crocus Bluff reservoir was estimated to be 0.2% of capital cost. The maintenance cost of the small building at the Crocus Bluff reservoir was estimated based on $140 per square metre of footprint based on DIAND (2005). The cost of heating the water for a new reservoir at Crocus Bluff is the largest contributor to O&M.

Table 6-3
Reservoir O&M Costs

	Pumphouse Site Bolted Steel Tank	Pumphouse Site Concrete Tank	Crocus Bluff Bolted Steel Tank
Annual O&M	$13,000	$16,000	$105,000

6.2.2 Klondike Valley and Dome Road Servicing O&M

Klondike Valley and Dome Road O&M cost estimates account for reservoir and generator maintenance costs as well as pumping and water heating costs. It should be noted that the water heating costs included in the following O&M costs account for the heating costs required for the total increase in flows in the water distribution system due to the development, as well as the additional re-circulation flows that are required for each design option.

The approximate fuel consumption rate at the existing WTP was determined based on fuel consumption data provided by the City. The data indicate daily records of fuel consumption, as well as outgoing water temperature after heating. These data were used to determine an average fuel consumption rate per kilowatt required to heat the water. Based on this rate, Option 1 will require approximately 325,000 L of additional fuel to heat the increased demand of water down the Callison line, and Option 2 will require approximately 280,000 L of fuel. The cost of fuel is assumed to be $1 per litre.

To account for growing water demands across the life cycles of both options, the cost associated with heating the additional water was applied in phases throughout the life cycle. For example, we assumed that no new water demands would occur until 2030, as development would likely not occur until then. At that time, it was assumed that half of the development would be added into the City's water distribution system (i.e. half the housing units in the Klondike Valley and Dome Road development areas would be developed), and that increase in demand would carry costs for heating the additional flow. From 2030 to full build-out in 2040, the water demands (and associated heating cots) were assumed to increase linearly.

For pumping O&M costs, an electricity cost of 0.13 $/kwh was used, and maintenance costs were assumed to be 2% of capital costs. Reservoir maintenance was again estimated to be 0.5% of capital costs, while backup generator maintenance costs were estimated to be 2% of capital costs. Pump station and reservoir building maintenance costs were again estimated at $140 per square metre of footprint. Option 1 – Booster Station and Reservoir has the highest O&M cost (**Table 6-4**).

Table 6-4
Klondike Valley and Dome Road O&M Costs

	Option 1 Booster Station & Reservoir	Option 2 Distribution Pumphouse
Annual O&M	$388,000	$ 353,000

6.3 Life Cycle Analysis

The total life cycle cost of an asset is equal to the sum of the capital costs, the O&M costs including energy costs, and the decommissioning/disposal costs. For planning purposes, the life cycle cost is used to compare total costs of an asset over a predetermined length of time such as 20 years. The total life cycle cost is based on the 2020 capital cost plus the O&M cost over the 20-year life of the system in 2020 dollars. The total O&M cost over the lifetime of the system in today's dollars is the "net present value." By adding the capital cost and the net present value of O&M, the total life cycle cost of the options can be compared.

The expected life of bolted steel tanks and concrete reservoirs exceeds 20 years; however, bolted steel tanks have a life expectancy of 30 years compared to 75 years for concrete tanks. At the end of the 20 years, a bolted steel reservoir has 10 more service years, whereas concrete tanks have an additional 55 years. To account for this, the remaining life of the asset is deducted from the Life Cycle Cost.

$$LCC = Capital\ Cost + (NPV\ of\ 20\ yr\ O\&M) - (Asset\ Residual\ Value)$$

Where:
LCC: life cycle cost
Capital Cost: As shown in **Table 6-1** or **6-2**
NPV of 20 yr O&M: 20-year net present value of O&M costs
Asset Residual Value: residual value of asset after 20 years assumes linear depreciation.

O&M costs were inflated by 2% every year over the next 20 years to account for inflation of cost of goods. The net present value of O&M costs assumed a discount rate of 5%. If the selected option is constructed later than 2020, a 2% escalation should be applied to the capital costs each year between 2020 and the year of construction. Refer to **Table 6-5** for life cycle cost estimates for the reservoir conceptual design and **Table 6-6** for the Klondike Valley and Dome Road conceptual design. Life cycle cost breakdowns are provided in **Appendix E**.

The lowest reservoir life cycle cost is a concrete reservoir at the Pumphouse site and the lowest Klondike Valley and Dome Road Servicing is Option 2 – Distribution Pumphouse.

Table 6-5
20-Year Life Cycle Cost Estimate of Reservoir Options

	Pumphouse Site Bolted Steel Tank	Pumphouse Site Concrete Tank	Crocus Bluff Bolted Steel Tank
Capital Cost (2020 dollars)	$6,400,000	$8,300,000	$7,300,000
NPV of O&M	$201,000	$247,000	$1,617,000
Residual Value	$(634,000)	$(1,957,000)	$(634,000)
20-Year Life Cycle Cost (Rounded)	**$5,967,000**	**$6,590,000**	**$8,283,000**

Table 6-6
20-Year Life Cycle Cost Estimate of Klondike Valley and Dome Road Servicing

	Option 1 Booster Station & Reservoir	Option 2 Distribution Pumphouse
Capital Cost (2020 dollars)	$16,700,000	$14,300,000
NPV of O&M	$4,652,000	$4,100,000
20-Year Life Cycle Cost	**$21,352,000**	**$18,400,000**

7 FACILITY CLASS

Under the *Public Health and Safety Act* (O.I.C. 2007/139), a large public drinking water system operator must hold a valid operator certification certificate equal to or greater than the facility class assigned to the water treatment and distribution system. The Environmental Operators Certification Program (EOCP) is the certification body that classifies and certifies water and wastewater operators in British Columbia and in Yukon. The Dawson WTP is classified as Class 2 Facility.

Associated Engineering performed the ECOP Water Distribution (V 5.0) classification for the distribution system considering the new infrastructure required for servicing Klondike Valley and Dome Road. The location of the new reservoirs, either at the Pumphouse site or at Crocus Bluff does not affect the distribution system classification. The existing system Infrastructure Point Score is 21, and the Influencer Point Score is 234. The existing distribution classification is Level 2.

Servicing the Klondike Valley and Dome Road area has the following impacts on the existing distribution system:

- Increases the number of pressure zones from 0 to 1, and
- Increases number of pump stations from 0 to 1.

These two changes increase the total distribution influencer points by 72 points; however, the final facility classification remains Level 2. Refer to **Appendix D** for the complete distribution system classification results.

8 SUMMARY AND RECOMMENDATIONS

The City of Dawson requires new reservoirs to replace the undersized reservoirs on the Pumphouse site, which are at the end of their design life. The City is considering reservoir storage either on the existing Pumphouse site or at a new raised reservoir on Crocus Bluff. In addition to new reservoirs, the City is planning for future development in the Klondike Valley and localized infill lots on Dome Road and requires a plan for servicing this area.

Population growth for the year 2040 in Dawson was estimated according to Yukon Bureau of Statistics (YBS) data and projections. Population in Yukon communities is growing, and the growth rate has risen from 1.3% to 1.6% since 2016. YBS projects the population of Dawson in 2040 will be 2,480. Water demand was estimated using per capital consumption developed by Stantec (2016a) of 1,200 L/cap/day and MDD factor of 1.6 based on actual water demand data. The 2040 MDD is projected to be 77 L/s.

Reservoir storage was estimated according to MMCDA design guidelines and includes fire protection, equalization storage, and emergency/disinfection storage. The reservoir was sized to provide 155 L/s for 2 hours for mixed/commercial/industrial fire as recommended by Stantec (2016a). The total reservoir storage volume required in 2040 is 3,500 m^3.

Conceptual designs were completed for potential reservoir locations and for site servicing options in the Klondike Valley and Dome Road areas.

8.1 Reservoir Summary and Recommendations

Two sites are proposed for new reservoirs:

1. Existing Pumphouse site across from the WTP.
2. Crocus Bluff.

Two options were compared: two bolted steel tanks in series and reinforced concrete reservoir with two cells. The proposed reservoirs will include level control in each cell, baffles to prevent short circuiting, and insulation and cladding. At the Pumphouse site, finishing's will be more extensive to meet heritage requirements of the downtown core.

The main advantage of the Pumphouse site is community acceptance of using this lot for water supply infrastructure, no changes to the WTP or distribution system are required, and less energy is required to heat water. Though the Crocus Bluff location will improve fire system reliability by removing the fire pump from the WTP and relying on gravity flow to meet peak demands, a clearwell is required at the Pumphouse site and extensive upgrades in the new WTP will be required. Around 1 km of forcemain will be required between the WTP and the Crocus Bluff reservoir increasing heat loss by 1°C. Heat loss in the watermain to Crocus Bluff and the extra clearwell was a key driver for higher operation and maintenance costs. With population growth and increased water demand, conserving energy will reduce O&M costs for the City. For these reasons, the Pumphouse site is the preferred location for new reservoirs.

In general, bolted steel tanks are easier to construct and have lower capital costs but shorter life expectancies than concrete reservoirs. Concrete reservoirs are proven for safe, durable potable water storage, would provide local economic opportunity for concrete supply, and have life expectancies up to 75 years. The concrete reservoir must be located on the front of the Pumphouse site leaving the back of the site open once the existing bolted tanks are

demolished. Though a concrete reservoir on Pumphouse site has a higher capital cost, the design life is much longer than the bolted tank. Associated Engineering accounted for longer design lives on the reservoirs by subtracting the 20-year reservoir residual value from the life cycle cost. Even with residual value considered, bolted steel tanks have lower life cycle costs. Based on the above, bolted steel tanks at the Pumphouse site is the preferred option.

We provide the following recommendations to proceed with reservoir design at the Pumphouse site:

1. Demolish the existing Pumphouse including hazardous material removal.
2. Conduct geotechnical investigation to determine tank foundation requirements.
3. Complete survey of existing Pumphouse site as Communications Building and existing pipework are critical infrastructure that must remain in operation for proposed upgrades.
4. Conduct preliminary design of new reservoirs on Pumphouse site including the following:
    a. An energy analysis to reduce heat loss in the reservoir.
    b. A drainage study to determine location of tank overflow.
    c. Engage architect with experience in City of Dawson heritage design.

8.2 Klondike Valley and Dome Road Site Servicing Summary and Recommendations

Two options were proposed to service the Klondike Valley and Dome Road development areas:

1. Construction of a new reservoir along Dome Road, which feeds the development areas by gravity and a booster station at the intersection of Dome Road and Highway 2 to fill the reservoir.
2. Construction of a new booster pump station with a wet well that directly feeds the development areas.

Option 1 has the advantage of providing more reliable fire flow to the new development. The Fire Underwriters Survey states that gravity systems delivering supply form the source to distribution directly without the use of pumps is advantageous because of its reliability, but pumped systems can also be made to provide a high degree of reliability. Option 1 also opens the possibility to future development or servicing about the Dome Road proposed development, but further analysis would be required for these services, especially additional heat losses that would occur in the lines and the corresponding challenges.

Option 2 is the less costly option based on the 20-year life cycle costing in Table 6-6 and still provides the required servicing while using less heating within the distribution system than Option 2. The concept design has used fire pumps that have full backup power at the WTP and at the proposed booster station, so the degree of reliability is increased, although still less than Option 1. Another advantage of Option 2 is that is allows for more staging options as pumps can be added to the proposed pump station as the development grows. Whereas with Option 1, it would not be economical to break the reservoir construction into phases.

Considering the above and the lower ongoing operations and maintenance costs in the form of heating, we recommend proceeding with Option 2 as the basis for future preliminary design planning.

CLOSURE

The services provided by Associated Engineering (B.C.) Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

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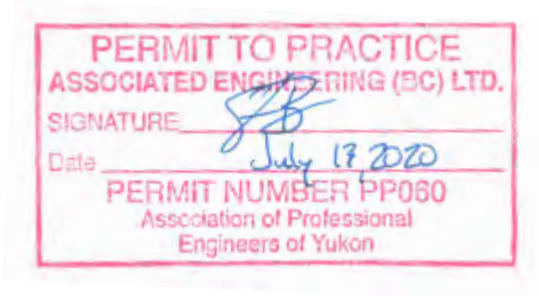

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APPENDIX A – RESERVOIR CT CALCULATIONS

Project name : City of Dawson Reservoir Replacement
System name: Dawson Chlorine Disinfiection
Client : Yukon Government, Community Services
Project No. : 2019-2794.00
Prepared by : AM
Reviewed by : ML
Date : 5/8/2020

Title : **Log removal calculation**

Formulas

Calculation of CT: CT=Cl2 residual * (Vu/Qmax) * T10/T
with: Cl2 residual = min. free chlorine concentration at the outlet of the storage tank
Vu = min. volume available for disinfection
Qmax = maximum distributed flow rate
T10/T = hydraulic efficiency of the storage tank

Log removal for Crypto: Log C=0

Log removal for Giardia: Log G = CTa / (0.2828*pH^2.69*Cl2residual^0.15*0.933^(T-5))

Log removal for virus: Log V = ((Cta * exp(0.071*T))-0.42)/2.94

Parameter	Value	Unit	Definition of parameter
Reservoir			
Cl2 residual	0.45	mg/L	Between 0.4 and 0.5 mg/L leaving WTP (email from TC Franks 20-April-2020)
Vu	653	m^3	Volume in reservoir for disinfection
MDD	77.0	L/s	2040 MDD
PHD	116.0	L/s	2040 PHD
PHD +Fire	271.0	L/s	2040 PHD + 155 L/s. Worst case scenario, not used for reservoir sizing.
Qmax	7.0	m^3/min	Maximum pumping rate from CT storage is PHD (116 L/s) in m^3/min.
T10/T	0.2	-	Hydraulic efficiency of the reservoir (between unbaffled 0.1 and poor 0.3)
Cta	8.44	mg.min/L	
Pipelines			
1. From WTP to Reservoir			
T10/T	1		Plug flow through pipes. Length to Width Ratio > 40:1
Diamter	0.24	m	
length	85	m	
Velocity	1.7	m/s	
time	49.9	s	
Cta	0.37	mg.min/L	
2. From Reservoir to WTP			
T10/T	1		Plug flow through pipes. Length to Width Ratio > 40:1
Diamter	0.4	m	
length	85	m	
Velocity	0.9	m/s	
time	92.0	s	
Cta	0.69	mg.min/L	
Total Cta	9.51	mg.min/L	Available CT at the plant
pH	8.09	-	Four new wells drilled 2014. WQ data from 4 samples between Nov. 8/15 and Sept. 21/16
T	3.5	℃	Min. temperature before turning on the heating system to the distribution system.
Log C	**0**	log	Log of inactivation for *Cryptosporidium*
Log G	**0.12**	log	Log of inactivation for *Giardia*
Log V	**4.00**	log	Log of inactivation for virus

Project Name:	City of Dawson Reservoir Replacement
Project Number:	2019-2794.00
Date:	25-May-20
Prepared by:	AM
Reviewed by:	ML
Reference:	Fire Underwriters Survey 1999 Water Supply for Public Fire Protection
Subject:	Reservoir volume needed for 2040

