SERVICING REPORT

SMITH CREEK

SEPTEMBER 2020

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September 4, 2020

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September 4, 2020

Date

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1 INTRODUCTION

1.1 GENERAL

WSP Canada Group Limited was retained by QuantumPlace Developments Ltd on behalf of Three Sisters Mountain Village Properties Ltd. (Client) to undertake the preparation of a conceptual servicing report for Smith Creek development (SCD), located in the Town of Canmore. The following report outlines water and sanitary sewer servicing concepts for the development in support of the Area Structure Plan (ASP). This servicing report provides direction for the implementation of the water and sanitary sewer servicing strategy for the development and identifies the tie-in points to the Town of Canmore water and sanitary sewer networks.

1.2 SITE DESCRIPTION

Smith Creek ASP land occupies approximately 154 ha (380 acres) in the already established community of Three Sisters Mountain Village and is located just east of the existing Stewart Creek development. The land is bound by the mountains to the south, Trans-Canada Highway (TCH) to the north, and by George Biggy Senior road to the east. The hamlet of Dead Mans Flats (DMF) is across the TCH to the north east of the development. Five creeks cross the development, draining south to north, including Stewart, Smith, Marsh, Cairns and Pigeon Creeks, respectively from west to east. The site is predominately forested and has an undulating topography.

There is an existing 400mm PVC watermain that currently runs through western edge of the development, along the southern edge of the TCH, and eventually terminates in Dead Mans Flats. See **Figure 2.1 in Appendix A** for further information on the proposed water system.

The nearest Town of Canmore sanitary gravity main is located in the existing Stewart Creek development. Please refer to the **Figure 3.1 in Appendix B** for further information on the proposed sanitary system.

1.3 PROJECT SCOPE

The scope of this report encompasses a review of previous studies and the preparation of a conceptual servicing report which will guide the overall development and provide a basis for design criteria and approach. This servicing report differs from the previous servicing reports as it considers updated land use concepts.

1.4 PREVIOUS STUDIES AND REPORTS

The following studies and agreements have been reviewed and utilized in the preparation of this updated service report:

- Sanitary Sewer Servicing Study, IBI Group Ltd., May 2013
- TSMV Water Network Analysis, IBI Group Ltd., March 2013
- Cost Agreement, TSMVPL and Town of Canmore, October 2013

IBI Servicing Studies and latest 2017 Utilities Master Plan for the Town of Canmore recommends down stream sanitary upgrades and an additional reservoir for the Smith Creek Development. It is also noted that a private written agreement between the Town of Canmore and TSMVPL dated October 21, 2013 was reviewed in the preparation of this report.

Several Town of Canmore resources, including the following design guidelines and manuals, were reviewed and utilized in the preparation of this report:

- Town of Canmore, Utilities Master Plan, Water and Sanitary, CIMA+, January 2017
- Town of Canmore, Utilities Master Plan, Water Master Plan, EPCOR, December 2010
- Town of Canmore, Utilities Master Plan, Sanitary Master Plan, Stantec, June 2010
- Town of Canmore, Guidelines for Subdivision and Development in Mountainous Terrain, June 2006
- Town of Canmore, Engineering Design and Construction Guidelines, 2020

1.5 PROPOSED LAND USE

The proposed land uses for the ASP lands are a mixture of residential, commercial and specialized (school) zones. Residential zones are mostly a mixture of low and medium density nodes consisting of single family, semi-detached, and townhomes. The large commercial zone is planned to be a mixture of commercial, light industrial and the potential for some residential. The specialized zone located in the middle of the development is reserved for a future school site.

1.6 TOWN OF CANMORE UMP POPULATION PROJECTIONS

The 2017 Town of Canmore Utility Master Plan describes population projections for future development in Section 2.3 of the report. Population projection numbers were calculated by multiplying the projected new units by 2.5 people/unit. The Smith Creek development lands considered for this ASP are referred to as "Stewart and Smith Creek" in Table 2 of the UMP.

Since the completion of the 2017 UMP, QuantumPlace Development Ltd and WSP have worked collaboratively with the Town to produce a revised land use concept for Smith Creek. The proposed residential portion of the development is a mix of single-family dwellings, semi-detached dwellings, and townhomes.

In determining the residential unit occupancy rates for the townhomes and semi-detached dwellings, we have analysed other communities in Western Canada with similar urban form, socio economic status, and influence from tourism. The results are shown in the table below.

Table 1.1 Household Size Comparison

	Community	City	Housing Type	Average household size
1	Victoria West	Victoria, BC	78% Apt/Town	1.9
2	Fairfield	Victoria, BC	72% Apt/Town	1.8
3	Downtown	Kelowna, BC	100% apt	1.7 (2830 apt for 4850 ppl predicted in Plan 2012) 1.0 (actual in 2006)
4	Bridgeland	Calgary, AB	66% Apt/Town	1.8
5	Hillhurst	Calgary, AB	51% Apt/Town	2
6	Mission	Calgary, AB	98% Apt/Town	1.4

We are recommending 2.1 people/unit for townhomes and semi-detached dwellings and 2.8 people/unit for single-family dwellings as this is more representative of occupancies within this type of development and building form.

References:

https://www.victoria.ca/assets/Departments/Planning~Development/Community~Planning/Local~Area~Planning/Vic~West/Vic%20West%20Profile.pdf

https://www.victoria.ca/assets/Departments/Planning~Development/Community~Planning/Local~Area~Planning/Fairfield~Gonzales/Fairfield_Profile_DRAFT_10.13.2016.pdf

https://www.kelowna.ca/sites/files/1/docs/2012-02-28_downtown_plan_report_final.pdf

https://www.kelowna.ca/sites/files/1/docs/related/ff-population_and_housing.pdf

https://www.calgary.ca/CSPS/CNS/Documents/community_social_statistics/community-profiles/bridgeland-riverside.pdf

https://www.calgary.ca/CSPS/CNS/Documents/community_social_statistics/community-profiles/hillhurst.pdf

https://www.calgary.ca/CSPS/CNS/Documents/community_social_statistics/community-profiles/mission.pdf