Reservoir Volume for 2040

S (Total Volume)	=A+B+greater of C or D		Fire Underwater Surveys Guidelines
A (Fire Storage)	1,116	m3	155 L/s for 2 hours in m^3
B (Equalization Storage)	1,670	m3	25% of projected 2040 MDD
C (Emergency Storage)	697	m3	25% of projected A and B
D (Disinfection Contact Volume)	653	m3	at PHD (2040) and T10/T of 0.2
TOTAL VOLUME with fire	3,483	m3	
TOTAL VOLUME no fire	2,323	m3	

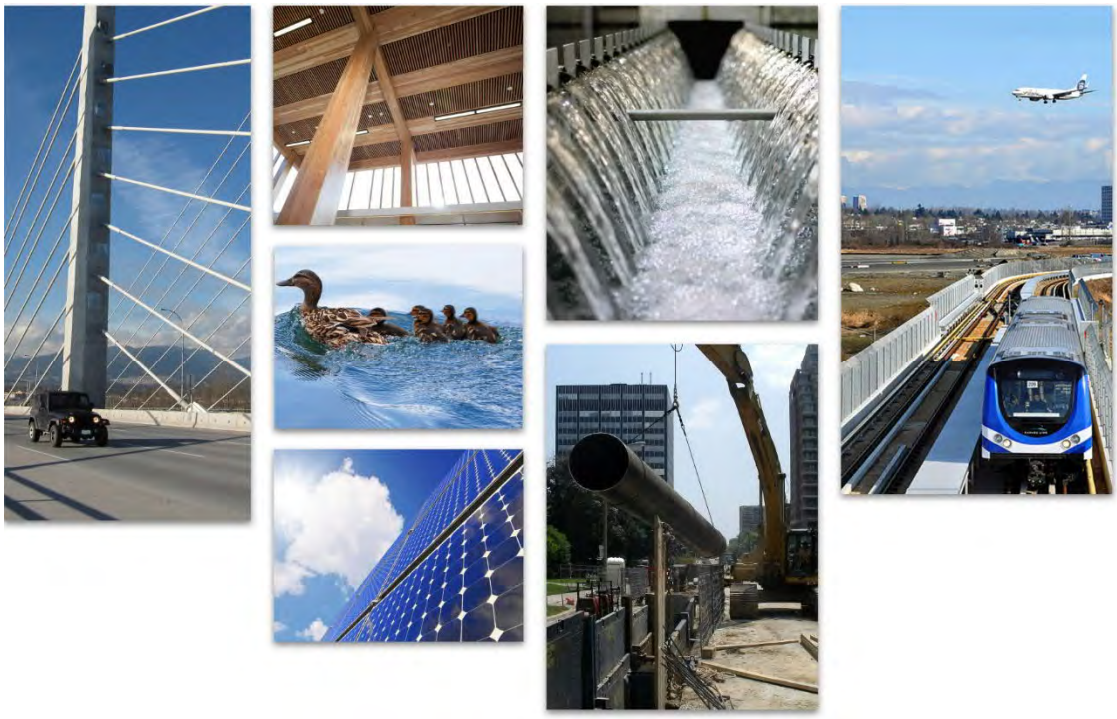
APPENDIX B – WATER MODEL DEVELOPMENT TECHNICAL MEMO

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

TECHNICAL MEMORANDUM

Government of Yukon
Community Services

City of Dawson Reservoir Replacement
Water Model Development



JULY 2020

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1 INTRODUCTION

The Government of Yukon (YG) engaged Associated Engineering (Associated) to complete the conceptual design of options to increase reservoir storage capacity for The City of Dawson (City). The project follows the ongoing completion of the new Water Treatment Plant and will address future demands and fire flow storage for the City. One of the tasks within the project was to provide conceptual water supply design options for the proposed development in the Klondike Valley and along Dome Road. This involved developing an updated water distribution model using WaterCAD software reflecting the new Water Treatment Plant infrastructure and creating two future scenarios reflecting potential options to service the proposed development. The existing City of Dawson WaterCAD water distribution model created in 2016 was used as a basis to perform the updates to the model.

1.1 Scope

The scope of the model development involved the following work:

- Update the existing City of Dawson model to reflect the new Water Treatment Plant infrastructure now in place.
- Create two new scenarios under fire flow and winter demand conditions to reflect two potential options to service the proposed Klondike Valley development.

The water model updates were performed using Bentley WaterCAD v81 software, and the following sections outline the model development process and provide the information necessary to understand the assumptions built into the model and its limitations.

2 BACKGROUND

2.1 Existing 2016 City of Dawson Water Model

The updated model was built upon an existing WaterCAD model of the City of Dawson water system completed in 2016 and provided by the City. The model creation is outlined in the 2016 *City of Dawson – Water Distribution System Model Report* prepared for YG by others. It was assumed that this model was representative of the system operation and that the system would continue operating in this way with the new Water Treatment Plant infrastructure in place. The following scenarios were included in the existing model and were used as a basis for the model updates, shown in **Table 2-1**.

Table 2-1
Existing 2016 Model Scenarios

Scenario Name	Scenario Description
ExADD	Base scenario showing 2016 conditions. Child scenarios for ADD, MDD, PHD, Fire Flow and WinterADD conditions.
+North100	Future scenario showing 2036 conditions, with proposed development at north end of the City. Child scenarios for ADD, MDD, PHD, Fire Flow and WinterADD conditions.

2.2 Water Treatment Plant Construction Drawings and Design Report

To update the existing model to reflect the new Water Treatment Plant infrastructure, design reports and IFC drawings from YG's 2016 *City of Dawson Water Treatment Upgrades & Pump House Replacement* project were used as reference. Information provided by these documents included pipe alignments, elevations and sizes, as well as distribution pumping information.

2.3 GeoYukon Mapping

To model the two potential options to service the proposed development in the Klondike Valley and Dome Road areas, public data and mapping from YG's GeoYukon application was used. The following information was gathered using GeoYukon:

- Alignments for the proposed transmission and local distribution pipes in the Dome Road area.
- Elevations for all proposed infrastructure, taken from a 2018 LiDAR surface.
- Aerial imagery to identify locations for possible storage locations in the Dome Road area.

3 MODEL DEVELOPMENT

To represent the updated and future water systems under a number of different demand and operational conditions, multiple scenarios were created as shown in **Table 3-1**.

Table 3-1
Updated 2020 Model Scenarios.

Scenario Name	Scenario Description
2020 Base	Base scenario with updated WTP infrastructure, with same demands as 2016 model. Child scenarios for ADD, MDD, PHD, MDD + Fire Flow, and WinterADD conditions.
Future – Option 1	Scenario with updated WTP infrastructure and proposed Option 1 infrastructure to service the Klondike Valley and Dome Road areas. Child scenarios for ADD, MDD, PHD, MDD + Fire Flow, and WinterADD conditions. Extended Period Simulation (EPS) analyses were conducted for ADD, MDD and WinterADD conditions as well.
Future – Option 2	Scenario with updated WTP infrastructure and proposed Option 2 infrastructure to service the Klondike Valley and Dome Road areas. Child scenarios for ADD, MDD, PHD, MDD + Fire Flow, and WinterADD conditions. EPS analyses were conducted for ADD, MDD and WinterADD conditions as well.

The proposed development in the Klondike Valley and Dome Road areas are separated into four new areas; Areas A, C, D and F. These areas have the following probable yield of housing lots to be serviced, shown in **Table 3-2**.

Table 3-2
Proposed Klondike Valley and Dome Road Development Areas and Housing Units

Area	Total Size	Developable Area	Housing Units (Probable Yield)
A	8.2 ha	5.7 ha	114
C	7.0 ha	4.9 ha	98
D	1.2 ha	1.2 ha	24
F	3.2 ha	3.2 ha	64
		Total	**300**

3.1 Water Demands

Demands for the 2020 Base scenario were left unchanged from the 2016 water model, while the demands for both Future – Option 1 and Future – Option 2 scenarios were increased based on the number of proposed lots in the Klondike Valley and Dome Road areas to be developed, as well as an additional proposed 15 lots at the north end of the City. The "per lot" demands established in the 2016 model and used in the updated model are as follows:

- ADD: 0.020 L/s
- MDD: 0.086 L/s
- PHD: 0.130 L/s
- WinterADD: 0.054 L/s

It should be noted that difference in the ADD and WinterADD "per lot" demand is to account for the bleeding occurring in the winter to avoid freezing. With these "per lot" demands established; the total system demands modeled for each scenario are shown in **Table 3-3**.

Table 3-3
Total System Demands for Each Scenario in Updated Model

	2020 Base Scenario	Future – Option 1 & 2 Scenarios
ADD	13 L/s	19.3 L/s
WinterADD	40.8 L/s	57.7 L/s
MDD	56.2 L/s	83.2 L/s
PHD	84.7 L/s	125.6 L/s

In the WinterADD scenario of the 2016 base model, there was an equivalent demand of 35 lots and 65 lots placed at two nodes along the existing watermain headed to the Callison area. The demands were only present in the WinterADD scenario and were kept in the updated 2020 WinterADD scenario for the sake of consistency.

3.1.1 Diurnal Pattern Development

To model varying demands in the distribution network over a 24-hour period, a diurnal time pattern was used. To develop the pattern, a previously developed diurnal time pattern for the comparable Town of Creston, BC was used as basis and calibrated to the established City of Dawson peaking hour factor of 1.5. The new diurnal pattern was applied

to the Extended Period Simulations of the MDD, ADD and WinterADD scenarios and is shown below in **Table 3-4**. The new diurnal pattern has less peaking factors than an average town like Creston due to the base bleeding demand occurring in the winter and spring months. This creates a flatter demand curve throughout a typical day.

Table 3-4
Diurnal Time Pattern for Demand Used in MDD and WinterADD EPS Analyses

Time	MDD Demand Multiplier	Time	Winter ADD Demand Multiplier
1 AM	0.74	1 PM	0.66
2 AM	1.09	2 PM	0.62
3 AM	1.42	3 PM	0.64
4 AM	1.45	4 PM	0.74
5 AM	1.50	5 PM	0.91
6 AM	1.45	6 PM	1.12
7 AM	1.42	7 PM	1.23
8 AM	1.19	8 PM	1.24
9 AM	0.74	9 PM	1.19
10 AM	0.68	10 PM	1.07
11 AM	0.62	11 PM	0.91
12 PM	0.66	12 PM	0.74

3.2 2020 Base Scenario Development

To update the model to reflect the new Water Treatment Plant infrastructure, the major changes to the 2016 model were as follows:

- Modelling the four existing raw water supply wells and their transmission mains.
- Modelling the two existing reservoirs at the old pumphouse site.
- Modelling the new distribution and fire pumps housed in the new Water Treatment Plant.

The following sections describe the assumptions made when modelling each of these components.

3.2.1 Raw Water Supply Wells

The City receives its raw water from four wells along the banks of the Yukon River at the south end of the City. The raw water is pumped to the new Water Treatment Plant where it is treated and then stored in the existing reservoirs. The wells were modelled as sources at an approximate location near the Yukon River and at an assumed elevation of 305 metres, and each were modelled with a submersible pump at an assumed elevation of 300 metres. To model the varying output of the wells (based on demand), one pair of wells was modelled to pump a total flow of 71 L/s (peak capacity of the WTP) and the other pair was modelled to pump a total flow of 51 L/s (WTP flow rate during ADD). During MDD and PHD scenarios, the larger output pair of wells is active in the model, while under ADD and WinterADD scenarios, the smaller output pair of wells is active.

New pipes were assigned a pipe material friction factor (Hazen-Williams 'C' Factor) of C=130, to match the pipes in the existing 2016 model. The elevation of nodes were either interpolated from the *City of Dawson Water Treatment Upgrades & Pump House Replacement* IFC drawings, or from the GeoYukon elevation finder application.

3.2.2 Existing Reservoirs

Treated water from the new Water Treatment Plant is stored in two existing above-ground reservoirs located on the site of the old pumphouse. Sizing information of the two reservoirs was provided by the City's operations staff, and base slab elevations were taken from the *City of Dawson Water Treatment Upgrades & Pump House Replacement* IFC drawings. **Table 3-5** below summarizes the reservoirs physical data that was modelled.

Table 3-5
Modelled Physical Information of Existing Reservoirs

	Reservoir 1	Reservoir 2
Diameter	8.2 m	12.0 m
Height	8.5 m	8.5 m
Volume	450 m^3	960 m^3
Base Slab Elevation	319.30 m	319.30 m

3.2.3 New Water Treatment Plant

Prior to entering the storage reservoirs, the raw water is routed through the new Water Treatment Plant where it is treated. After being stored in the reservoirs, the treated water is again routed through the new Water Treatment Plant where it is pumped out to distribution, through four new distribution pumps and one new fire pump in the case of an emergency. The distribution and fire pumps were modelled with the following flow rates, shown in **Table 3-6**.

Table 3-6
Modelled Distribution and Fire Pump Flow Rates

Pump Number	Flow Rates
P-510	40 L/s
P-520	40 L/s
P-530	30 L/s
P-540	30 L/s
P-560 (Fire Pump)	189 L/s

To model the variable speed drive functionality of the distribution pumps and the fire pump, PRV's were modelled directly downstream of the pumps, and were both set to a discharge pressure of 90 psi. New pipes were assigned a pipe material friction factor (Hazen-Williams 'C' Factor) of C=130, to match the pipes in the existing 2016 model, and the elevation of all pumps was taken from the *City of Dawson Water Treatment Upgrades & Pump House Replacement* IFC drawings.

3.2.4 Return Loop Flow Control Valves

The City's water supply distribution network functions partly as a collection of six loops that circulate water throughout the City and return to the Water Treatment Plant. These return flow rates are controlled by seven flow control valves, and they were updated to match field data provided by the City's operations staff. Four of the flow control valves are assumed to be housed in the new Water Treatment Plant, while the other three are housed in a valve chamber downtown. The flow rates of each are shown in **Table 3-7.**

Table 3-7
Modelled Flow Rates Through Return Loop Flow Control Valves

	Flow Rate
Loop 1 (WTP)	0.40 L/s
Loop 2 (WTP)	0.53 L/s
Loop 3 (Valve Chamber)	0.56 L/s
Loop 4 (Valve Chamber)	0.62 L/s
Loop 5 (Valve Chamber)	0.69 L/s
Loop 6 (WTP)	1.06 L/s
Main Loop (WTP - 3,4,5 Combined)	1.87 L/s

3.2.5 Fire Flow Scenario

In case of a fire, the fire pump housed in the Water Treatment Plant will be able to feed both the supply lines and the return lines to provide maximum fire flow to each distribution loop.

3.2.6 Operational Controls of Scenario

To model an extended period simulation of the 2020 Base model scenario, the raw water well pumps were controlled based on the water levels of the existing reservoirs. It was assumed that the reservoirs would have an operating range of 80%-95% full, meaning the supply pumps would turn on when levels in the reservoirs dipped below 80%, and would subsequently turn off once levels reached 95%. This control is summarized in **Table 3-8**.

Table 3-8
Model Operational Controls

IF	THEN
Ex Res-1 Hydraulic Grade <= 326.10m	Well Pump Status = On
Ex Res-1 Hydraulic Grade >= 327.38m	Well Pump Status = Off

3.3 Future – Option 1 Scenario Development

The first option for servicing the future development in the Klondike Valley and Dome Road areas involved the placement of a new reservoir up Dome Road on Moose Mountain Road, near the Moose Mountain Ski Hill. This reservoir would be fed by a new transmission watermain running up Dome Road that would tie-in to the existing Callison dead-end watermain. Treated water from the Callison watermain would be pumped up to the new reservoir

by a booster pump located near the intersection of Dome Road and Highway 2 and would gravity flow back to the proposed development areas to service them. The water would then flow back to the Water Treatment Plant through a new dedicated return line, at a flow set by a flow control valve. This would create an additional loop in the City's existing distribution system.

3.3.1 Watermain

New pipes were assigned a pipe material friction factor (Hazen-Williams 'C' Factor) of C=130, to match the pipes in the existing 2016 model and is a reasonable assumption for HDPE pipe when taking into consideration bends and fittings. The elevation of nodes were taken from the GeoYukon elevation finder application, based on assumed locations within the Dome Road right-of-way, and within Areas A and C. It should be noted that the servicing of Areas A and C were modelled with local pipes in a loop configuration directly serviced from the proposed reservoir, while areas F and D were modelled as singular nodes since they are serviced directly from the Callison dead-end watermain.

3.3.2 Reservoir

The proposed reservoir was sized to provide fire, equalization and emergency storage to Areas A and C only. **Table 3-9** outlines the volume required for the proposed reservoir.

Table 3-9
Proposed Reservoir Required Volume

	Description	Volume
A (Fire Storage)	75 L/s for 1.7 hours as per City of Dawson Residential FF requirements	459 m^3
B (Equalization Storage)	25% of Projected MDD (areas A and C only)	394 m^3
C (Emergency Storage)	25% of (A+B)	213 m^3
	Total	**1066 m^3**

To provide the required volume, the proposed reservoir was modelled as a 7-metre-high cylindrical reservoir with a diameter of 14 metres. The elevation of the base of the reservoir was taken from the GeoYukon elevation finder application, and was found to be 448 metres, meaning the top water level of the reservoir is 455 metres.

3.3.3 Booster Pump Station

The proposed booster pump was modelled to provide a maximum flow equivalent to the Maximum Day Demand of Areas A and C, combined with the fixed return flow going back to the Water Treatment Plant. The pump was also modelled with sufficient head to move water to the top water level of the proposed reservoir. To reduce the high pressures on the return line heading back to the Water Treatment Plant, a PRV was modelled adjacent to the booster pump, on the return line. This PRV was modelled with a set point of 85 psi and would presumably be housed in the booster pump station.

3.3.4 Fire Flow Configuration

In the case of a fire flow event, the proposed reservoir can not only service Areas A and C, but Areas D and F and all of the Callison dead-end line east of Dome Road. This is made possible with a connection between the proposed return line and the existing Callison dead-end line at the intersection of Dome Road and Highway 2. This connection has only been modelled to be active during fire flow scenarios.

3.3.5 Operational Controls of Scenario

To model an extended period simulation of the Future – Option 1 scenario, the existing controls on the base scenario controlling the raw water supply pumps remained, and another set of controls was implemented to control the proposed booster pump. The booster pump would be controlled by the water levels in the proposed reservoir, with an assumed operating range of 80%-95% full. The controls for this scenario are summarized in **Table 3-10**.

Table 3-10
Model Operational Controls

IF	THEN
Ex Res-1 Hydraulic Grade <= 326.10m	Well Pump Status = On
Ex Res-1 Hydraulic Grade >= 327.38m	Well Pump Status = Off
Prop Res Hydraulic Grade <= 453.60m	Booster Pump Status = On
Prop Res Hydraulic Grade <= 454.65m	Booster Pump Status = Off

3.4 Future – Option 2 Scenario Development

The second option for servicing the future development in the Klondike Valley and Dome Road areas involved the placement of a wet well at the base of Dome Road (near the intersection of Highway 2) and a booster pump downstream that directly services areas A and C through a new transmission main that ties in to the existing Callison dead-end watermain. After servicing Areas A and C, the water would be returned back to the Water Treatment Plant through a new dedicated return line at a flow set by a flow control valve, creating an additional loop in the City's existing distribution system.

3.4.1 Watermain

Similar to the modelled watermain in the Future – Option 1 scenario, all new pipes were assigned a pipe material friction factor (Hazen-Williams 'C' Factor) of C=130, to match the pipes in the existing 2016 model, and all node elevations were taken from the GeoYukon elevation finder application. The servicing of Areas A and C were also modelled with local pipes in a loop configuration directly serviced from the proposed booster pump, while areas F and D were modelled as singular nodes since they are serviced directly from the Callison dead-end watermain.

3.4.2 Booster Station Wet Well

The proposed booster station wet well was sized to provide fire flow for a duration of 10 minutes. Using the City of Dawson's residential fire flow requirement of 75 L/s, the wet well was sized to be 45 m^3. The wet well was modeled as a rectangular tank with a surface area of 15 m^2 and a height of 3 metres. The approximate base elevation of 322 metres for the wet well was taken from the GeoYukon elevation finder application, meaning the top water level of the wet well is modelled at 325 metres.

3.4.3 Booster Pump Station

The proposed booster pump was modelled to provide a maximum flow equivalent to the Peak Hour Demand for Areas A and C, combined with the fixed return flow going back to the Water Treatment Plant. The pump was also modelled with sufficient head to move water from the top water level of the wet well to Areas A and C while providing service pressures of approximately 50 psi. To accommodate varying demands throughout a 24-hour period, the booster pump is required to be constantly pumping with a variable speed drive. To model this functionality, a PRV was placed directly downstream of the pump, set at a discharge pressure that is sufficient to provide the service pressures previously mentioned.

To model the hydraulics of the head-break occurring at the wet well, a flow control valve was placed upstream of the wet well. This flow control valve creates head loss and regulates the water level in the wet well, preventing it from spilling.

3.4.4 Fire Flow configuration

In the case of a fire flow event, a proposed fire pump was modelled to provide 189 L/s to match the existing fire pump in the new Water Treatment Plant. The proposed fire pump can not only service Areas A and C, but Areas D and F and some lots on the Callison dead-end line as well. Similar to Option 1, this is made possible with a modelled connection between the proposed return line and the existing Callison dead-end line; only active in fire flow scenarios.

3.4.5 Operational Controls of Scenario

To model an extended period simulation of the Future – Option 2 scenario, the existing controls in the 2020 Base scenario controlling the raw water supply pumps remained, and another set of controls was implemented to control the wet well level. The flow control valve supplying the wet well would either open or close depending on the water level in the wet well, with a desired level of 83% full. The controls for this scenario are summarized in **Table 3-11**.

Table 3-11
Model Operational Controls

IF	THEN
Ex Res-1 Hydraulic Grade <= 326.10m	Well Pump Status = On
Ex Res-1 Hydraulic Grade >= 327.38m	Well Pump Status = Off
Prop WetWell Hydraulic Grade <=324.50m	FCV Status = On
Prop WetWell Hydraulic Grade >324.50m	FCV Status = Off

4 SUMMARY

Associated Engineering was engaged by the Government of Yukon to update the existing City of Dawson water distribution system model to reflect recent updates to the City's Water Treatment Plant and provide conceptual model scenarios for the servicing of future development in the Klondike Valley and Dome Road areas. With the updated model scenarios, further analysis can be made to provide recommendations for future development and guide any next steps in further studies.

CLOSURE

This report was prepared for the Government of Yukon Community Services to update the existing City of Dawson water distribution system model to reflect recent updates to the City's Water Treatment Plant and provide conceptual model scenarios for the servicing of future development in the Klondike Valley and Dome Road areas.

The services provided by Associated Engineering (B.C.) Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Prepared by:

Jacob Tetreault, Engineer-In-Training
Project Engineer

Reviewed by:

PROFESSIONAL ENGINEER
YUKON TERRITORY
July 13, 2020

Matt Lozie, P.Eng.
Process Mechanical Engineer

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (BC) LTD.
SIGNATURE
Date July 17, 2020
PERMIT NUMBER PP060
Association of Professional Engineers of Yukon

APPENDIX C – KLONDIKE VALLEY & DOME RD. FUTURE DEVELOPMENT MAP

Legend

- Dome Road Region A
- Dome Road Region C
- Dome Road Region D
- Dome Road Region F
- Land Parcels - Surveyed
- First Nations Settlement Lands

0 50 100 200
Meters

Yukon

Drawing Title:
City of Dawson Dome Road Urban Residential Regions

Drawing Number:
4

Project:
Dome Road Development Project

Drawn By			Accepted By	
Name:	Date:	Department:	Name:	Signature:
Kevin Fisher	12/11/2019	LDB		

APPENDIX D - FACILITY CLASSIFICATION

Dawson City Water Distribution

Facility or system name: New Reservoirs with Klondike Valley and Dome Road Servicing Number:

Water Distribution V 5.0

Step 1: Infrastructure Point Score

Place an x (lower case) in the box for each component present in the system.

Category	Subcategory	Component	Points	Facility	Facility Points	Associated Engineering Comments
Source	Treated		0	X		
	Groundwater (not under influence of surface water)		4			
Infrastructure	Basic system infrastructure		5			
	Distribution Pumps		6	X		
	Pressure reducing/sustaining valves		6			
	Reservoirs	In-ground	4			
		Elevated	6	X		
	Cathodic protection/corrosion control		4	X		Applies to steel-bolted tank only.
Chlorine Boosting (secondary disinfection only, primary is under treatment)	Chlorine	Gas	9			
		Solid (calcium hypochlorite)	8			
		Liquid (sodium hypochlorite)	8			
		On-site generation (sodium hypochlorite)	9			
	Chloramine		9			
	Chemical feeders (corrosion control, etc).		7			
Emergency management	Backup power		5	X		
				Total Distribution Infrastructure Points:	21	

Step 2: Interim Facility Classification

Level	Infrastructure Point Score	
	From	To
1	0	24
2	25	39
3	40	49
4	50	
Interim facility classification:		1

Step 3: Influencer Point Score

Category	Influencer	Points	Existing	Future	Associated Engineering Comments
Size	Population during periods of normal use	0		3480 in 2040	
	Flow during periods of normal use m3/d	0		0.0577	
	Peak flow (i.e. largest day) m3/d	0		0.0832	
Pressure zones	Single pressure zone	0	X		
	2-4	36		X	Addition of Dome Road increases pressure zones from 1 to 2.
	5-10	45			
	Greater than 10	54			
Pump stations	1-3	36		X	Existing system has no pump stations; Dome Road servicing increases no. of pump stations to 1
	4-10	45			
	>10	54			
Clear well reservoirs	1-2	36	X	X	36 points awarded for either Pumphouse Site (2 reservoirs) or Crocus Bluff (2 reservoirs + 1 clearwell)
	3-7	36			
	>7	45			
Variations in flow	<100%	21			
	100% - 200%	28			
	>200%	35	X	X	
Kilometres of pipe	0-200	12	X	X	
	200-400	16			
	400-600	20			
	>600	28			
Other factors	System used for fire protection	35	X	X	
	Predominently a dead end system	42			
	More than 50% of system > 50 years old	42			
SCADA Control	Third party - Critical control decisions provided by 3rd party	32			
	Full - SCADA control, central HMI	40	X	X	
	Some - Limited SCADA/PLC	48			
	None - manual checks	56			
Labour force	Operations team with system controls by senior operator supported by technical staff	15			
	Operations team with system controls by senior operator	20	X	X	
	Limited staff. Operator tasks encompass entire system.	25			
Operational Staff Responsibilities	Loss management or leak detection program	21			
	Data collection and condition monitoring program	28			
	Inspections of pressure reducing valves and pumping stations	28	X	X	
	Inspection/cleaning of resevoirs	42			Assumed all reservoir cleaning would be done by 3rd party
	Preventive maintenance program (hydrants, line valves, flushing, etc)	28	X	X	
	Cross connection control program	42			
			Total Distribution Influencer P	234	306

Step 4: Facility classification increase due to Influencers

Move up # of levels	Influencer Point Score	
	From	To
0	0	230
1	231	430
2	431	500
3	501	
Move up # of levels:		1

Associated Engineering Comments

For both existing and future distribution system

Step 5: Final facility classification

Step 2: Interim facility classification	1
Step 4: Increase due to influencers	1
Final facility Classification	2

The existing and future distribution systems are Classified as Level 2.

APPENDIX E – COST ESTIMATES

Associated Engineering | GLOBAL PERSPECTIVE, LOCAL FOCUS.

CALCULATIONS

PROJECT	City of Dawson Reservoir Replacement	**PROJ. NO.**	2019-2794
DETAILS	Capital Cost Estimate - New Reservoirs	**BY**	A. McClintock
	Reservoir at Pumphouse Site - Steel Bolted Tanks	**DATE**	20-Jun-2020

Item No.	Description	Unit	Quantity	Unit Rate	Total
1.0	**General**				
1.01	General Requirements (20% of Construction Costs)	%	20	-	$627,401
1.02	Survey	LS	1	$10,000	$10,000
1.03	Geotechnical Investigation	LS	1	$20,000	$20,000
Subtotal					$657,401
2.0	**Site Services**				
2.01	Grubbing and Site Stripping	m^2	235	$9	$2,056
2.02	Tank Demolition	ea	2	$25,000	$50,000
2.03	Pumphouse Hazmat Removal	LS	1	$133,000	$133,000
2.04	Pumphouse Demolition	LS	1	$615,000	$615,000
2.05	Excavation and Backfill Tank Pads	ea	2	$60,000	$120,000
2.06	Concrete Ringwall Foundation	LS	1	$115,200	$115,200
2.07	Fencing (1.2 m tall)	lm	30	$105	$3,150
2.08	Trenching and Backfill Storm Sewer	lm	25	$330	$8,250
2.09	S/I 400 mm HDPE Drainage Pipe	lm	25	$350	$8,750
2.10	S/I 1 x 1200 mm dia. Maintenance Holes, 2.5 m depth	LS	1	$10,000	$10,000
2.11	Tie-in to existing 450 mm watermain	LS	1	$10,000	$10,000
Subtotal					$1,075,406
3.0	**Tanks (Bolted Steel)**				
3.01	14.5 m dia. Bolted Steel Tank	LS	1	$797,300	$797,300
3.02	16.5 m dia. Bolted Steel Tank	LS	1	$1,104,300	$1,104,300
Subtotal					$1,901,600
4.0	**Structural/Architectural**				
4.01	Architectural Heritage Requirements (10% of reservoir cost)	%	10	$1,901,600	$190,160
Subtotal					$190,160
5.0	**Mechanical**				
5.01	Process Piping	LS	1	$120,000	$120,000
Subtotal					$120,000
6.0	**Electrical**				
6.01	Level Transducer and Heat Trace	LS	1	$40,000	$40,000
Subtotal					$40,000

	Construction Subtotal	**$3,984,568**
40%	**Contingency**	**$1,593,827**
	Construction Total	**$5,578,395**
15%	**Engineering**	**$836,759**
	TOTAL	*$6,415,154*
	TOTAL (Rounded)	***$6,400,000***

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

CALCULATIONS

PROJECT	City of Dawson Reservoir Replacement	**PROJ. NO.**	2019-2794
DETAILS	Capital Cost Estimate - New Reservoirs	**BY**	A. McClintock
	Reservoir at Pumphouse Site, Concrete Tank	**DATE**	20-Jun-2020

Item No.	Description	Unit	Quantity	Unit Rate	Total
1.0	**General**				
1.01	General Requirements (20% of Construction Costs)	%	1	-	$755,979
1.02	Survey	LS	1	$10,000	$10,000
1.03	Geotechnical Investigation	LS	1	$20,000	$20,000
Subtotal					$785,979
2.0	**Site Services**				
2.01	Grubbing and Site Stripping	m^2	470	$9	$4,113
2.02	Tank Demolition	ea	2	$25,000	$50,000
2.03	Pumphouse Hazmat Removal	LS	1	$133,000	$133,000
2.04	Pumphouse Demolition	LS	1	$615,000	$615,000
2.05	Excavation to offsite disposal	m3	940	$32	$30,080
2.06	Pit Run Sub-Base	m3	940	$55	$51,700
2.07	Trenching and Backfill Drainage Pipe	lm	25	$330	$8,250
2.08	S/I 400 mm HDPE Drainage Pipe	lm	25	$350	$8,750
2.09	S/I 1 x 1200 mm dia. Maintenance Holes, 2.5 m depth	LS	1	$10,000	$10,000
2.10	Tie-in to existing 450 mm watermain	LS	1	$10,000	$10,000
Subtotal					$920,893
3.0	**Tanks (Concrete)**				
3.01	Concrete Reservoir 28.5 x 14.5 x 10 m	LS	1	$2,669,000	$2,669,000
Subtotal					$2,669,000
5.0	**Structural/Architectural**				
5.01	Architectural Heritage Requirements (20% of reservoir cost)	%	20	$2,669,000	$533,800
Subtotal					$533,800
6.0	**Mechanical**				
6.01	Process Piping	LS	1	$150,000	$150,000
Subtotal					$150,000
7.0	**Electrical**				
7.01	Level Transducers and Heat Trace	LS	1	$40,000	$40,000
Subtotal					$40,000

	Construction Subtotal	**$5,099,671**
40%	**Contingency**	**$2,039,868**
	Construction Total	**$7,139,539**
15%	**Engineering**	**$1,070,931**
	TOTAL	*$8,210,470*
	TOTAL (Rounded)	***$8,300,000***

Associated Engineering | GLOBAL PERSPECTIVE, LOCAL FOCUS.