NOTE:
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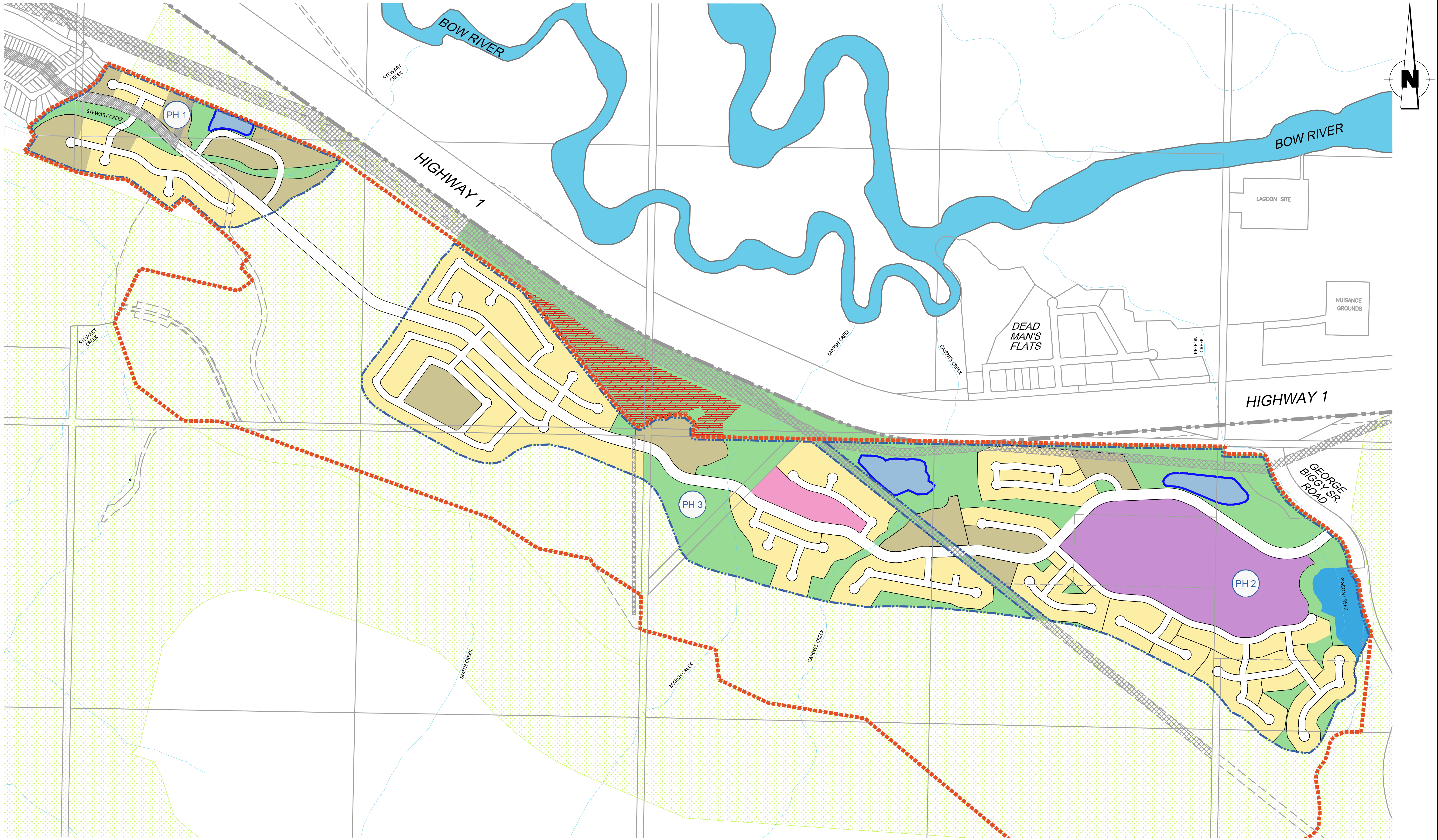
QUANTUMPLACE DEVELOPMENTS LTD.

SMITH CREEK - ASP

SITE LOCATION PLAN

SCALE:	DATE:	PROJECT No:	DRAWING No:
NTS	2020-07-28	5215046-000	FIGURE 1.1



LEGEND

- STEWART CREEK ASP BOUNDARY
- CANMORE TOWN LIMITS
- PHASE BOUNDARIES
- EXISTING TRANSMISSION R/W
- EXISTING UTILITY R/W
- RESIDENTIAL (LOW DENSITY)
- RESIDENTIAL (MEDIUM DENSITY)
- COMMERCIAL
- SPECIALIZED SCHOOL
- STORMWATER MANAGEMENT FACILITY
- SEDIMENT AREA
- NATURAL GREENSPACE
- UNDEVELOPABLE AREA
- WILDLIFE CORRIDOR

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SMITH CREEK - ASP

CONCEPTUAL LAND USE PLAN

SCALE:	DATE:	PROJECT No:	DRAWING No:
NTS	2020-07-29	5215046-000	FIGURE 1.2

2 WATER DISTRIBUTION SYSTEM

2.1 CRITERIA AND APPROACH

This section of the report will discuss the design approach taken in modelling the water network system for the development.

2.1.1 COMPUTER MODEL

The computer software used for the analysis was Bentley WaterCAD Connect Edition. WaterCAD is a Windows based program that uses a series of nodes and pipes to predict the hydraulic behavior within a water distribution system.

2.1.2 EXISTING WATER NETWORK AND BOUNDARY CONDITIONS

The water network is proposed to tie in to the existing 400 mm watermain that supplies water to DMF at two locations. CIMA+ has provided boundary conditions to WSP for the proposed system modeling which are provided in **Table 2.1**. Boundary conditions provided to WSP by CIMA+ were for Maximum Day Demand and Maximum Day Demand Plus Fire Flow scenarios. These boundary conditions will be verified as the design progresses.

Table 2.1 Boundary Conditions

		Hydraulic Grade Line (m)	
Label	Location	Maximum Daily Demand	Maximum Daily Demand Plus Fire Flow
HGL Connection	Existing watermain that runs from west into the proposed development area	1397	1395
N-106	Existing watermain that runs north into DMF	1397	1392.5

2.1.3 WATER NETWORK DESIGN CRITERIA

Our design criteria are based on the recently approved 2020 Town of Canmore Engineering Design Guidelines. We have also reviewed the specific constraints associated with the SCD with the Town of Canmore and discussed where variances to this guideline would be appropriate.

For our analysis, we have allowed for the following design guidelines for a water distribution system:

- Minimum system pressure of 140 kPa (20 psi) for Maximum Daily Demand (MDD) plus fire flow
- Preferred system pressure of 350 kPa (50 psi) for Maximum Daily Demand (MDD)
- Minimum system pressure of 276 kPa (40 psi) for Maximum Daily Demand (MDD), with a requirement for consideration of impacts on land usage and service sizing.
- Pressures in excess of 550 kPa (80 psi) shall be avoided within residential units either using in-line Pressure Reducing Valves (PRVs) to create pressure zones or in-home PRVs to control at the houses.
- System pressures should generally not exceed 690 kPa or 100 psi. Pressures in excess of this limit will require additional considerations to ensure the system will be functional.
- Maximum velocity of 1.5 m/s for the MDD condition.
- Maximum velocity of 3.0 m/s within a loop and 6.0 m/s for a dead-end pipe for the MDD plus fire flow condition. Maximum velocities of 3.5 m/s will be considered if sufficient context is provided.
- Maximum head loss of 2 m/km for the MDD condition as a general guideline.

System water demands were based on the proposed land use types within the development and are summarized in **Table 2.2**.

Table 2.2 Water Demands

Criteria	Amount
Residential Unit Occupancy Rate	2.8 persons for each single-family home 2.1 persons for each of the semi-detached 2.1 persons for each of the townhomes 1.6 persons for each of the apartment units
Proposed Units	Analysis completed using the maximum feasible residential density of 1,813 units.
Institutional, Commercial & Industrial (ICI) Population	55 persons per hectare
Consumption Rate (Average Daily Demand)	360 L/person/day

Criteria	Amount
Residential Maximum Day Demand (MDD)	720 L/person/day
Residential Peak Hour Demand (PHD)	1440 L/person/day

The consumption rates provided in **Table 2.2** are based on the future water demand scenario provided in the 2017 UMP.

Though the network was modeled in alignment with the recommendations of the UMP, we believe the per capita water consumption is not representative of water use in a modern development. The City of Calgary is currently using 315 L/person/day and the City of Edmonton recently reduced this figure to 220 L/person/day, generally related to sustainability initiatives, low-flow fixtures, low-flow appliances and other modern changes in various codes and regulations. It is in the best interest of the Town as it relates to longer term considerations like maintenance and operational cost to ensure infrastructure is right sized for actual demand. The design parameters should be re-visited as design development continues, and we understand the Town is taking this into consideration for future revisions of the Engineering Design Guidelines. TSMVPL has also advised that at the detailed engineering design stages that reduced water consumption rates will be discussed with the Town to ensure that right sizing of infrastructure is evaluated at that time to ensure that affordability, servicing, and long-term operating impacts are considered appropriately.

Populations, densities, and areas were determined from the Area Structure Plan. The Maximum Daily Demand and Peak Hour Demand for commercial and institutional land uses were assumed to follow the same multipliers as the residential demands listed in **Table 2.2**.

The fire flow criterion adopted for low to medium density land use is 85 L/s and 200 L/s for institutional, commercial, and industrial (ICI) land uses. The design flow rates are summarized in **Table 2.3**.

Table 2.3 Design Flow Rates

Demand Condition	Estimated Flow – Smith Creek (L/s)
Average Day Demand, ADD (L/s)	24.3
Maximum Day Demand, MDD (L/s)	48.7
Peak Hourly Demand, PHD (L/s)	97.3
Fire Flow (L/s)	85 or 200 depending on Land Use
Maximum Draw Rate (MDD + Fire Flow) (L/s)	248.7

2.2 MODELING RESULTS

Modeling for the proposed servicing plan was completed for the Maximum Day demand and the Maximum Day plus Fire Flow demands.

Proposed Watermain Layout

Figure 2.1 in Appendix A shows the proposed layout of the water distribution system. The proposed water system will tie into the existing pipe that supplies water to DMF at two locations as shown in **Figure 2.1 in Appendix A**. The proposed internal watermain network for the development consists of watermains ranging between 200 mm and 400 mm in diameter.

The proposed water system layout is based on the preliminary development information currently available. A more detailed analysis should be undertaken during future design phases to confirm the estimated water demand requirement, boundary conditions, the size and capacity of the proposed water distribution system including the location of PRVs, reservoirs, and booster pumps, and any potentially required upgrades to the Town's existing water supply/distribution system. Servicing to DMF will remain a key consideration as the design progresses.

Proposed Reservoir

A new water reservoir has been proposed for the development as recommended in the 2017 UMP and previous IBI servicing studies. As detailed information on filling of the reservoir and its operation levels is not available at this time, it has been modelled in WaterCAD as a reservoir with a downstream supply HGL of 1411 m. This supply HGL has been recommended for optimum water system performance. Further modelling is recommended at the subdivision stage of the design to assess the reservoir filling strategy, operating levels, and their impact on servicing throughout the development. WSP notes the boundary conditions provided by CIMA+ are lower than the HGL of the new reservoir and this will need to be coordinated as the design progresses.

Proposed Pressure Reducing Valves and Booster Pumps

Phase 1 operates based on supply pressure from the existing Stewart Creek water system. This portion of development operates independently from the adjacent development lands and a PRV is recommended between Phase 1 and Phase 3.

Due to the significant elevation differences on the eastern half of the development, it is likely that this area will be split into three pressure zones. Depending on the final grading, this may require an additional three PRVs.

The south eastern end of the development has the highest overall elevation. A booster station is likely required to service these properties and provide adequate fire flow.

Maximum Day Demand

The minimum and maximum pressures simulated in the network for the maximum day demand were 275 kPa (40 psi) and 786 kPa (114psi). Several nodes do not meet the Town's updated recommended pressure criterion of 350 kPa (50 psi), but all exceed the minimum requirement of 280 kPa (40 psi). A number of the nodes exceeded the recommended maximum pressure criterion of 620 kPa (90 psi).

Under Maximum Day Demand conditions, no pipes are modelled to have velocities exceeding the maximum allowable velocity criterion of 1.5 m/s, and no pipes are modelled to have head loss gradients that exceed the maximum allowable head loss criteria of 2.0 m/km.

Maximum Day Demand – Pressure Deficiencies in the Proposed System

Phase 1: Several nodes in Phase 1 of the development area had simulated pressures of 303 – 345 kPa (44 – 50 psi). This is due to insufficient supply pressures from the existing system and the high elevation of the properties.

Phase 3: In the west of Phase 3, there are three nodes that had simulated pressures of 273 – 296 kPa (40 – 47 psi) due to high elevation of the properties. A number of nodes in the north west region of Phase 3 are lower elevation regions and had simulated pressures 676 – 786 kPa (98 – 114 psi).

Recommendations

Phase 1: It is noted that minimum operating pressures of 276 kPa (40 psi) can be considered with limitations associated with land usage and service sizing. Grading in the detailed design phase may increase these pressures slightly, but not enough for all nodes to be within the recommended limits. Minimum pressures in Phase 1 can be improved by increasing supply pressures in the existing system from the west. A supply HGL increase of 5m to 1402m is simulated to increase Phase 1 service pressures during maximum day demand to 344 – 524 kPa (50 – 76 psi). Capital cost and potential system impacts associated with raising the existing system supply pressures were not evaluated as part of this study but can be re-visited in future design phases if required.

Phase 3: It is noted that minimum operating pressures of 276 kPa (40 psi) can be considered with limitations associated with land usage and service sizing. Grading in the detailed design phase may increase these pressures slightly, but not enough for all nodes to be within the recommended limits. Minimum pressures in the south east corner of Phase 3 can be improved by increasing supply HGL from the proposed new reservoir to 1420 m. However, increasing the supply HGL will further worsen the exceedances of the high-pressure nodes within the north west corner of Phase 3 and may require additional PRVs.

For nodes with higher pressures, it is recommended that PRVs (possibly privately owned) be evaluated. In addition, the watermains and thrust blocks in this area would need to be designed to accommodate the higher pressures. This would be assessed in detail at the subdivision stage of the design in this area.

Maximum Day Plus Fire Flow – Available Fire Flows

A Maximum Day Demand plus Fire Flow simulation was conducted at all demand nodes in the proposed network. A minimum fire flow requirement of 85 L/s was assigned to all nodes except the school and commercial nodes which have a fire flow requirement of 200L/s. Minimum and maximum fire flows while maintaining minimum system pressures of 140 kPa (20 psi) were 137 L/s and 250 L/s.

Fire flows to the commercial areas and to the high elevation properties in the south east corner of Phase 2 are likely supported by a proposed booster pump station.

Maximum Day Plus Fire Flow – Fire Flow in the Proposed System

Under the proposed system and provided boundary conditions, the modelling simulation does not show any nodes within the development with insufficient fire flows. The minimum residual pressure within the system during fire flow conditions is simulated to be 140 kPa (20 psi).