CALCULATIONS

PROJECT	City of Dawson Reservoir Replacement	**PROJ. NO.**	2019-2794
DETAILS	Capital Cost Estimate - New Reservoirs	**BY**	J. Tetreault
	Option 2 - Elevated Reservoir at Crocus Bluff	**DATE**	20-Jun-2020

Item No.	Description	Unit	Quantity	Unit Rate	Total
1.0	**General**				
1.01	General Requirements (20% of Construction Costs)	%	20	-	$710,540
1.02	Survey	LS	1	$20,000	$20,000
1.03	Geotechnical Investigation	LS	1	$40,000	$40,000
Subtotal					$770,540
2.0	**Site Services**				
2.01	Clearing Transmission main (6 metre wide clearance required)	m^2	1200	$5	$6,000
2.01	450mm HDPE Insulated Pipe	m	475	$575	$273,125
2.02	300mm HDPE Insulated Pipe	m	475	$375	$178,125
2.03	>15% Grade Upcharge	m	450	$315	$141,750
2.04	Trenching and Backfill	m	475	$330	$156,750
2.05	Clearing Crocus Bluff Site	m^2	2200	$5	$11,000
2.06	Grubbing and Site Stripping	m^2	2200	$9	$19,250
2.07	Reservoir Access Road	lm	400	$405	$162,000
2.08	Excavation and Backfill Tank Pads	LS	1	$120,000	$120,000
2.09	Concrete Ringwalls	LS	1	$115,200	$115,200
2.10	Fencing (1.2 m tall)	lm	180	$105	$18,900
2.11	250mm HDPE un-insulated overflow pipe	lm	150	$300	$45,000
2.12	300mm Watermain Tie-in at WTP site	ea	1	$19,000	$19,000
Subtotal					$1,266,100
3.0	**Tank (Bolted Steel)**				
3.01	2 x Bolted Steel Tank	LS	1	$1,901,600	$1,901,600
Subtotal					$1,901,600
4.0	**Structural/Architectural**				
4.01	Reservoir Building (4 x 4 m)	LS	1	$160,000	$160,000
Subtotal					$160,000
4.0	**Mechanical**				
4.01	WTP Tie-in	ea	2	$100,000	$200,000
4.02	300 mm PRV	ea	1	$30,000	$30,000
4.03	Reservoir Building Mechanical	LS	1	$25,000	$25,000
Subtotal					$255,000
5.0	**Electrical**				
5.01	Reservoir Building	LS	1	$50,000	$50,000
5.02	Electrical Site Servicing	LS	1	$50,000	$50,000
5.03	Radio Communications	LS	1	$30,000	$30,000
Subtotal					$130,000

	Construction Subtotal	**$4,483,240**
40%	**Contingency**	**$1,793,296**
	Construction Total	**$6,276,536**
15%	**Engineering**	**$941,480**
	TOTAL	*$7,218,016*
	TOTAL (Rounded)	***$7,300,000***

Associated Engineering | GLOBAL PERSPECTIVE, LOCAL FOCUS.

CALCULATIONS

PROJECT	City of Dawson Reservoir Replacement	**PROJ. NO.**	2019-2794
DETAILS	Capital Cost Estimate - Dome Road Servicing	**BY**	J. Tetreault
	Dome Road Option 1 - Reservoir	**DATE**	30-Jun-2020

Item No.	Description	Unit	Quantity	Unit Rate	Total
1.0	**General**				
1.01	General Requirements (20% of Construction Costs)	%	20	-	$1,710,750
1.02	Survey	LS	1	$20,000	$20,000
1.03	Geotechnical Investigation	LS	1	$40,000	$40,000
Subtotal					$1,770,750
2.0	**Site Services**				
2.01	250 mm HDPE Insulated Pipe	lm	450	$325	$146,250
2.02	200 mm HDPE Insulated Pipe	lm	3150	$265	$834,750
2.03	150 mm HDPE Insulated Pipe	lm	3700	$220	$814,000
2.04	100 mm HDPE Insulated Pipe	lm	1050	$175	$183,750
2.05	Trenching and Backfill	lm	6350	$330	$2,095,500
2.06	BST R&R (1,700 m x 4 m)	m^2	6800	$15	$102,000
2.07	Excavation and Backfill Tank Pad	ea	1	$60,000	$60,000
2.08	Concrete Ringwall	LS	1	$26,000	$26,000
Subtotal					$4,262,250
3.0	**Reservoirs**				
3.01	14 m dia. Bolted Steel Tank	LS	1	$1,669,000	$1,669,000
Subtotal					$1,669,000
4.0	**Structural/Architectural**				
4.01	Reservoir Building (4 x 4 m)	LS	1	$160,000	$160,000
Subtotal					$160,000
4.0	**Mechanical**				
4.01	23 L/s Pump System (incl. Building and PRV and 1 valve chamber)	ea	1	$1,280,000	$1,280,000
4.02	250 mm Fire Flow PRV (incl. process piping and valves - housed in Pump Building)	ea	1	$27,500	$27,500
4.03	Valve Chamber	ea	1	$300,000	$300,000
4.04	100 mm Flow Control Valve at WTP	ea	1	$10,000	$10,000
4.05	Upgrades to WTP Callison Boiler	LS	1	$675,000	$675,000
Subtotal					$2,292,500
5.0	**Electrical**				
5.01	Pump Station Site Servicing	LS	1	$50,000	$50,000
5.02	Reservoir Site Servicing	LS	1	$100,000	$100,000
5.03	100 kW Backup Generator (housed in Pump Building)	ea	1	$100,000	$100,000
5.04	Fiber Optic Line to Pump Building	LS	1	$50,000	$50,000
5.05	Radio Pump Building to Reservoir	LS	1	$30,000	$30,000
Subtotal					$330,000

	Construction Subtotal	**$10,324,500**
40%	**Contingency**	**$4,129,800**
	Construction Total	**$14,454,300**
15%	**Engineering**	**$2,168,145**
	TOTAL	*$16,622,445*
	TOTAL (Rounded)	***$16,700,000***

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

CALCULATIONS

PROJECT	City of Dawson Reservoir Replacement	**PROJ. NO.**	2019-2794
DETAILS	Capital Cost Estimate - Dome Road Servicing	**BY**	J. Tetreault
	Dome Road Option 2 - Wet Well	**DATE**	20-May-2020

Item No.	Description	Unit	Quantity	Unit Rate	Total
1.0	**General**				
1.01	General Requirements (20% of Construction Costs)	%	20	-	$1,463,800
1.02	Survey	LS	1	$20,000	$20,000
1.03	Geotechnical Investigation	LS	1	$40,000	$40,000
Subtotal					$1,523,800
2.0	**Site Services**				
2.01	200 mm HDPE Insulated Pipe	lm	4250	$265	$1,126,250
2.02	150 mm HDPE Insulated Pipe	lm	2200	$220	$484,000
2.03	100 mm HDPE Insulated Pipe	lm	1050	$175	$183,750
2.04	Trenching and Backfill	lm	5900	$330	$1,947,000
2.05	BST R&R (1,500 m x 4 m)	m^2	6000	$15	$90,000
Subtotal					$3,831,000
3.0	**Mechanical**				
3.01	30 L/s Pump Station (incl. Building, Wet well, FCV, PRV and valve chamber)	ea	1	$1,660,000	$1,660,000
3.02	95 L/s Fire Pump	ea	1	$265,500	$265,500
3.03	250 mm Fire Flow PRV (incl. process piping and valves - housed in Pump Building)	ea	1	$27,500	$27,500
3.04	Valve Chamber	ea	1	$300,000	$300,000
3.05	100 mm Flow Control Valve at WTP	ea	1	$10,000	$10,000
3.05	Upgrades to WTP Callison Boiler	LS	1	$675,000	$675,000
Subtotal					$2,938,000
4.0	**Electrical**				
4.01	Site Servicing	LS	1	$50,000	$50,000
4.02	450 kW Backup Generator (housed in separate enclosure)	ea	1	$450,000	$450,000
4.03	Fiber Optic line to pump building	LS	1	$50,000	$50,000
Subtotal					$550,000

	Construction Subtotal	**$8,842,800**
40%	**Contingency**	**$3,537,120**
	Construction Total	**$12,379,920**
15%	**Engineering**	**$1,856,988**
	TOTAL	*$14,236,908*
	TOTAL (Rounded)	***$14,300,000***

City of Dawson Reservoir Replacement
ANNUAL OPERATIONS & MAINTENANCE COST ESTIMATE

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Reservoir at Pumphouse Site, Steel Bolted Tank

Item	Description	Units	Unit Price	Qty	Annual Frequency	2020 Cost
1	Reservoir Maintenance	%	$ 1,901,600.00	0.5	1	$ 9,508
2	Anode replacement	ea	$ 6,000.00	2	0.1	$ 1,200
3	Fire Pump Annual Test	ea	$ 2,500.00	1	1	$ 2,500
					Subtotal	$ 13,208
					Subtotal (Rounded)	**$ 13,000**

Reservoir at Pumphouse Site, Concrete

Item	Description	Units	Unit Price	Qty	Annual Frequency	2020 Cost
1	Reservoir Maintenance	%	$ 2,669,000.00	0.5	1	$ 13,345
2	Fire Pump Annual Test	ea	$ 2,500.00	1	1	$ 2,500
					Subtotal	$ 15,845
					Subtotal (Rounded)	**$ 16,000**

Reservoir at Crocus Bluff site

Item	Description	Units	Unit Price	Qty	Annual Frequency	2020 Cost
1	Reservoir Maintenance	%	$ 1,901,600.00	0.5	1	$ 9,508
2	Anode replacement	ea	$ 6,000.00	2	0.1	$ 1,200
3	Road Maintenance	%	$ 162,000.00	0.2	1	$ 324
4	Building Maintenance (4m x 4m Building)	m^2	$ 140.00	16	1	$ 2,240
5	Fuel Cost for Additional Water Heating	L	$ 1.00	91,200	1	$ 91,200
					Subtotal	$ 104,472
					Subtotal (Rounded)	**$ 105,000**

Klondike Valley and Dome Road Option 1 - Reservoir

Item	Description	Units	Unit Price	Qty	Annual Frequency	2020 Cost
1	Reservoir Maintenance	%	$ 924,480.00	0.5	1	$ 4,622
2	Generator Maintenance	%	$ 160,000.00	2	1	$ 3,200
3	Pumping Electricity & Maintenance	LS	$ 39,350.00	1	1	$ 39,350
4	Fuel Cost for Future Demand Water Heating	L	$ 1.00	325,000	1	$ 325,000
5	Reservoir Building Maintenance (4m x 4m Building)	m^2	$ 140.00	16	1	$ 2,240
6	Pump Station Building Maintenance (12m x 8m Building)	m^2	$ 140.00	96	1	$ 13,440
					Subtotal	$ 387,852
					Subtotal (Rounded)	**$ 388,000**

Klondike Valley and Dome Road Option 2 - Wet well

Item	Description	Units	Unit Price	Qty	Annual Frequency	2020 Cost
1	Generator Maintenance	%	$ 450,000.00	2	1	$ 9,000
2	Pumping Electricity & Maintenance	LS	$ 50,372.00	1	1	$ 50,372
3	Fuel Cost for Future Demand Water Heating	L	$ 1.00	280,000	1	$ 280,000
4	Pump Station Building Maintenance (12m x 8m Building)	m^2	$ 140.00	96	1	$ 13,440
					Subtotal	$ 352,812
					Subtotal (Rounded)	**$ 353,000**

PROJECT	**City of Dawson Reservoir Replacement**	PROJ. NO.	2019-2794
DETAILS	Life Cycle Cost Estimate	BY	A. McClintock
	Reservoir at Pumphouse Site, Steel Bolted Tank	DATE	20-May-20

Annual O&M Cost **$13,000**

Yearly O&M Cost Escalation 2.0%

Discount Rate 5.0%

Net Present Value of Annual O&M Cost **$201,000**

	Year	O&M Escalation	Net Present Worth
1	2020	$ 13,000	$ 13,000
2	2021	$ 13,260	$ 12,629
3	2022	$ 13,525	$ 12,268
4	2023	$ 13,796	$ 11,917
5	2024	$ 14,072	$ 11,577
6	2025	$ 14,353	$ 11,246
7	2026	$ 14,640	$ 10,925
8	2027	$ 14,933	$ 10,613
9	2028	$ 15,232	$ 10,309
10	2029	$ 15,536	$ 10,015
11	2030	$ 15,847	$ 9,729
12	2031	$ 16,164	$ 9,451
13	2032	$ 16,487	$ 9,181
14	2033	$ 16,817	$ 8,918
15	2034	$ 17,153	$ 8,664
16	2035	$ 17,496	$ 8,416
17	2036	$ 17,846	$ 8,176
18	2037	$ 18,203	$ 7,942
19	2038	$ 18,567	$ 7,715
20	2039	$ 18,939	$ 7,495
		NPV O&M (rounded)	**$ 201,000**
		TOTAL CAPITAL	**$ 6,400,000**
		ASSET RESIDUAL	**$ (634,000)**
		TOTAL LIFE CYCLE COST	**$ 5,967,000**