Maximum Day Plus Fire Flow – Velocities and Headloss

All pipe velocities within the proposed water distribution system are modelled to be below the allowable velocity of 3.0 m/s.

The proposed pipe diameter around the looped commercial parcel in Phase 2 is 400 mm in diameter. Velocities exceed 3.0 m/s when flows are greater than 375 L/s. Under the proposed land use and calculated demands, the 400 mm pipes are not modelled to have flows greater than 375 L/s, and therefore not expected to have velocities exceeding 3.0 m/s.

All dead-end watermains are currently proposed to be 200 mm or 250 mm, and are located within residential areas that have a fire flow requirement of 85 L/s. At this flow rate, the maximum velocity within 200 mm and 250 mm watermains are calculated to be 2.7 m/s and 1.73 m/s, respectively, which are below the 6.0 m/s criterion for dead-end pipes.

Overall, the proposed water network model tries to provide a balance in meeting the current Town of Canmore guidelines and offering practical and logical recommendations that could be considered at the Area Structure Plan stage of the design for the areas with minor exceedances. The water model will be expanded on in the subsequent detail design stages as more detailed information becomes available, with the Town of Canmore reviewing and approving the model at each stage of the design.

2.2.1 OTHER RECOMMENDATIONS

Water Supply Storage

The current model simulation assumes a new reservoir will be constructed with an HGL of 1411 m, located south of Phase 3, but to be constructed in Phase 2 of the development. It is likely that a booster station will be needed to fill this reservoir. The current study does not include an assessment of this booster station or the fill strategy of the new reservoir.

Servicing to DMF

The Town has agreed to supply the DMF with up to 244.6 L/s of flow for fire protection. We have used the provided boundary conditions, design criteria, and assigned a 250 L/s demand to DMF during fire flow analysis. This analysis is based on the boundary conditions discussed in Table 2.1. Confirming this level of fire flow servicing and its potential hydraulic effects to the existing system upstream is outside the scope of this study and is assumed to have been addressed in the existing Town of Canmore water model. It is important to note that the water model assumes that sufficient water supply volume is available to provide 250 L/s fire flow to DMF. This assumption should be further tested during the subsequent stages of design when the water model is further developed.

3 SANITARY SEWER SYSTEM

This section of the report will discuss the sanitary sewer network and servicing.

3.1 CATCHMENT SUMMARY

The Plan Area will be serviced with a gravity sanitary collection system and a number of sanitary Lift Stations with sanitary sewer forcemain pipes. Based on the conceptual grading design and resulting topography, the sanitary sewer servicing is divided into five (5) sanitary catchment areas requiring five (5) lift stations. Proposed Lift stations 1 and 5 will discharge directly to the existing two sewer forcemains in the existing Stewart Creek development. Lift stations 2, 3, and 4 are proposed to discharge to Lift Station 1. The sanitary sewer system shall be designed in accordance with the latest Town of Canmore Engineering Design Guidelines. **Please refer to Figure 3.1 in Appendix B for further detail.** All catchment areas are preliminary, to be confirmed with detailed designs at future approvals. It is the intent to refine the sanitary design to minimize infrastructure requirements and balance lift station sizing with logical development sequencing within the proposed phases.

3.1.1 CATCHMENT AREA 1

Catchment Area 1 is located on the east side of the Plan Area and is the largest of the catchment areas, at approximately 66.63 ha. Catchment land uses consist mostly of low and medium density residential, commercial/industrial and specialized school zone. The proposed catchment will take advantage of the natural south to north topography and drain by gravity to a proposed Lift Station 1. Lift Station 1 will drain and connect to the existing 300mm sanitary sewer forcemain stub at the edge of Stewart Creek at the western edge of the ASP lands. **Please refer to Figure 3.1 in Appendix B for further detail**.

3.1.2 CATCHMENT AREA 2

Catchment Area 2 is located in the north-east of the Plan Area and is a smaller catchment area measuring approximately 10.88 ha. The area is a mixture of low and medium residential land uses. Again, natural topography of the catchment drains south to north to a proposed Lift Station 2. Lift Station 2 will drain into Lift Station 1 via sanitary sewer forcemain pipe. **Please refer to Figure 3.1 in Appendix B for further detail.**

3.1.3 CATCHMENT AREA 3

Catchment Area 3 is the smallest catchment area at approximately 6.04 ha of development lands and it consists of low density residential lands and specialized school zone. The proposed catchment naturally drains south to north and will connect to a proposed Lift Station 3. Lift Station 3 will connect to gravity line underneath Three Sisters Parkway that feeds into Lift Station 1. **Please refer to Figure 3.1 in Appendix B for further detail.**

3.1.4 CATCHMENT AREA 4

Catchment Area 4 is located immediately west of Marsh and Smith Creek and is approximately 28.11 ha in size. The catchment area predominantly consists of low density residential development. The topography is similar in nature to other catchment areas with south to north natural drainage. As such, the catchment area is proposed to drain into a Lift Station 4, which is located at the north-west corner of the catchment area. It ultimately drains into Lift Station 1 via sanitary sewer forcemain discharging into sanitary gravity main that feeds Lift Station 1.The ultimate discharge point for Catchment Area 4 can be revisited at a subdivision stage of development to asses if connecting to a sewer forcemain from Lift Station 1 to an existing forcemain in Stewart Creek is more advantageous to the system than draining Catchment Area 4 into Lift Station 1. **Please refer to Figure 3.1 in Appendix B for further detail.**

3.1.5 CATCHMENT AREA 5

Catchment Area 5 is the remaining approximately 21.61 ha of Smith Creek development lands immediately adjacent Stewart Creek at the ASP's most western edge. The catchment area is a mix of low and medium density residential land uses. The catchments topography has a slight south to north drainage and as such the catchment will drain into a Lift Station 5. Sanitary forcemain from Lift Station 5 will connect to an existing 200mm forcemain stub at the edge of Stewart Creek lands. **Please refer to Figure 3.1 in Appendix B for further detail.**

3.2 DESIGN CRITERIA AND APPROACH

The following design criteria in **Table 3.1**, is adopted in the Town's latest UMP by CIMA+ for sewage generation rates, along with peaking factors for different types of development.

As discussed in the section 1.6 of this report, we are assuming persons/unit numbers which more accurately reflect the mixture of townhouse and apartment style units.

Table 3.1 Sewage Generation Rates

Land Use type	Unit rates	2017 UMP Town of Canmore values
Residential	L/c/d	360
Commercial	L/ha/d	17,000
School	L/c/d	70*
Industrial	L/ha/d	17,000
Inflow/Infiltration	L/s/ha	0.28

Land Use type	Unit rates	2017 UMP Town of Canmore values
Peaking Factor Residential	PF	Harmon Formula, 2.5 min
Peaking Factor Non-Residential (Commercial, Industrial)	PF	3.5
Manning's n value	N/A	0.013

*As noted in the Alberta Environment's Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems.

3.2.1 SYSTEM ANALYSIS

The gravity sanitary sewer system was analysed for flow by the use on Manning's equation. It is a widely used equation in determining design flows in pipes. The Manning's equation is as follows:

$$Q = \frac{A \times 10^3}{n} R^{2/3} S^{1/2}$$

Where:
- Q = Flow Rate (L/s)
- A = Flow Area (m2)
- n = Roughness coefficient (0.013 for PVC pipes)
- S = slope (m/m)

Further, the capacity in the system was analysed on an individual pipe section basis. The calculated design flows were compared to the theoretical capacities of the pipes to provide percent full flow of each pipe section. The formula used to calculate percent full is as follows:

$$UPC = \frac{DF}{PC} \times 100$$

Where:
- UPC = Used Pipe Capacity (%)
- PC = Pipe Capacity (%)
- DF = Design Flow (L/s)

Generally, used pipe capacity below 86% is considered acceptable for sanitary sewer design. Values above 86% suggest the pipe is over capacity and may suffer from surcharging. **Please refer to the Sanitary Sewer Spreadsheet in Appendix B for further detail.**

3.3 MODELING RESULTS

Sanitary sewer modelling results are summarized in the **Table 3.2** below. The flows were separated for the three contribution areas and their discharge points identified. **Please refer to the Sanitary Sewer Spreadsheet in Appendix B for further detail.**

Table 3.2 Estimated Sewage Flows

Description	Contribution Area (Ha)	Estimated Flow (L/s)	Discharge Point
Catchment Area 1	66.63	44.54	To LS 1 and
Catchment Area 2	10.88	11.47	To LS 2 and MH 24
Catchment Area 3	6.04	6.02	To LS 3 and MH 28
Catchment Area 4	28.11	24.75	To LS 4 and MH 30
Catchment Area 5	21.61	15.03	To LS 5
Total	133.27	101.81	

The sewer system for the proposed ASP lands will connect to available sewer forcemain stubs located under Three Sisters Parkway just east of the existing Stewart Creek development.

During the phased construction of the remaining area in Stewart Creek and new lands in Smith Creek, certain sections of the existing sanitary sewer network system will reach their perspective capacities. As such, upgrades to the existing sanitary sewer system may be required. All the future planned upgrades were identified in the latest 2017 Town of Canmore Utility Master Plan. WSP agrees that certain upgrade projects will be needed in the future, however we recommend that lift stations 8 and 10 be evaluated for infiltration issues and if found, those issues be corrected first. Additionally, flow monitoring and recording actual flows to the same lift stations will inform the Town better on actual upgrades needed and their timelines.

A more detailed sanitary sewer analysis is recommended to be undertaken at subdivision stage to better estimate flows from the development and consider development phasing.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 WATER NETWORK ANALYSIS

The following conclusions have been drawn regarding the proposed water distribution system for the development area.

We have modeled the proposed development and have made recommendations for system performance appropriate to an Area Structure Plan level of design and modelling. Due the elevation differences within the development, and the HGL of the water supply, its likely that five PRVs and a booster pump would be required, to be confirmed with detailed designs at future approvals.

The modelling has identified potential minor deficiencies with respect to pressure and fire flow in the model. Though recommendations for addressing these deficiencies have been provided, it is acknowledged that detailed design will still need to be undertaken with future approvals when more development designs details are known, and that the base model represents a reasonable compromise between system performance and required infrastructure.

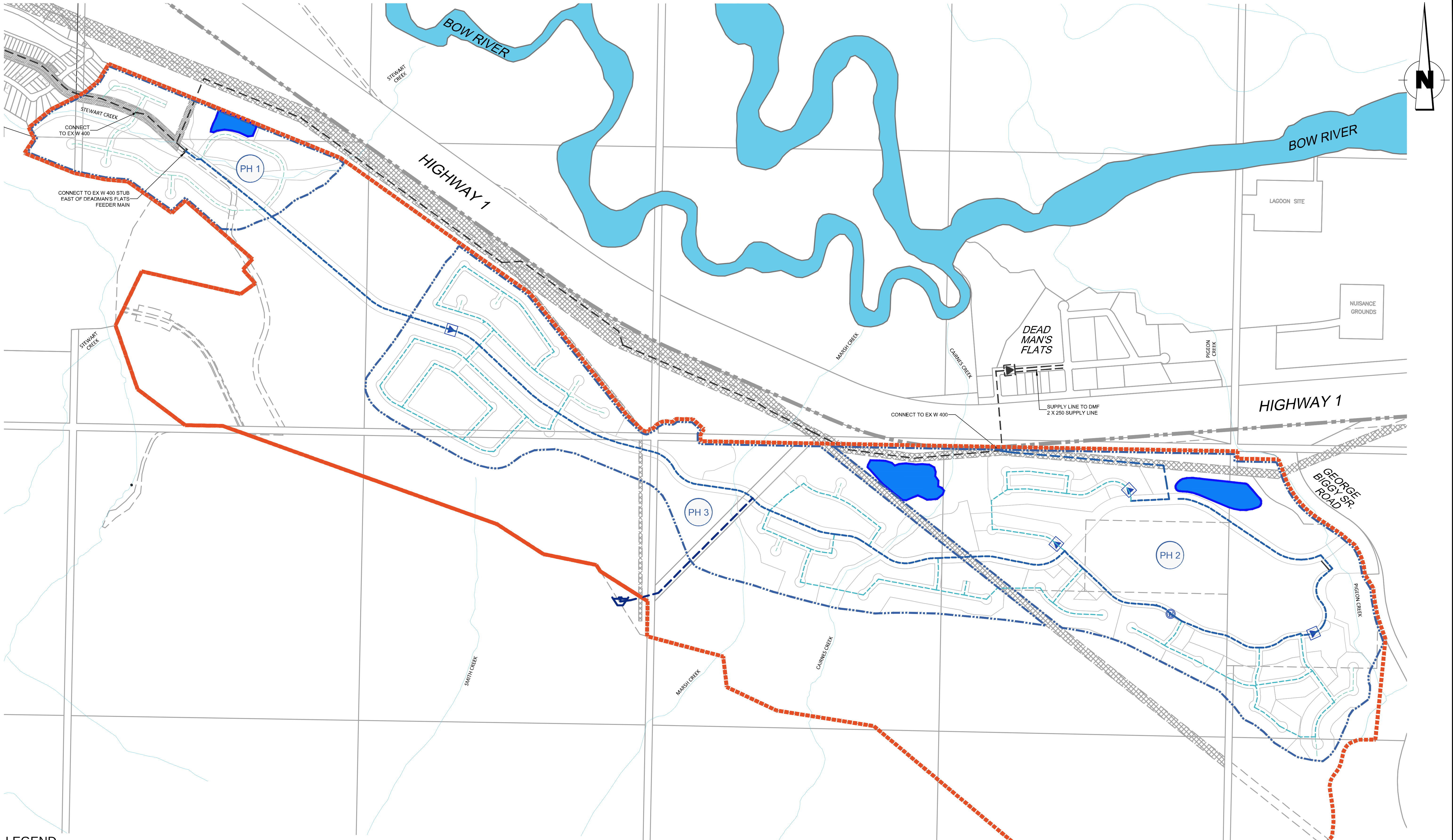
A more detailed analysis should be undertaken during future design phases to confirm the estimated water demand requirement, boundary conditions, the size and capacity of the proposed water distribution system including the location of PRVs, reservoirs, and booster pumps, and any potentially required upgrades to the Town's existing water supply/distribution system.