PROJECT	**City of Dawson Reservoir Replacement**	PROJ. NO.	2019-2794
DETAILS	Life Cycle Cost Estimate	BY	A. McClintock
	Reservoir at Pumphouse Site, Concrete	DATE	20-May-20

Annual O&M Cost **$16,000**

Yearly O&M Cost Escalation 2.0%

Discount Rate 5.0%

Net Present Value of Annual O&M Cost **$247,000**

	Year	O&M Escalation	Net Present Worth
1	2020	$ 16,000	$ 16,000
2	2021	$ 16,320	$ 15,543
3	2022	$ 16,646	$ 15,099
4	2023	$ 16,979	$ 14,667
5	2024	$ 17,319	$ 14,248
6	2025	$ 17,665	$ 13,841
7	2026	$ 18,019	$ 13,446
8	2027	$ 18,379	$ 13,062
9	2028	$ 18,747	$ 12,688
10	2029	$ 19,121	$ 12,326
11	2030	$ 19,504	$ 11,974
12	2031	$ 19,894	$ 11,632
13	2032	$ 20,292	$ 11,299
14	2033	$ 20,698	$ 10,976
15	2034	$ 21,112	$ 10,663
16	2035	$ 21,534	$ 10,358
17	2036	$ 21,965	$ 10,062
18	2037	$ 22,404	$ 9,775
19	2038	$ 22,852	$ 9,495
20	2039	$ 23,309	$ 9,224
		NPV O&M (rounded)	**$ 247,000**
		TOTAL CAPITAL	**$ 8,300,000**
		ASSET RESIDUAL	**$ (1,957,000)**
		TOTAL LIFE CYCLE COST	**$ 6,590,000**

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

PROJECT	**City of Dawson Reservoir Replacement**	PROJ. NO.	2019-2794
DETAILS	Life Cycle Cost Estimate	BY	A. McClintock
	Reservoir at Crocus Bluff Site	DATE	20-May-20

Annual O&M Cost **$105,000**

Yearly O&M Cost Escalation 2.0%

Discount Rate 5.0%

Net Present Value of Annual O&M Cost **$1,617,000**

	Year	O&M Escalation	Net Present Worth
1	2020	$ 105,000	$ 105,000
2	2021	$ 107,100	$ 102,000
3	2022	$ 109,242	$ 99,086
4	2023	$ 111,427	$ 96,255
5	2024	$ 113,655	$ 93,505
6	2025	$ 115,928	$ 90,833
7	2026	$ 118,247	$ 88,238
8	2027	$ 120,612	$ 85,717
9	2028	$ 123,024	$ 83,268
10	2029	$ 125,485	$ 80,889
11	2030	$ 127,994	$ 78,577
12	2031	$ 130,554	$ 76,332
13	2032	$ 133,165	$ 74,151
14	2033	$ 135,829	$ 72,033
15	2034	$ 138,545	$ 69,975
16	2035	$ 141,316	$ 67,975
17	2036	$ 144,142	$ 66,033
18	2037	$ 147,025	$ 64,147
19	2038	$ 149,966	$ 62,314
20	2039	$ 152,965	$ 60,534
		NPV O&M (rounded)	**$ 1,617,000**
		TOTAL CAPITAL	**$ 7,300,000**
		ASSET RESIDUAL	**$ (634,000)**
		TOTAL LIFE CYCLE COST	**$ 8,283,000**

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

PROJECT	**City of Dawson Reservoir Replacement**	PROJ. NO.	2019-2794
DETAILS	Life Cycle Cost Estimate	BY	A. McClintock
	Dome Road Option 1 - Reservoir	DATE	20-May-20

Annual O&M Cost (2020-2029)	**$263,000**
Annual O&M Cost (2030-2034)	**$325,000**
Annual O&M Cost (2035-2039)	**$388,000**
Yearly O&M Cost Escalation	2.0%
Discount Rate	5.0%
Net Present Value of Annual O&M Cost	**$4,652,000**

	Year	O&M Escalation	Net Present Worth
1	2020	$ 263,000	$ 263,000
2	2021	$ 268,260	$ 255,486
3	2022	$ 273,625	$ 248,186
4	2023	$ 279,098	$ 241,095
5	2024	$ 284,680	$ 234,207
6	2025	$ 290,373	$ 227,515
7	2026	$ 296,181	$ 221,015
8	2027	$ 302,104	$ 214,700
9	2028	$ 308,146	$ 208,566
10	2029	$ 314,309	$ 202,607
11	2030	$ 396,173	$ 243,216
12	2031	$ 404,097	$ 236,267
13	2032	$ 412,179	$ 229,516
14	2033	$ 420,422	$ 222,959
15	2034	$ 428,831	$ 216,589
16	2035	$ 522,197	$ 251,186
17	2036	$ 532,641	$ 244,009
18	2037	$ 543,294	$ 237,037
19	2038	$ 554,160	$ 230,265
20	2039	$ 565,243	$ 223,686
		NPV O&M (rounded)	**$ 4,652,000**
		TOTAL CAPITAL	**$ 16,700,000**
		TOTAL LIFE CYCLE COST	**$ 21,352,000**

PROJECT	**City of Dawson Reservoir Replacement**	PROJ. NO.	2019-2794
DETAILS	Life Cycle Cost Estimate	BY	A. McClintock
	Dome Road Option 2 - Wet well	DATE	20-May-20

Annual O&M Cost (2020-2029)	**$227,000**
Annual O&M Cost (2030-2034)	**$289,000**
Annual O&M Cost (2035-2039)	**$353,000**
Yearly O&M Cost Escalation	2.0%
Discount Rate	5.0%
Net Present Value of Annual O&M Cost	**$4,100,000**

	Year	O&M Escalation	Net Present Worth
1	2020	$ 227,000	$ 227,000
2	2021	$ 231,540	$ 220,514
3	2022	$ 236,171	$ 214,214
4	2023	$ 240,894	$ 208,093
5	2024	$ 245,712	$ 202,148
6	2025	$ 250,626	$ 196,372
7	2026	$ 255,639	$ 190,762
8	2027	$ 260,752	$ 185,311
9	2028	$ 265,967	$ 180,017
10	2029	$ 271,286	$ 174,873
11	2030	$ 352,289	$ 216,275
12	2031	$ 359,335	$ 210,096
13	2032	$ 366,522	$ 204,093
14	2033	$ 373,852	$ 198,262
15	2034	$ 381,329	$ 192,597
16	2035	$ 475,092	$ 228,527
17	2036	$ 484,593	$ 221,998
18	2037	$ 494,285	$ 215,655
19	2038	$ 504,171	$ 209,493
20	2039	$ 514,254	$ 203,508
		NPV O&M (rounded)	**$ 4,100,000**
		TOTAL CAPITAL	**$ 14,300,000**
		TOTAL LIFE CYCLE COST	**$ 18,400,000**

Report to Council

[ ] For Council Decision [X] For Council Direction [ ] For Council Information

[ ] In Camera

AGENDA ITEM:	Dome Road Master Planning Project Deliverables	
PREPARED BY:	Stephanie Pawluk, CDO	**ATTACHMENTS:**
DATE:	October 20, 2020	Dome Road Draft Engagement Plan Covid-19 Response Plan Project Schedule
RELEVANT BYLAWS / POLICY / LEGISLATION: N/A		

RECOMMENDATION

That Committee of the Whole:

1. Receive the project schedule as information, and

2. Review, provide feedback on, and forward the following to Council for decision:

- Dome Road Master Planning Draft Engagement Plan
- Covid-19 Response Plan

ISSUE / PURPOSE

The City has partnered with YG on the Dome Road Future Subdivision Master Planning Project. YG awarded a contract with Stantec for the purpose of completing the master planning process. Stantec has produced draft deliverables including an Engagement Plan, which outlines how engagement for this project will be conducted and where decision making points rest with Council, a Covid-19 Response Plan that is up to date with current standards and guidelines, and a Project Schedule that outlines the entirety of the process.

BACKGOUND SUMMARY

The master planning process began at the beginning of October 2020. The objective of this process is to design a residential subdivision along Dome Road that is supported by the local community while carefully considering how to develop the site in the most appropriate way, maximizing development efficiencies and evaluating servicing options to responsibly manage infrastructure.

ANALYSIS / DISCUSSION

Administration reviewed these deliverables and provided initial feedback to the consultants. The deliverables have since been updated by the consultant to reflect feedback from both City Administration and YG. Administration is now seeking feedback from Committee of the Whole prior to forwarding the deliverables to Council for approval.

APPROVAL		
NAME:	Cory Bellmore, CAO	**SIGNATURE:** C.Bellmore
DATE:	October 30,2020	

Stantec

Memo

To:	Ben Campbell/Stephanie Pawluk	From:	Stantec Consulting Ltd.
File:	Dawson – Dome Road Subdivision	Date:	October 28, 2020

Reference: Dawson Dome Road Subdivision: Engagement Plan

INTRODUCTION

PURPOSE OF THIS PROJECT

Design a residential subdivision along Dome Road that is supported by the local community while carefully considering how to develop the site in the most appropriate way, maximizing development efficiencies and evaluating servicing options to responsibly manage infrastructure.

What will the Final Deliverable look like?

A comprehensive Master Plan document with proposed land use concept plan and preliminary engineering.

How will the final deliverable by approved?

Ultimately, Dawson City Council will approve the Master Plan document and land use concept; to be constructed by the Yukon government.

PURPOSE OF ENGAGEMENT

- Foster collaboration between Yukon government and City of Dawson, as partners.
- Identify priorities of the City of Dawson, Yukon government, and Tr'ondëk Hwëch'in and determine how this development can meet their goals.
- Enhance awareness of the realities of land development, including how design can drastically impact affordability to property owners and the City of Dawson through increased servicing and infrastructure maintenance costs.
- Gain local community support for the project through the incorporation of past and future feedback on the design.
- Allow for a range of in-person and online opportunities for community members and stakeholders to provide input into this project.

DESIRED OUTCOMES

- The final Master Plan meets the objectives of Yukon government and the City of Dawson and the land use concept is adopted by City Council.
- Yukon government, City of Dawson, Tr'ondëk Hwëch'in, Dawson City residents, and other stakeholders understand the purpose of the project and how design can impact goals of the development.
- Yukon government, City of Dawson, and Tr'ondëk Hwëch'in have an opportunity to influence the development's design.

Reference: **Dawson Dome Road Subdivision: Engagement Plan**

- The public understand how previous feedback gathered through the Slinky West Visioning Charrette, and current-day feedback has influenced the Dome Road subdivision design.

COMMUNICATION PRINCIPLES

This DRAFT Engagement Plan is being guided by the following principles:

Inclusivity	We will encourage participation by those who will be affected by the planning process and those interested in the outcomes. This means we will provide a range of ways to engage.
Trust and Respect	We will engage in an open and respectful way that fosters understanding between diverse views and interests.
Transparency and Accountability	We will design open and clear engagement activities. Those participating will understand their role, the level of engagement, how their input will be used, and the overall process.
Open and Timely Communication	We will strive to provide information that is timely, accurate, objective, easily understood, accessible, and balanced.
Equity	The processes will include a range of events and tools to allow all community members a reasonable opportunity to contribute, as well as hear and understand other views.

REVIEW OF ENGAGEMENT LEVELS

Project Team

- Dome Road Technical Advisory Working Group
  - City of Dawson Representatives
  - Government of Yukon Representatives
- Stantec
- In-person and online meetings

Governments

- City of Dawson
  - Mayor and Council
  - Administration
- Yukon government
  - Administration
- Tr'ondëk Hwëch'in
  - Chief and Council
  - Administration
- In-person and online meetings

Dawson City Residents

- Mailed letter from Dawson City Mayor and Council

Reference: **Dawson Dome Road Subdivision: Engagement Plan**

- Online informational videos
- In-person and Microsoft Teams public information sessions
- Online survey

Tr'ondëk Hwëch'in Citizens

- Information package sent by Tr'ondëk Hwëch'in
- Online informational videos
- In-person and online meetings
- Online survey
- Community information packages

Reference: **Dawson Dome Road Subdivision: Engagement Plan**

PROPOSED ENGAGEMENT TOOLS

The following lists each of the proposed engagement tools.

Engagement Activity	Proposed Date
ON-GOING	
Dome Road Technical Advisory Working Group Meetings	**Ongoing**
• Due to COVID-19 protocol, Stantec will be hosting all Technical Advisory Working Group meetings online using Microsoft Teams. • Group members from the Yukon government and City of Dawson are welcome to meet in-person within their offices to join the online meetings. Every effort will be made to group meetings together when the project team is in the City of Dawson. • The Stantec office is currently closed to visitors.	
PHASE 1: PROJECT START-UP	
Project Start up meeting	October 19, 2020
• Due to COVID-19 protocol, meeting with be online using Microsoft Teams. • Group members from the Yukon government and City of Dawson are welcome to meet in-person within their offices to join the online meetings. • The Stantec office is currently closed to visitors.	
Dawson City Council	November 18, 2020
• Request approval for the COVID plan and Engagement Plan. COW is on November 4 and Council is Nov 18, 2020. This resolution will not impact the timing of the next stage.	
PHASE 2: REVIEW OF DATA AND LAND SUITABILITY ANALYSIS	
Introductions with Tr'ondëk Hwëch'in	Week of Nov 2, 2020
• This meeting will also be held remotely using Microsoft Teams **Purpose:** • Introduce the project and our team, review relevant background information and gather feedback with Tr'ondëk Hwëch'in. Understand how the First Nation would like us to engage with them. • Review values document provided and ask questions to get any clarification or add detail as needed.	
Development Potential Workshop with Dome Road Technical Advisory Working Group	November 25, 2020
• This workshop will be held virtually, but with small groups in person where possible. • We will use Microsoft Teams, or similar platform to connect. **Purpose:** • Review the background information and outcomes of the land suitability analysis. • Highlight the community feedback received through previous engagement, and development challenges as previously studied – with the goal of coming to a shared understanding of the site's opportunities, constraints, and development potential.	