4.2 SANITARY SYSTEM ANALYSIS

The following is a summary of findings for the sanitary sewer network analysis.

The development can be serviced with a mix of gravity sewer and up to five sewer lift stations with forcemains connecting to the existing sanitary forcemain pipe stubs within the existing Stewart Creek Development. We recommend that actual flows are established prior to proceeding with offsite infrastructure upgrades. We do not foresee any upgrades beyond what has been considered in the UMP.

APPENDIX A – CONCEPTUAL WATER NETWORK



LEGEND

	STEWART CREEK ASP BOUNDARY		EXISTING WATERMAIN		POTENTIAL RESERVOIR
	CANMORE TOWN LIMITS		CONCEPTUAL 150 WATERMAIN		POTENTIAL PRESSURE REDUCING VALVE
	PHASE BOUNDARIES		CONCEPTUAL 200 WATERMAIN		POTENTIAL BOOSTER STATION
	EXISTING TRANSMISSION R/W		CONCEPTUAL 250 WATERMAIN		
	EXISTING UTILITY R/W		CONCEPTUAL 350 WATERMAIN		
			CONCEPTUAL 400 WATERMAIN		

NOTE:
These design documents are prepared solely for the use by the party with whom the design professional has entered into a contract and there are no representations of any kind made by the design professional to any party with whom the design professional has not entered into a contract.

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200 0 200 600
1:10000

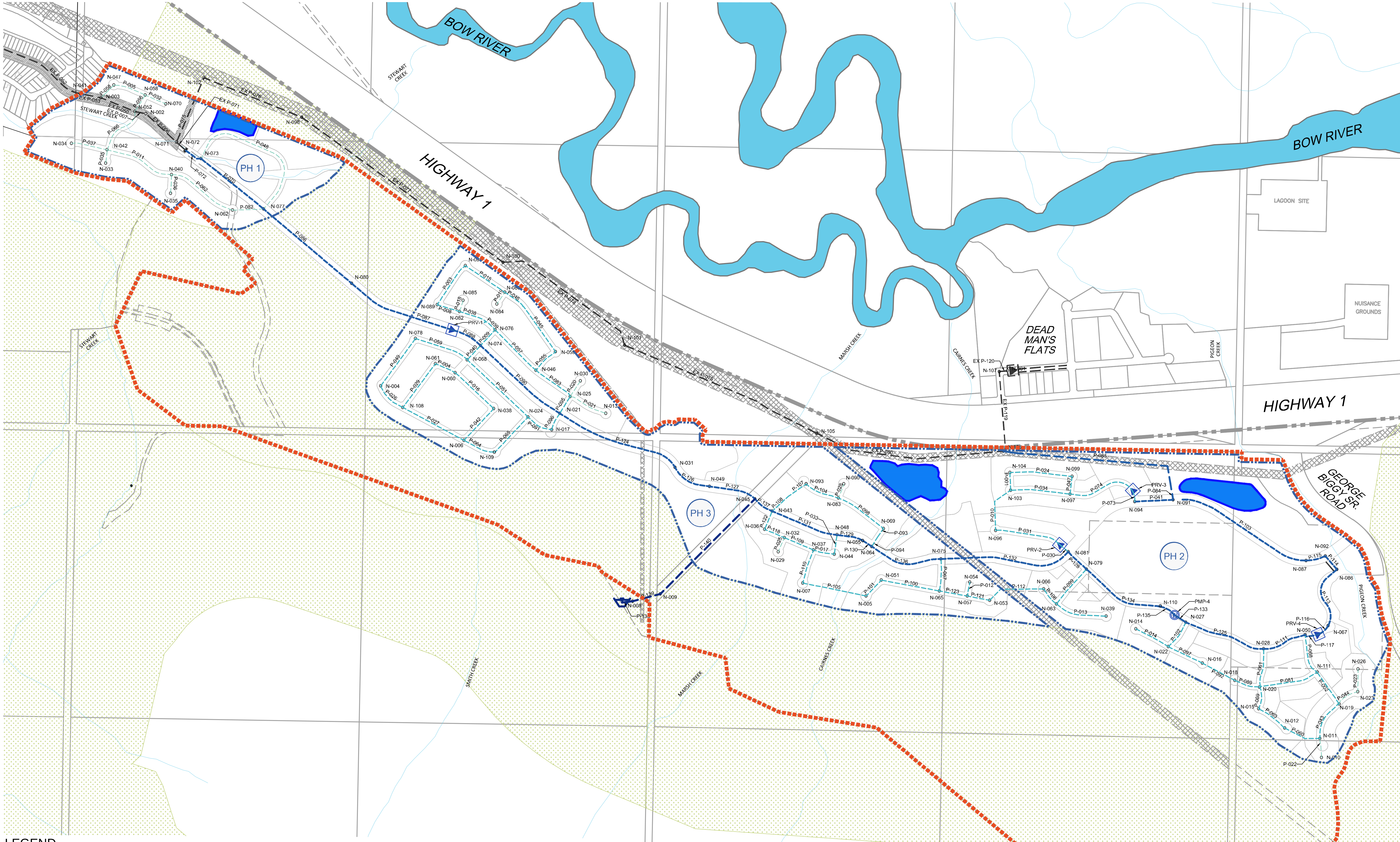
QUANTUMPLACE DEVELOPMENTS LTD.

SMITH CREEK - ASP

CONCEPTUAL WATER NETWORK

SCALE:	DATE:	PROJECT No:	DRAWING No:
NTS	2020-07-29	5215046-000	FIGURE 2.0

Last Saved: 2020-07-29 11:27:37 AM, By: Kennedy, Erin Plot Style: WSP_CAL-2016.ctb
P:\5215046-000 Quantum-Smith Creek ASP\Civil\5000 - Professional Services\5410 - Design-Technical\5414 - Sketches-Figures\2020-07-27_5215046-000_WATR-Concept.dwg



LEGEND

STEWART CREEK ASP BOUNDARY	EXISTING WATERMAIN
CANMORE TOWN LIMITS	CONCEPTUAL 150 WATERMAIN
PHASE BOUNDARIES	CONCEPTUAL 200 WATERMAIN
EXISTING TRANSMISSION R/W	CONCEPTUAL 250 WATERMAIN
EXISTING UTILITY R/W	CONCEPTUAL 350 WATERMAIN
WILDLIFE CORRIDOR	CONCEPTUAL 400 WATERMAIN

POTENTIAL RESERVOIR
POTENTIAL PRESSURE REDUCING VALVE
POTENTIAL BOOSTER STATION

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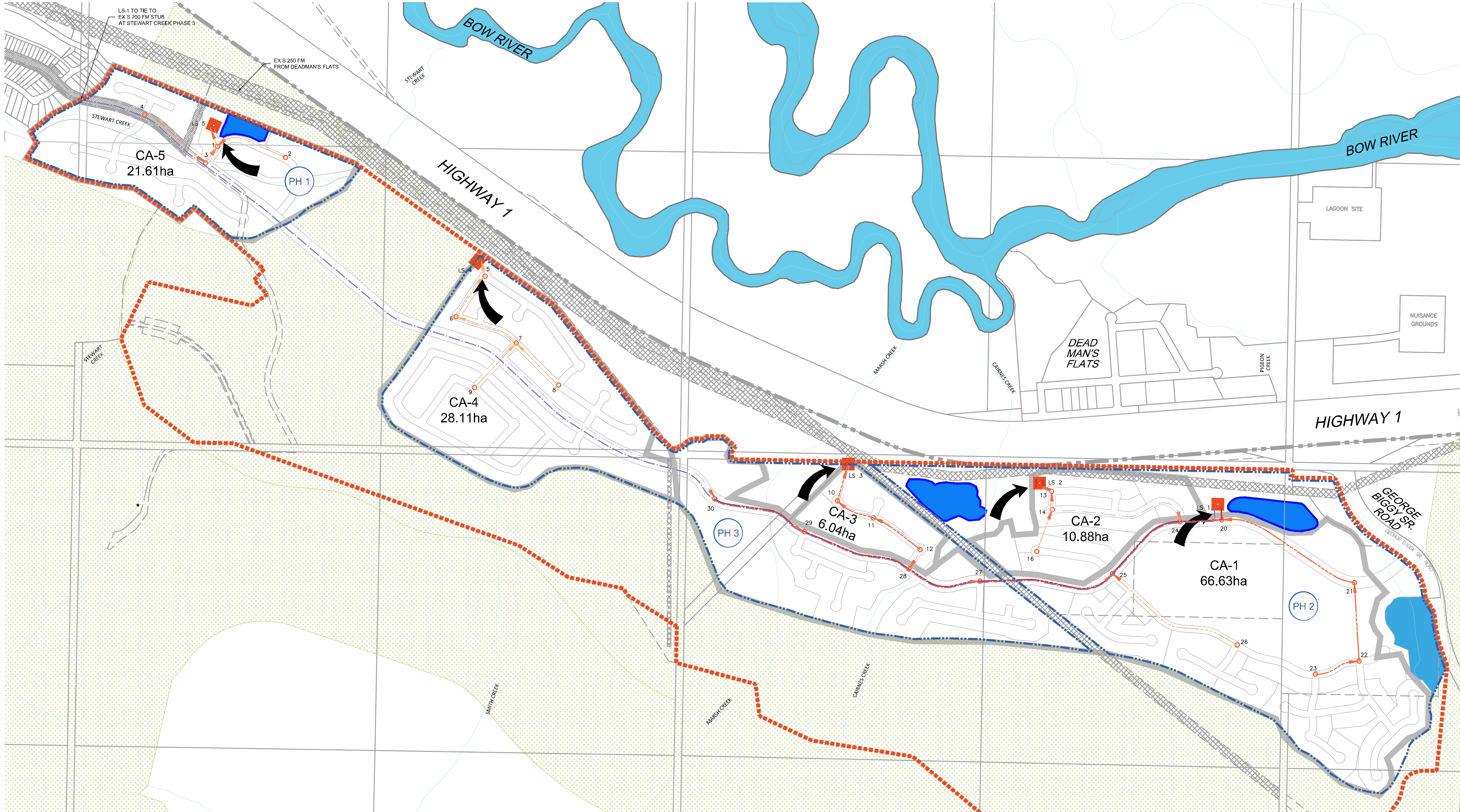
SMITH CREEK - ASP

CONCEPTUAL WATER NETWORK MODEL

SCALE:	DATE:	PROJECT No:	DRAWING No:
NTS	2020-07-29	5215046-000	FIGURE 2.1

Last Saved: 2020-07-29 11:27:37 AM, By: Kennedy, Erin Plot Style: WSP_CAL-2016.ctb
P:\5215046-000 Quantum-Smith Creek ASP\Civil\5000 - Professional Services\5410 - Design-Technical\5414 - Sketches-Figures\2020-07-27_5215046-000_WATR-Concept.dwg

APPENDIX B – CONCEPTUAL SANITARY NETWORK & SANITARY SEWER SPREADSHEET



LEGEND

- SMITH CREEK ASP BOUNDARY
- CANMORE TOWN LIMITS
- PHASE BOUNDARIES
- EXISTING TRANSMISSION R/W
- EXISTING UTILITY R/W
- WILDLIFE CORRIDOR
- CONCEPTUAL LIFT STATION
- INDICATES WHERE THE CATCHMENT AREAS HAVE BEEN ACCOMODATED IN THE SANITARY SEWER SYSTEM
- SANITARY CATCHMENT BOUNDARY
- CONCEPTUAL 200mm SANITARY SEWER
- CONCEPTUAL 250mm SANITARY SEWER
- CONCEPTUAL 300mm SANITARY SEWER
- CONCEPTUAL 150mm SANITARY FORCEMAIN
- CONCEPTUAL 300mm SANITARY FORCEMAIN
- EXISTING 200mm SANITARY FORCEMAIN
- EXISTING 250mm SANITARY FORCEMAIN

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SMITH CREEK - ASP

CONCEPTUAL SANITARY SEWER NETWORK

SCALE:	DATE:	PROJECT No:	DRAWING No:
NTS	2020-07-29	5215046-000	FIGURE 3.1

Design Parameters:

Average Daily Flow	=	360	L/c/d
Average Non-Residential F	=	17,000	L/ha/d
(e.g. Commercial;Retail;Industrial)			
Average Hotel Flow	=	600	L/unit/d
Infiltration Allowance	=	0.28	L/ha/d
Manning's "n"	=	0.013	
Residential Peaking Factor	=	min. 2.5 or (1+14/(4+P^0.5); where p=populations in 1000's	
Comm'l (Non-Resd'l) Peaki	=	3.5	
Hotel Peaking factor	=	4	