Reference: **Dawson Dome Road Subdivision: Engagement Plan**

Engagement Activity	Proposed Date
Dawson City Council	December 9, 2020
• Present the Development Potential Brief to City Council. COW on December 2 and Council on December 9, 2020.	
PHASE 3: COMPLETION OF THE 2019 VISIONING CHARRETTE EXERCISE AND ENGAGEMENT	
Planning Brief Engagement with Tr'ondëk Hwëch'in	January 12, 2021
• In-person meeting, held at Tr'ondëk Hwëch'in offices. • Meeting can be with staff, leadership or citizens. • This meeting will also be broadcasted using Microsoft Teams for those unable to attend in-person. **Purpose:** • Introduce the project and our team, review relevant background information as outlined in the Planning Brief, gain an understanding of leadership's objectives, and gather feedback.	
Planning Brief Engagement with the Community	January 7 to 15, 2021
Purpose: • To present the Planning Brief and gather feedback.	
Advertising Materials	
• Project notice posters: project name, website location. • Project notification letters for City of Dawson residents: mail-outs to all property owners from Mayor and Council. • Tr'ondëk Hwëch'in information package • Local radio announcement for in-person engagement opportunity. • Klondike Sun advertisement for in-person engagement opportunity. • City of Dawson website and/ or social media posts for in-person engagement opportunity.	
Tool 1: Public Online Video	
• Short presentation video (PowerPoint presentation with voice-over) to describe the project, its purpose, and review the background information as outlined in the Planning Brief. • Video will be posted on the City of Dawson website and advertised on social media pages. **Direct viewers of the video to complete the short public survey to provide feedback.**	
Tool 2: Public Online Survey (Hosted through Survey Monkey)	January 7 to 15, 2021
Will be used to gather questions and comments about the project. Examples of the types of questions that will be asked are listed below. • Do you have any questions about the purpose of this project? • Do you have any questions about the background information presented in the Planning Brief? • Are there any other things that need to be considered during the design of the development?	
Tool 3: Public Information Session – In-Person	January 13, 2021
• In-person public engagement event held at TBD. • To be designed using COVID-19 protocol (see attached for Sample COVID Event Plan). **Yukon First Nation Training:**	

Reference: **Dawson Dome Road Subdivision: Engagement Plan**

Engagement Activity	Proposed Date
• We will rely on a Tr'ondëk Hwëch'in youth to assist with the event planning, set-up, contact tracing, and note taking. **Purpose:** • Review the background information as outlined in the Planning Brief with stakeholders and the public. • During this session, key staff will be present to explain the information, answer questions, and gather feedback. **Direct attendees of the session to complete the short public survey to provide feedback.**	
Tool 4: Public Information Session – Online Broadcasting	January 15, 2021
• We will broadcast the public information session live through Microsoft Teams, and record the event to be posted online following the meeting. • Online attendees will also have the opportunity to ask questions in real time. **Direct attendees of the session to complete the short public survey to provide feedback.**	
Dawson City Council	Feb 10, 2021
• Present the Final Planning Brief to City Council for approval. Also present the draft design concepts and get feedback on these prior to public engagement.	
PHASE 4: DRAFT CONCEPT PLAN	
Draft Concept Plans Engagement with Tr'ondëk Hwëch'in	March 1, 2021
• In-person meeting, held at Tr'ondëk Hwëch'in offices • This meeting will also be broadcasted using Microsoft Teams for those unable to attend in-person. **Purpose:** • Walk through each of the proposed development concepts and review the strengths and weaknesses of each; as well as how each relates to their previously-identified goals/ priorities. • As a result of this meeting, we hope to gain feedback about which concept, if any, Tr'ondëk Hwëch'in prefers and any modifications that may be required.	
Draft Concept Plans Engagement with the Community	March 1 to 10, 2021
Advertising Materials	
• Local radio announcement for in-person engagement opportunity • Posters a key locations and community notice boards around town • Klondike Sun advertisement for in-person engagement opportunity • City of Dawson website and/ or social media posts for online video and in-person engagement opportunity • Tr'ondëk Hwëch'in information package	
Tool 1: Public Online Video	
• Short presentation video (PowerPoint presentation with voice-over) to present the draft concept plans to explain the strengths and weaknesses of each and how each relates to the community's previously-identified priorities. • Video will be posted on the City of Dawson website and advertised on social media pages. • Direct viewers of the video to complete the short public survey to provide feedback.	

Reference: **Dawson Dome Road Subdivision: Engagement Plan**

Engagement Activity	Proposed Date
Tool 2: Public Online Survey (Hosted through Survey Monkey)	March 1 to 10, 2021
Will be used to gather feedback on the draft concept plans. Examples of the types of questions to be asked are listed below. • Concept A and short description – How would you rate Concept A (sliding-scale) – Do you have any comments or questions about Concept A? • Concept B and short description – How would you rate Concept B (sliding-scale) – Do you have any comments or questions about Concept B? • Concept C and short description – How would you rate Concept C (sliding-scale) – Do you have any comments or questions about Concept C? • Do you have any other thoughts that should be considered?	
Tool 3: Public Information Session – In-Person	March 2, 2021
• In-person public engagement event held at TBD • To be designed using COVID-19 protocol (see attached for Sample COVID Event Plan) **Yukon First Nation Training**: • We will rely on a Tr'ondëk Hwëch'in youth to assist with the event planning, set-up, contact tracing, and note taking. **Purpose:** • Present the draft concept plans to explain the strengths and weaknesses of each and how each relates to the community's previously-identified priorities. **Direct attendees of the session to complete the short public survey to provide feedback.**	
Tool 4: Public Information Session – Online Broadcasting	March 3, 2021
• We will broadcast the public information session live through Microsoft Teams, and record the event to be posted online following the meeting. • Online attendees will also have the opportunity to ask questions in real time. • Direct attendees of the session to complete the short public survey to provide feedback.	
PHASE 5: SUBDIVISION MASTER PLAN REVIEW AND APPROVAL	
Dawson City Council	Early April, 2021
• Present Preferred Concept and Draft Master Plan to City Council for feedback.	
Present the Draft Dome Road Master Plan to Tr'ondëk Hwëch'in	Late April, 2021
• Present Master Plan to Tr'ondëk Hwëch'in and get feedback.	
Draft Dome Road Master Plan – Public Review	Late April, 2021
Advertising Materials	
• Local radio announcement for in-person engagement opportunity • Posters a key locations and community notice boards around town • Klondike Sun advertisement for in-person engagement opportunity	

Reference: **Dawson Dome Road Subdivision: Engagement Plan**

Engagement Activity	Proposed Date
• City of Dawson website and/ or social media posts for online materials and in-person engagement opportunity • Tr'ondëk Hwëch'in information package	
Tool 1: Posting of Master Plan Online	Late April, 2021
• We will post both the Final Concept Plan and Final Dome Road Subdivision Master Plan online for two weeks so community members can review both at their own pace.	
Tool 2: Public Online Survey (Hosted through Survey Monkey)	Late April, 2021
Will be used to gather feedback on the final concept plan and master plan. Examples of the types of questions to be asked are listed below. • Concept Plan and short description – How would you rate the final Concept Plan (sliding-scale) – Do you have any comments or questions about the concept plan? • Master Plan [link] – Do you have any comments or questions about the Master Plan? **Do you have any other thoughts that should be considered?**	
Tool 3: Public Information Session – In-Person	Late April, 2021
• In-person public engagement event held at TBD • To be designed using COVID-19 protocol (see attached for Sample COVID Event Plan) **Yukon First Nation Training:** • We will rely on a Tr'ondëk Hwëch'in youth to assist with the event planning, set-up, contact tracing, and note taking. **Purpose:** • Showcase the Final Concept Plan to stakeholders and the public. • During this session, key staff will be present to explain the information, answer questions, and gather feedback. **Direct attendees of the session to complete the short public survey to provide feedback.**	
Tool 4: Public Information Session – Online Broadcasting	Late April, 2021
• We will broadcast the public information session live through Microsoft Teams, and record the event to be posted online following the meeting. • Online attendees will also have the opportunity to ask questions in real time. **Direct attendees of the session to complete the short public survey to provide feedback.**	
Dawson City Council	May, 2021
• Present the Final Mater Plan to City Council for approval.	
Present the Final Dome Road Master Plan to Tr'ondëk Hwëch'in	May, 2021
• Present Final Master Plan to Tr'ondëk Hwëch'in.	

Reference: **Dawson Dome Road Subdivision: Engagement Plan**

Engagement Activity	Proposed Date
PHASE 6: YESAB Submission	
Dawson City Council	June, 2021
• Present YESAB application update for information.	

Phase	Task	Description	Project Schedule (Completion Date)	Hr	Status	Deliverables / Milestone	Meeting/Event	Client Support	Client/Stake holder time requirement (hours)
Phase 1 Project Start-Up	Task 1.1	Transfer of Data and Background Information	October 23, 2020	30	Partial	Base plan		Provide access to all available documents	4
	Task 1.2	Project Kick-off Meeting	October 19, 2020	10	Meeting 1 – complete Meeting 2	Meeting agenda and notes, Draft/Final Dome Road Technical Advisory Working Group Terms of Reference	DRTAWGM #1	Meeting Attendance	1.5/per attendee
	Task 1.3	COVID-19 Response Memo	October 2, 2020	8	Completed	COVID-19 response plan		Review /Approval Deliverable	2
	Task 1.4	Communications and Engagement Plan	October 2, 2020	16	Completed	Communication and Engagement Plan	Meet with Tr'ondëk Hwëch'in	Review /Approval Deliverable, Meeting Attendance	3/per attendee, 4 for review
Phase 2 Review of Data and Land Suitability Analysis	Task 2.1	Review of Relevant Policies and Plans	October 23, 2020	32	Partial	Summary of relevant Policies and Plans		Review /Approval Deliverable	4
	Task 2.2	Land Suitability Analysis	October 31, 2020	34	Partial	Opportunities and Constraints/ Development Suitability Map	Golder Associates Tetra Tech	Review /Approval Deliverable, Meeting Attendance	2/per attendee, 8 for review
	Task 2.3	Offsite Engineering and Servicing Review	November 15, 2020	48	Partial	Tech memo		City of Dawson to provide access to all available information	16
	Task 2.4	Development Potential Workshop	November 25, 2020	32		Dome Road Technical Advisory Working Group workshop	DRTAWGM #2 in Dawson /Site visit	Workshop Attendance, Site Visit, Meeting Attendance	3/per attendee plus travel
	Task 2.5	Development Potential Briefing	November 30, 2020	36		Development Potential Brief		Review /Approval Deliverable	
Phase 3 Completion of the Visioning Charrette and Engagement	Task 3.1	Draft Planning Brief	December 16, 2020	40		Draft Planning Brief		Review /Approval Deliverable	8
	Task 3.2	Tr'ondëk Hwëch'in Engagement on Planning Brief	January 12, 2021	22		Meeting agenda and notes	Meet with Tr'ondëk Hwëch'in	Meeting Attendance	3/per attendee
	Task 3.3	Community Engagement on the Planning Brief	January 13, 2021	22		Meeting presentation materials and meeting summary	Engagement Session 1	Session Attendance	

	Task 3.4	Finalize the Planning Brief	January 22, 2021	40		Final Planning Brief		Review /Approval Deliverable	24
	Task 3.5	Presentation of the Final Planning Brief	February 4, 2021	12		Planning Brief presentation, meeting notes	Presentation	Meeting Attendance	2/per attendee
Phase 4 Draft Concept Plan	Task 4.1	Draft Neighbourhood Design Option(s)	February 5, 2021	30		Draft neighbourhoods design option(s)		Review /Approval Deliverable	8
	Task 4.2	Internal Review of Draft Neighbourhood Design Option(s)	February 18, 2021	8		High-level design options(s)	DRTAWGM #3	Meeting Attendance	4/per attendee
	Task 4.3	Begin the Draft Dome Road Master Plan and Pre-Design Report	November – March1, 2021	160		Table of Contents		Answer questions and provide advice	8
	Task 4.4	Tr'ondëk Hwëch'in Engagement on the Draft Concept Plans	March 1, 2021	22		Meeting agenda and notes	Meet with Tr'ondëk Hwëch'in	Meeting Attendance	2/per attendee
	Task 4.5	Community Engagement on the Draft Concept Plans	March 2, 2021	22		Meeting presentation materials and meeting summary	Engagement Session 2	Session Attendance	3/per attendee plus travel
	Task 4.6	Selection of Preferred Design Concept	March 12, 2021	8		Workshop agenda and materials, workshop notes, Preferred Concept Plan	DRTAWGM #4	Review /Approval Deliverable	8
	Task 4.7	YESAB Project Familiarization Meeting	February, 2021	8		YESAB Project Proposal annotated table of contents	Meeting with YESSA	Meeting Attendance	1/per attendee
	Task 4.8	Completion of the Draft Dome Road Subdivision Master Plan and Pre-Design Report	March 30, 2021	120		Draft Dome Road Subdivision Master Plan and Economic and Market Analysis		Review /Approval Deliverable	8
Phase 5 Subdivision Master Plan Review and Approval	Task 5.1	Draft Dome Road Subdivision Master Plan Presentation	Early April, 2021	32		Presentation materials	DRTAWGM #5	Review /Approval Deliverable	2/per attendee
	Task 5.2	Yukon Government and City of Dawson Review	March 30-April 10, 2021			Draft Dome Road Subdivision Master Plan		Review /Approval Deliverable	60
	Task 5.3	Draft Dome Road Subdivision Master Plan Revisions	Late April, 2021	60		Draft Dome Road Subdivision Master Plan v2		Review /Approval Deliverable	24

	Task 5.4	Public Review of the Draft Dome Road Master Plan	Late April, 2021	32		Online survey, meeting presentation, and summary	Engagement Session 3		3/per attendee plus travel
	Task 5.5	Finalize Master Plan	May, 2021	30		Final Dome Road Subdivision Master Plan	DRTAWGM #6	Approval Deliverable	1/per
PHASE 6 YESAB Submission	Task 6.1	Prepare YESAB submission	March – April, 2021	94		Draft and Final YESAB submission		Review /Approval Deliverable	4
	Task 6.2	YESAB Review Support	Late April – June, 2021	88		Application support		Meeting Attendance	4
	Task 6.3	Final Project Submission	June 15, 2021	40		Final documents and maps in requested format			4

Stantec

Memo

To:	Ben Campbell/Stephanie Pawluk	From:	Stantec Architecture Ltd.
File:	Dawson City - Dome Rd Future Subdivision Master Plan	Date:	October 23, 2020

Reference: COVID-19 Plan for Public Gathering

In accordance with the guidelines outlined by the Yukon government regarding holding a gathering, Stantec has prepared the following COVID-19 Plan to assist staff in hosting a safe public event.

This Plan has been developed based on the current COVID-19 situation and the current restrictions and guidelines provided by Yukon government. It is understood that if the situation in the territory changes before the planned events, this Plan may need to be updated.

GOALS

- Prevent the spread of illness by restricting attendance from those who may be infected with COVID-19, enhancing sanitation standards for those in attendance, and maintaining physical distancing between all attendees and staff.
- Accommodate all safety protocols which may vary by location, organization (Stantec, Yukon government, City of Dawson, stakeholder/ venue organization), personal comfort level, and may change as the project goes along.
- Showcase Stantec, the Yukon government, and City of Dawson as leaders in safety and professionalism.
- Support both in-person and physically-distanced engagement as appropriate.

COVID PRECAUTIONS, BY ENGAGEMENT ACTIVITY

IN-PERSON, SMALL GROUP MEETINGS

About

- The Technical Advisory Working Group (i.e. representatives from Stantec, Yukon government, and City of Dawson) will be meeting on an on-going basis to discuss the project.
- Representatives from the Project Team will also be meeting with Tr'ondëk Hwëch'in and stakeholders on an as-needed basis to discuss the project.

Safety Precautions Taken Before the Event

- All meetings will be held using the online platform Microsoft Teams.
  - Participants will be encouraged to join online using video if possible.
- Based on the safety protocols held at the time of each meeting, in-person gathering may be permitted to supplementary the online meeting.
- All participants will be given the option to join meetings either in-person or online.

Reference: **COVID-19 Plan for Public Gathering**

In-Person Safety Precautions

Selection of venue

- Venues for in-person gatherings will be selected based on their capacity to accommodate applicable safety protocols in place at the time of the meeting and their technical capacity to join the online Microsoft Teams meeting.
  - Safety regulations requirements may include:
    - 2m physical-distancing between each attendee
    - Access to the washrooms by attendees
    - Work with venue staff to sanitizing of all surfaces before and after use

Travel

- Attendees travelling to an in-person meeting will be required to consider National, Territorial/ Provincial, local, or employer travel regulations at the time of the meeting.
  - Air travel may be discouraged
  - Self-isolation upon arrival may be required
  - Carpooling may be restricted or require face coverings

Determining suitability for attendance

- All attendees of in-person meetings must complete their own applicable safety forms (e.g. Fit for Duty forms) to confirm they are able to attend the meeting:
  - are not experiencing any symptoms of COVID-19,
  - have not travelled outside of Yukon, NWT, Nunavut, or BC within the last 14 days, or
  - have not come into contact with someone who is suspected or confirmed to have COVID-19 within the last 14 days

In-person meeting protocols

- Host venues will be responsible for providing hand sanitizer containing a minimum of 60% alcohol for attendees' use.
- Host venue will be responsible for gathering contact information for all attendees, which will be submitted to Stantec who will keep it a paper record for a minimum of 21 days, for the purposes of contract-tracing. Contact information not to be shared and is destroyed after the 21 days.
- Host venues will be responsible for informing attendees if they are required/ encouraged to wear face coverings.
  - This requirement will be based on local/ venue/ or employer regulations with the strictest regulation being used.
  - Disposable masks will be provided to participants, but will be optional
- No shared food or drink should be consumed during the meeting. Packaged food may be provided.
- Host venues will be responsible for cleaning and sanitizing the meeting area and any other spaces which were used.

Reference: **COVID-19 Plan for Public Gathering**

IN-PERSON, LARGE GROUP MEETINGS

About

- Three in-person, large group meeting (ie. public information session) will be held for this project which is regulated by Yukon government.
- Because the event will be open to the general public, attendees will not be members of the same social bubble.
  - In accordance with YG's COVID regulations, attendance will be limited to 50 persons, including staff, provided that physical distancing can be maintained.

Safety Precautions Taken Before the Event

- Each public information session may broadcasted (on a separate date) using the online platform Microsoft Teams.
  - The event will be recorded and posted online for those who were unable to attend.
- All members of the public will be given the option to attend an in-person public information session or join the online broadcast.
- Sign up to each session will be required to anticipate the number of participants and ensure that the venues are appropriate.

Selection of Venue

- The selection of a venue for indoor in-person public information sessions will require the project team to make assumptions on the number of participants, objectives of each session and potential activities. Venues will be selected to ensure COVID capacity is appropriate for each session.

Inside the venue

Set-up

- Chairs will be arranged to promote physical distancing.
  - Chairs will be arranged in sets of 2 or 4, to allow attendees to sit together in family groupings, with a minimum of 2m surrounding each set of chairs.
- All surfaces will be wiped down and sanitized.
- Tape will be placed on the floor to indicate one-way traffic movement through the room.

Washrooms

- Washrooms will be checked for liquid soap, paper towel, toilet paper, and warm running water
- Signs will be posted in the washrooms reminding users to properly wash their hands
  - Will use the poster as prepared by Yukon government (attached)

At the entrance

- A sign will be posted at the entrance advising guests to physically distance themselves from other attendees.
  - Will use the poster as prepared by the Yukon government (attached)
- Hand sanitizer containing a minimum of 60% alcohol will be provided for attendees' use

Reference: COVID-19 Plan for Public Gathering

Outside

- A sign will be posted on the exterior of the entrance advising guests who arrive with symptoms to return home.
  - Will use the poster as prepared by Yukon government (attached)
- If possible, tape will be used outside the entrance to mark 2m spacing; encouraging physical distancing while attendees wait in line to get into the venue

Safety Precautions as Attendees Arrive

Screening

- All guests will be greeted by a staff member at the entrance of the venue.
- Attendees will be asked by a staff member if they:
  - are experiencing any symptoms of COVID-19,
  - have travelled outside of Yukon, NWT, Nunavut, or BC within the last 14 days, or
  - have come into contact with someone who is suspected or confirmed to have COVID-19 within the last 14 days
- If the answer to any of the questions is yes, guest will not be permitted access into the event.
- Those permitted into the venue will be asked for their name and phone number, to allow for contact tracing. Records will be kept for a minimum of 21 days. Contact information not to be shared and is destroyed after the 21 days.

Entry guidance

- Guests will be asked to apply hand sanitizer prior to entry into the venue.
- Guests will then be asked to find a seat in the venue, sit, and stay seated during the event.
- Guests will be told that no mingling will be permitted; as such, if they would like to mingle, please remain outdoors until the event begins.

Safety Precautions Taken During the Event

- No shared food or drink will be provided. Packages foods may be provided.
- A microphone will not be used.
- All attendees will be seated during the event.
- A formal presentation will be given by staff, standing at the front of the room, at least 2m away from the nearest person.
  - Tape will be placed on the floor to indicate where presenters should stand to maintain physical distancing.
- Following a question and answer period, guests will be asked to leave the venue while maintaining physical distance.

Safety Precautions Taken After the Event

- Staff will wear gloves while taking down the venue, cleaning, and emptying garbage containers.
- Work with the venue to ensure that all surfaces will be wiped down and sanitized.

Reference: **COVID-19 Plan for Public Gathering**

Resources Required

- 1 Entry pre-screening poster, printed (attached)
- 3 Hand-washing posters, printed (attached)
- 3 Physical distancing posters, printed (attached)
- 1 roll of scotch tape
  To be used to hand posters

- 1 roll of masking tape
  To be used to mark out 2m spacing outside, inside for presenters, and one-way traffic

- 1 bottle of hand sanitizer, containing at least 60% alcohol
- Box of disposable masks
- 1 Contact-tracing form (attached)
- 2 pens

- Bucket
- Hot water
- Cleaning agent
- Cloths
- Disposal gloves
  To be used during venue clean-up

Attachment: COVID-19 regulation posters, COVID-19 Contact Tracing

Stantec

COVID-19 Contact Tracing Form

Event description			
Date		**Time**	
Location			

Attendee Name – Must Include All Staff Members	Phone #

Report to Council

☐	For Council Decision	☒	For Council Direction
☐	For Council Information		

☐ In Camera

SUBJECT:	Official Community Plan and Zoning Bylaw Housekeeping Amendments	
PREPARED BY:	Stephanie Pawluk, CDO	**ATTACHMENTS:** Draft OCP Amendment Bylaw (#2019-14) Draft ZBL Amendment Bylaw (#2019-15)
DATE:	Oct 23, 2020	
RELEVANT BYLAWS / POLICY / LEGISLATION: Municipal Act Official Community Plan Zoning Bylaw		

RECOMMENDATION

It is respectfully recommended that Committee of the Whole provide feedback and forward OCP Amendment Bylaw 20190-14 and ZBL Bylaw 2019-15 to council for Third and final Reading

BACKGROUND SUMMARY

The OCP underwent a yearly review in 2019, as per S. 16.2 of the OCP. The Zoning Bylaw must be consistent with the OCP, therefore; the Zoning Bylaw was also reviewed. Due to staff turnover and competing priorities, the Bylaws have not yet proceeded to Third Reading.

OCP Bylaw Amendment No. 2 was given Second Reading February 12th, 2020 as per Council resolution C20-02-18. Approval from the Minister to proceed to Third Reading, as per s. 282 of the Municipal Act, was granted on May 7th, 2020.

Zoning Bylaw Amendment No. 5 was given second reading on February 12th, 2020, and then went before Council on June 9th, 2020. As per Council resolution C20-09-10 “Moved by Councillor Johnson, seconded by Councillor Shore that Bylaw #2019-15 being the *Zoning Bylaw Amendment No. 5 Bylaw* be tabled to the Committee of the Whole,” Administration received direction to conduct research and present the Zoning Bylaw to Committee of the Whole prior to Third and final Reading.

ANALYSIS / DISCUSSION / ALIGNMENT TO OCP & STRATEGIC PRIORITIES

Municipal Act

S. 288(2) of the *Municipal Act* states that *“a council must not adopt a zoning bylaw, or an amendment to a zoning bylaw, that is not consistent with an official community plan”.* The proposed changes in the Zoning Bylaw Amendment will be consistent with the OCP.

Zoning Bylaw

S. 17.1.1 of the *Zoning Bylaw* states that *“Council may initiate any text amendment to this bylaw.”*

Council Information Requests: Zoning Bylaw Amendment

1. Provide more context on the Appendix 1 map. Please see Appendix 1 for the updated map.

2. s. 4.03: Define dry cleaning distribution station

- S. 4.03 has been edited to remove “dry cleaning distribution station” and replace it with “dry cleaning establishment.”
- The definition now reads:
  “PERSONAL SERVICE ESTABLISHMENT means a business which is associated with the grooming or health of persons or the maintenance or repair of personal wardrobe articles and accessories, and may include a barber shop, beauty parlor, shoe repair shop, self-service laundry or dry cleaning establishment.”

3. Concern over the ambiguity of the permit cancellation: “Partially complete applications that are inactive for a period of six months or more may be cancelled at the discretion of the development officer.” (s. 4.08)

- Having Administrative discretion over the 6-month cancellation of inactive applications is important for when special circumstances arise. For example, if Administration requests additional information that the applicant is unable to provide for 6 months (eg. septic approval from YG), it is unreasonable to cancel the application simply because the 6-month inactivity mark is up.
- Applicants spend significant amounts of time and money on development applications; it is not Administration’s intention to cancel applications for the sole reason of the 6-month inactivity mark coming up. The intent is for Administration to communicate with applicants about their intent to pursue their applications and consider their status on a case-by-case basis.

4. s. 4.09: valid survey instruments – what is accepted?

- Generally, a survey is considered valid if it is conducted and signed off by a Canada Land Surveyor.
- Proposed rewording: “The applicant is unable to prove the extent of a development using a survey conducted by a registered Canada Land Surveyor.”
- An example of when this clause could be applied: A proponent receives a development permit to construct a garden suite and constructs said structure; upon the CDO’s compliance inspection of the structure, the setback is questioned. If the proponent is unable to show where their rear lot line is, they may be required to contract a survey to prove the development’s compliance with the approved permit.

5. s. 4.13: What is a small-scale residential unit, and how big can this be?

- As listed in the permitted uses of the C2 Zone (s. 12.2.1), small-scale residential includes:
  - family day home
  - garden suite
  - modular home
  - residential security unit
  - secondary suite
  - single detached dwelling

- The C2 zone states: “the development regulations for the R1 Zone shall apply to the development of single family detached dwellings” (s. 12.2.2.2). As such, the answer to the question of how big small-scale residential structures can be, is found in the R1 Zone size regulations:
    - Maximum 35 ft tall for a principal building
    - Maximum 20 ft tall for an accessory building
    - Minimum floor area of primary dwelling unit: 256 ft^2
    - Maximum parcel coverage: 50%

6. s. 4.12: define “personal service establishment”

- As per s. 4.03 of this Bylaw Amendment, personal service establishment will be added to the definitions section in the Zoning Bylaw (s. 2.2).
  “PERSONAL SERVICE ESTABLISHMENT means a business which is associated with the grooming or health of persons or the maintenance or repair of personal wardrobe articles and accessories, and may include a barber shop, beauty parlor, shoe repair shop, self-service laundry or dry cleaning establishment.”

APPROVAL		
NAME:	Cory Bellmore, CAO	**SIGNATURE:** C Bellmore
DATE:	October 31,2020	

THE CITY OF DAWSON

Official Community Plan Amendment No. 2 Bylaw

Bylaw No. 2019-14

WHEREAS section 265 of the Municipal Act, RSY 2002, c. 154, and amendments thereto, provides that a council may pass bylaws for municipal purposes.

WHEREAS section 278 of the Municipal Act, RSY 2002, c. 154, and amendments thereto, provides that a council must, within three years of formation or alteration of municipal boundaries, adopt or amend by bylaw an official community plan.

WHEREAS section 285 of the Municipal Act, RSY 2002, c. 154, and amendments thereto, provides that an official community plan may be amended, so long as the amendment is made in accordance with the same procedure established for adoption of an official community plan.

THEREFORE, pursuant to the provisions of the *Municipal Act* of the Yukon, the council of the City of Dawson, in open meeting assembled, **ENACT AS FOLLOWS**:

PART I - INTERPRETATION

1.00 Short Title

This bylaw may be cited as the ***Official Community Plan Amendment No. 2 Bylaw***

2.00 Purpose

2.01 The purpose of this bylaw is to provide for

(a) A re-designation of lands from Urban Residential to Downtown Core.

CAO

Presiding Officer

Table of Contents

3.00 Definitions

3.01 In this Bylaw:

(a) Unless expressly provided for elsewhere within this bylaw the provisions of the *Interpretations Act,* RSY 2002, c. 125, shall apply;

(b) "Bylaw Enforcement Officer" means a person employed by the City of Dawson to enforce bylaws;

(c) “CAO” means the Chief Administrative Officer for the City of Dawson;

(d) “city” means the City of Dawson;

(e) “council” means the Council of the City of Dawson;

PART II – APPLICATION

4.00 Amendment

4.01 This bylaw re-designates Block M, Ladue Estate and Lots 5, 9, and 10, Block H, Ladue Estate from Urban Residential to Downtown Core, as shown in Appendix 1.

PART III – FORCE AND EFFECT

5.00 Severability

5.01 If any section, subsection, sentence, clause or phrase of this bylaw is for any reason held to be invalid by the decision of a court of competent jurisdiction, the invalid portion shall be severed and the part that is invalid shall not affect the validity of the remainder unless the court makes an order to the contrary.

6.00 Enactment

6.01 This bylaw shall come into force on the day of the passing by Council of the third and final reading.

7.00 Bylaw Readings

Readings	Date of Reading
FIRST	**November 20, 2019**
MINISTERIAL NOTICE	**January 21, 2020**
PUBLIC HEARING	**February 12, 2020**
SECOND	**February 12, 2020**
MINISTERIAL APPROVAL	**May 7, 2020**
THIRD and FINAL	

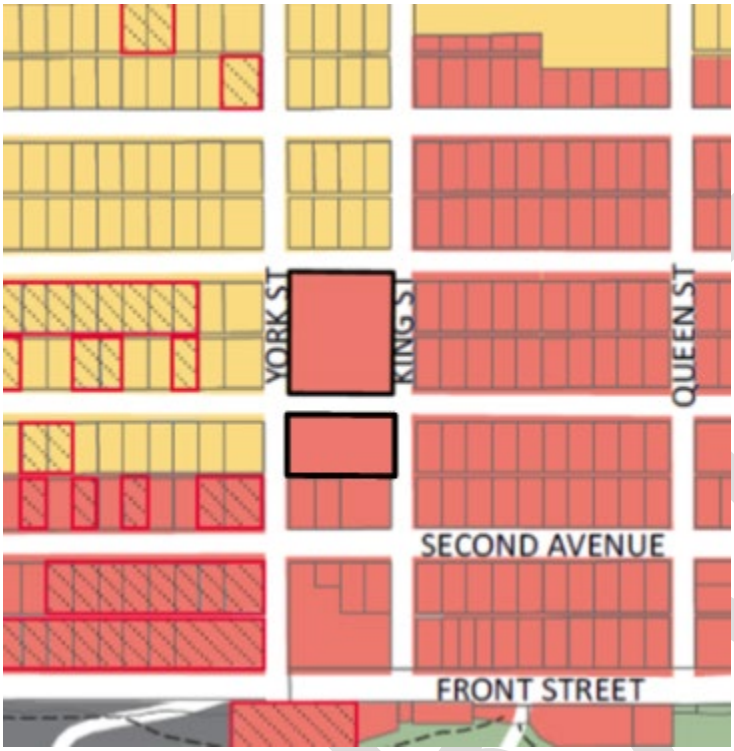
Original signed by

Wayne Potoroka, Mayor
Presiding Officer

Cory Bellmore, CAO
Chief Administrative Officer

8.00 Appendices

Appendix 1. Amendment to Schedule C



CAO

Presiding Officer

May 7, 2020

Cory Bellmore
Chief Administrative Officer
City of Dawson
Box 308
Dawson City, YT Y0B 1G0

Dear Cory Bellmore:

RE: Submission of Proposed Official Community Plan for Approval

Thank you for submitting Bylaw #2019-14 & 2019-12, bylaws to adopt the City of Dawson's Official Community Plan, for my approval.

I am pleased to advise that there were no significant concerns raised in our inter-departmental review of the bylaw. As such, I am happy to issue approval of the bylaw pursuant to s. 282 of the *Municipal Act*. Please note that approval to proceed to third reading with this bylaw is not an expression of Yukon Government's approval of, or commitment to, any development noted within the Official Community Plan.

Please retain this letter as part of the bylaw documentation. It is the official record of my approval as required by legislation.

Sincerely,

John Streicker
Minister of Community Services

THE CITY OF DAWSON

Zoning Bylaw Amendment No. 5 Bylaw

Bylaw No. 2019-15

WHEREAS section 265 of the Municipal Act, RSY 2002, c. 154, and amendments thereto, provides that a council may pass bylaws for municipal purposes.

WHEREAS section 288 of the Municipal Act, RSY 2002, c. 154, and amendments thereto, provides that a council, within two years after the adoption of an official community plan, or as soon as is practicable after the adoption of an amendment to an official community plan, a council must adopt a zoning bylaw.

WHEREAS section 288 of the Municipal Act, RSY 2002, c. 154, and amendments thereto, provides that no person shall carry out any development that is contrary to or at variance with a zoning bylaw.

THEREFORE, pursuant to the provisions of the *Municipal Act* of the Yukon, the council of the City of Dawson, in open meeting assembled, **ENACT AS FOLLOWS**:

PART I - INTERPRETATION

1.00 Short Title

This bylaw may be cited as the ***Zoning Bylaw Amendment No. 5 Bylaw***

2.00 Purpose

2.01 The purpose of this bylaw is to provide for

(a) A re-zoning of Lot 7, Block J, Ladue Estate from C1: Core Commercial to P1: Parks and Natural Space.
(b) A series of text amendments.

CAO

Presiding Officer

Table of Contents

3.00 Definitions

3.01 In this Bylaw:

(a) Unless expressly provided for elsewhere within this bylaw the provisions of the *Interpretations Act,* RSY 2002, c. 125, shall apply;

(b) "Bylaw Enforcement Officer" means a person employed by the City of Dawson to enforce bylaws;

(c) “CAO” means the Chief Administrative Officer for the City of Dawson;

(d) “city” means the City of Dawson;

(e) “council” means the Council of the City of Dawson;

PART II – APPLICATION

4.00 Amendment

4.01 This bylaw amends Schedule C to re-zone Lot 7, Block J, Ladue Estate from C1: Core Commercial to P1: Parks and Natural Space, as shown in Appendix 1.

4.02 Repeal s. 1.9.1 “Lots created before the approval of this bylaw that are less than the minimum dimensions or more than the maximum dimensions required of the zone they are in shall be considered to be conforming lots for the purposes of this bylaw”.

4.03 Insert the following definition to s. 2.2: “PERSONAL SERVICE ESTABLISHMENT means a business which is associated with the grooming or health of persons or the maintenance or repair of personal wardrobe articles and accessories, and may include a barber shop, beauty parlor, shoe repair shop, self-service laundry or dry cleaning establishment.”

4.04 Insert the following definition to s. 2.2: “RENEWABLE ENERGY SYSTEM means a system or device where energy is derived from sources that are not depleted by using them and transformed for use. Renewable energy systems include but are not limited to solar-electric or solar-thermal panel systems.”

4.05 Insert the following definition to s. 2.2: “STRUCTURAL ALTERATION means any change in the supporting members of a structure, including but not limited to foundations, exterior load-bearing walls, door and window openings, roof, and access/egress components (such as decks or porches), which does not increase the

exterior dimensions of height or footprint. For the purposes of this bylaw, full removal of a structure or structural component and replacing it in its entirety constitutes structural alteration."

4.06 Insert the following clause: S. 4.2.10 "wall tents or similar temporary structures provided the wall tent consists only of a frame and canvas walls. For the purposes of this bylaw, construction of a structure with a floor, walls, or roof requires an approved development permit."

4.07 Insert the following clause: S. 4.2.11 "roof-mounted renewable energy devices outside of the Downtown Core."

4.08 Repeal s. 4.3.6 and replace with the following: S. 4.3.6 "an application shall not be deemed complete until all requirements above have been submitted to the satisfaction of a development officer. Partially complete applications that are inactive for a period of six months or more may be cancelled at the discretion of the development officer."

4.09 Insert the following clause: S. 4.4.1.5 (V) "the applicant is unable to prove the extent of a development using valid survey instruments".

4.10 Repeal s. 5.3 and re-insert the clause as s. 4.8.

4.11 Repeal s. 8.11(c) and replace with the following: s. 8.11(c) "a Cannabis Retail Service shall be allowed to sell non-regulated goods. A Cannabis Retail Service must comply with s. 17(1) of the Federal *Cannabis Act* when selling goods that promote cannabis."

4.12 Insert "personal service establishment" in s. 12.1.1 as a permitted use.

4.13 Repeal s 12.2 and replace with the following: S. 12.2 "The purpose of the C2 zone is to permit a wide range of commercial uses that provide service to local industry and/or highway tourism and service needs. Small-scale residential uses in this district are permitted, though the area remains predominately a service commercial zone."

4.14 Update Table 12-1 as follows: Repeal the line "minimum building height: 13.72m/45ft" and replace with "maximum building height: 13.72m/45ft".

4.15 Update Table 12-3 as follows: Repeal the line "minimum building height: 13.72m/45ft" and replace with "maximum building height: 13.72m/45ft".

4.16 Update Table 12-3 as follows: Repeal the line "minimum setback of buildings from front parcel line: 15.24m/50ft" and replace with "minimum setback of buildings from front parcel line: 6.10m/20ft".

4.17 Repeal s 16.4.1 and replace with the following: S. 16.4.1 "If the corrective measures described in a notice of offence order issued pursuant to section 16.3 are not completed within the specified time, [clause removed] the person to whom the order was issued may be issued an offence ticket by a development officer".

4.18 Repeal s. 16.4.3.

4.19 Insert the following clause: S. 16.4.5 “for greater certainty, a person found to be in contravention of this bylaw on an ongoing basis may be fined for each day the contravention continues, as per section 340 of the Yukon *Municipal Act*.”

4.20 Repeal s 16.5 and 16.6 and replace with the following:
S. 16.5 “Summary Conviction Penalties

4.21 Insert the following clause: S. 17.2.3 (VII) “development assessment documentation as detailed in s. 4.3 Development Permit Applications.”

.1 A person who fails or refuses to comply with an offence ticket is liable to sanctions as described in section 343 of the Yukon Municipal Act.

.2 In addition to the penalties provided for under section 16.4 of this bylaw, a person convicted of an offence pursuant to section 1.2, may be ordered to remove such development and reclaim the site at that person’s own expense.

.3 Should any person owning or occupying real property within the City refuse or neglect to pay any penalties that have been levied pursuant to this bylaw, the development officer may inform such person in default that the charges shall be added to, and shall form part of, the taxes payable in respect of that real property as taxes in arrears if unpaid on December 31 of the same year.

.4 When a development officer has issued a ticket under section 16.4 that results in a summary conviction, the development officer shall report this information to Council.”

PART III – FORCE AND EFFECT

5.00 Severability

5.01 If any section, subsection, sentence, clause or phrase of this bylaw is for any reason held to be invalid by the decision of a court of competent jurisdiction, the invalid portion shall be severed and the part that is invalid shall not affect the validity of the remainder unless the court makes an order to the contrary.

6.00 Enactment

6.01 This bylaw shall come into force on the day of the passing by Council of the third and final reading.

CAO _____ Presiding Officer _____

7.00 Bylaw Readings

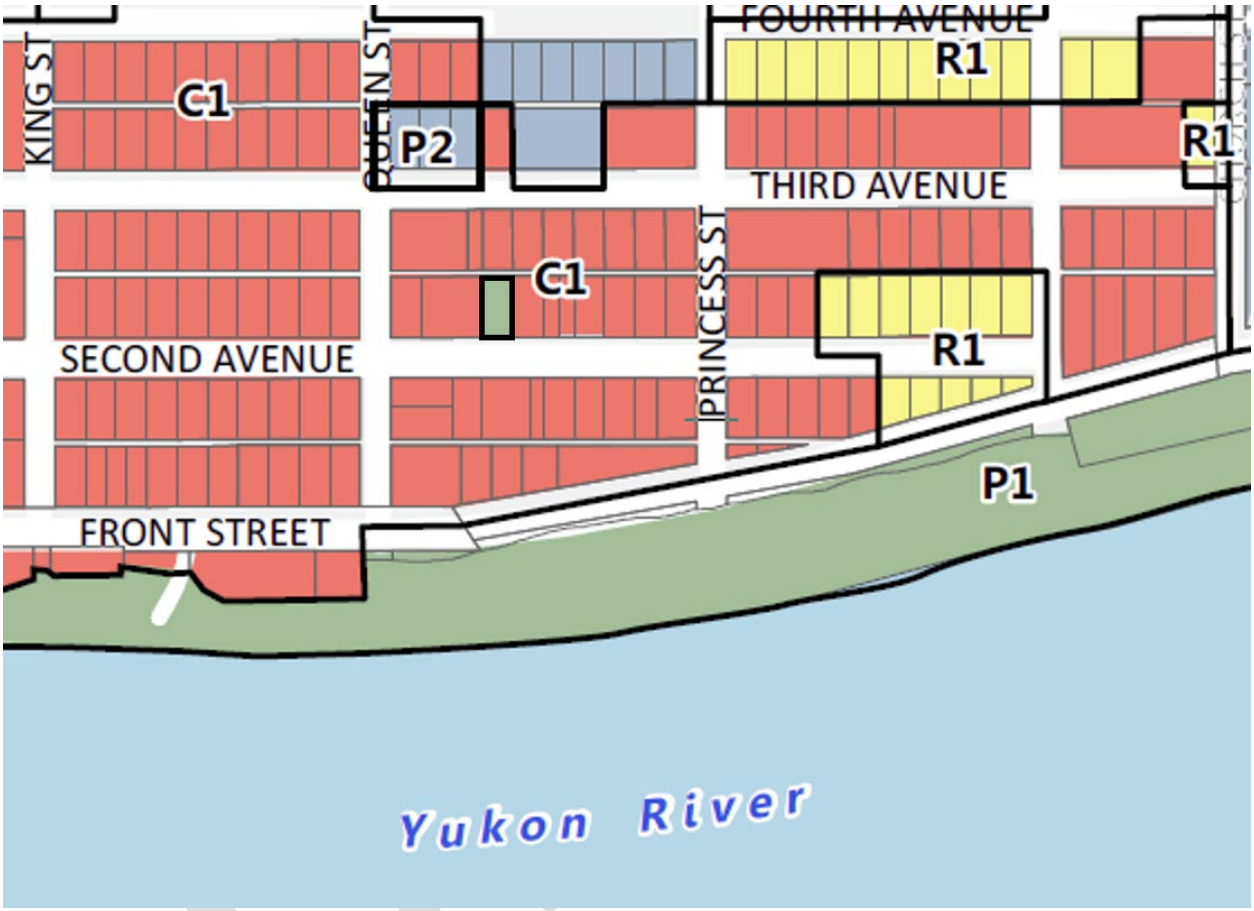
Readings	Date of Reading
FIRST	**November 20, 2019**
PUBLIC HEARING	**February 12, 2020**
SECOND	**February 12, 2020**
THIRD and FINAL	

Wayne Potoroka, Mayor
Presiding Officer

Cory Bellmore, CAO
Chief Administrative Officer

8.00 Appendices

Appendix 1. Amendments to Schedule C



CAO

Presiding Officer

Klondike
Development
Organization
A partnership of the City of Dawson, Dawson City Chamber of Commerce,
Klondike Institute of Art & Culture, Klondike Visitors Association, and Chief Isaac Incorporated

City of Dawson
PO Box 308
Dawson City
Yukon, Y0B 1G0

October 20, 2020

Re: City of Dawson support for a renewable energy project within the municipality

Dear Mayor and Council,

Thank you for the opportunity to present details of our proposed solar power project to you at a Committee of the Whole meeting earlier this month. Klondike Development Organization submits this letter as a follow-up, requesting that the City of Dawson provide an indication of how you feel you can best support the project's ongoing financial viability.

Our suggestion was for a change to your Development Incentives policy and program such that special renewable energy developments outside of the historic townsite become eligible. Members of Council suggested that other mechanisms may be preferable means of supporting green energy projects in the municipality.

While there remains time before funding may be confirmed, and before we are ready to order components, a number of steps such as a power production agreement must take place in between. As you can imagine, there is a degree of complexity to getting this project off the ground, and multiple critical pieces of this endeavor will all be significantly aided with certainty about operational finances, not least of which being the potential tax burden of the project. Could we aim for a response from the City before December?

KDO is keen to make this project work for the City of Dawson as partners in redevelopment of a brownfield, putting land of little value into use generating solar power for our community. A small pilot project but a step towards reducing our carbon footprint. The City of Dawson has done an excellent job of recognizing the need to incentivize development in the municipality and we hope that a solution to the problem presented at the October 7 meeting can be found.

Sincerely,

Jackie Olson, KDO President

(867) 993-4431
PO Box 1613 Dawson City, YT Y0B 1G0
klondikedevelopment@gmail.com
www.klondikedevelopment.com

Department of Economic Development
PO Box 2703, Whitehorse, Yukon Y1A 2C6

October 15, 2020

Mayor and Council
City of Dawson
Box 308
Dawson City, Yukon Y0B 1G0

Dear Mayor Wayne Potoroka and Council:

RE: Invitation for Municipalities to Participate in the Immigration Strategy Engagement

This letter is to invite you to provide input for the development of a new immigration strategy for Yukon.

The Government of Yukon is developing a new immigration strategy and would like to hear from municipal governments on whether the programs, as administered, are meeting their labour force needs and those of their community. Your input is valuable in helping shape the priorities and outcomes of the strategy.

Relevant information including the engagement survey and background documents can be found online at: https://engageyukon.ca/. The engagement survey for the immigration strategy will be online from October 20 to December 4.

To facilitate the engagement process the City of Dawson is also invited to request a virtual engagement forum or interview if you would like to do so.

To confirm your participation via online survey, virtual meeting or both; or for any questions related to this initiative, please contact us at immigrationstrategy@gov.yk.ca. We would appreciate to receive confirmation of your participation by **November 13, 2020**.

Sincerely,

Justin Ferbey
Deputy Minister of Economic Development