SMITH CREEK ASP - PRELIMINARY SANITARY SEWER DESIGN CALCULATION

01-Jun-20

		MANHOLE		Residential Areas										Non-Residential Areas									Pipe Design					
Catchment Area	**Drainage Area Label**	**Upper**	**Lower**	**Added Area (ha)**	**Total Area (ha)**	**Added Units**	**Total Units Added**	**Persons per unit**	**Added Pop. (persons)**	**Total Pop. (persons)**	**Peak Factor**	**Avg. Dry Weather Flow (L/s)**	**Peak Flow (L/s) A**	**Retail Commercial Industrial (ha)**	**Added Flow (L/s)**	**Cumm. Flow (L/s)**	**Added Peak Flow (L/s)**	**Cumm. Peak Flow (L/s) B**	**Infiltration Allowance (L/s) C**	**Peak Dry Weather Flow (L/s) (A+B)**	**Total Design Flow (A+B+C) (L/s)**	**Pipe Slope (%)**	**Full Flow Vel.**	**Pipe Dia. (mm)**	**Pipe Material**	**Pipe Cap. (L/s)**	**% Full**
CA-1	10	30	29	2.410	2.410	97	97	2.100	204	204	4.15	0.85	3.5		0.00	0.00	0.00	0.00	0.67	3.52	4.19	0.900	1.17	200	PVC	36.8	11
	8	29	28	3.760	6.170	85	182	2.800	238	442	4.00	1.84	7.4		0.00	0.00	0.00	0.00	1.73	7.36	9.09	1.900	1.70	200	PVC	53.4	17
		28	27		6.170		182	2.800	0	442	4.00	1.84	7.4		0.00	0.00	0.00	0.00	1.73	7.36	9.09	2.900	2.10	200	PVC	66.0	14
	6,7	27	25	4.690	10.860	118	300	2.800	330	772	3.87	3.22	12.4		0.00	0.00	0.00	0.00	3.04	12.45	15.49	3.900	2.44	200	PVC	76.5	20
	half 3	26	25	3.400	14.260	76	376	2.800	213	985	3.80	4.10	15.6		0.00	0.00	0.00	0.00	3.99	15.61	19.60	1.900	1.70	200	PVC	53.4	37
	half 3	25	24	3.400	17.660	75	451	2.100	158	1142	3.76	4.76	17.9		0.00	0.00	0.00	0.00	4.94	17.91	22.85	2.900	2.10	200	PVC	66.0	35
		24	20		17.660	0	451	2.100	0	1142	3.76	4.76	17.9		0.00	0.00	0.00	0.00	4.94	17.91	22.85	3.900	2.44	200	PVC	76.5	30
	half TL1	23	22	3.620	3.620	82	82	2.100	172	172	4.17	0.72	3.0		0.00	0.00	0.00	0.00	1.01	2.99	4.01	1.000	1.43	250	PVC	70.2	6
	half TL1	22	21	3.610	7.230	80	162	2.100	168	340	4.05	1.42	5.7		0.00	0.00	0.00	0.00	2.02	5.75	7.77	0.900	1.36	250	PVC	66.6	12
	half TL 2	21	20	9.550	16.780	22	184	2.100	46	386	4.03	1.61	6.5	9.550	1.88	1.88	6.58	6.58	4.70	13.06	17.76	0.500	1.01	250	PVC	49.7	36
	half TL 2	20	LS 1	9.550	26.330	21	656	2.100	44	1573	3.66	6.55	24.0	9.550	1.88	3.76	6.58	13.15	7.37	37.17	**44.54**	0.450	1.08	300	PVC	76.6	58
CA-2	5	15	14	3.200	3.200	128	128	2.100	269	269	4.10	1.12	4.6		0.00	0.00	0.00	0.00	0.90	4.59	5.49	0.500	1.14	300	PVC	80.8	7
	4	16	14	4.720	7.920	105	233	2.800	294	563	3.95	2.35	9.3		0.00	0.00	0.00	0.00	2.22	9.26	11.47	1.500	1.98	300	PVC	139.9	8
		14	13		7.920	0	233	2.100	0	563	3.95	2.35	9.3		0.00	0.00	0.00	0.00	2.22	9.26	11.47	0.300	0.89	300	PVC	62.6	18
		13	LS 2		7.920		233	2.100	0	563	3.95	2.35	9.3		0.00	0.00	0.00	0.00	2.22	9.26	**11.47**	1.300	1.84	300	PVC	130.2	9
CA-3	9a	12	11	2.810	2.810	62	62	2.800	174	174	4.17	0.72	3.0		0.00	0.00	0.00	0.00	0.79	3.02	3.80	0.600	1.11	250	PVC	54.4	7
	9b - School	11	10	2.290	5.100		62	2.100	0	174	4.17	0.72	3.0	2.290	0.45	0.45	1.58	1.58	1.43	4.59	6.02	1.600	1.81	250	PVC	88.9	7
		10	LS 3		5.100		62	2.100	0	174	4.17	0.72	3.0		0.00	0.45	0.00	1.58	1.43	4.59	**6.02**	2.600	2.31	250	PVC	113.3	5
CA-4	11	9	7	11.370	11.370	255	255	2.800	714	714	3.89	2.98	11.6		0.00	0.00	0.00	0.00	3.18	11.57	14.76	1.600	1.81	250	PVC	88.9	17
	half 12	8	7	4.150	15.520	94	349	2.800	263	977	3.81	4.07	15.5		0.00	0.00	0.00	0.00	4.35	15.50	19.84	1.000	1.43	250	PVC	70.2	28
	half 12	7	6	4.150	19.670	92	441	2.800	258	1235	3.74	5.15	19.2		0.00	0.00	0.00	0.00	5.51	19.24	24.75	1.500	1.75	250	PVC	86.0	29
		6	5		19.670		441	2.800	0	1235	3.74	5.15	19.2		0.00	0.00	0.00	0.00	5.51	19.24	24.75	2.500	2.26	250	PVC	111.1	22
		5	LS 4		19.670		441	2.800	0	1235	3.74	5.15	19.2		0.00	0.00	0.00	0.00	5.51	19.24	**24.75**	3.500	2.68	250	PVC	131.4	19
CA-5	14,15	4	3	9.320	9.320	248	248	2.100	521	521	3.97	2.17	8.6		0.00	0.00	0.00	0.00	2.61	8.60	11.21	0.800	1.1	200	PVC	34.7	32
		3	1		9.320	0	248	2.100	0	521	3.97	2.17	8.6		0.00	0.00	0.00	0.00	2.61	8.60	11.21	1.000	1.23	200	PVC	38.7	29
	13	2	1	3.830	13.150	85	333	2.100	179	699	3.89	2.91	11.3		0.00	0.00	0.00	0.00	3.68	11.35	15.03	0.400	0.78	200	PVC	24.5	61
		1	LS 5		13.150		333	2.100	0	699	3.89	2.91	11.3		0.00	0.00	0.00	0.00	3.68	11.35	**15.03**	0.400	0.78	200	PVC	24.5	61
																					101.81						

APPENDIX C – WATERCAD MODEL OUTPUT

FlexTable: Pipe Table

Active Scenario: MDD - Dev 1397 - Base Scenario

ID	Label	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
642	P-001	49	N-103	N-104	250.0	0.01	0.00	0.000
954	P-002	108	N-111	N-019	250.0	1.29	0.03	0.004
726	P-003	135	N-089	N-095	250.0	-0.49	0.01	0.001
767	P-004	61	N-060	N-061	250.0	0.00	0.00	0.000
554	P-005	93	N-058	N-047	200.0	-1.44	0.05	0.018
559	P-006	117	N-002	N-071	400.0	11.44	0.09	0.028
557	P-007	32	N-052	N-002	400.0	11.44	0.09	0.028
742	P-008	65	N-082	N-089	250.0	-0.12	0.00	0.000
867	P-009	60	N-076	N-074	250.0	1.51	0.03	0.007
895	P-010	136	N-103	N-096	250.0	0.28	0.01	0.000
565	P-011	197	N-042	N-040	200.0	-0.48	0.02	0.002
481	P-012	39	N-054	N-057	250.0	-0.33	0.01	0.000
613	P-013	148	N-063	N-039	250.0	0.44	0.01	0.001
616	P-014	103	N-022	N-014	250.0	0.44	0.01	0.001
729	P-015	133	N-095	N-088	250.0	-0.85	0.02	0.002
770	P-016	148	N-038	N-060	250.0	0.59	0.01	0.001
675	P-017	60	N-037	N-044	250.0	-0.63	0.01	0.002
478	P-018	33	N-085	N-082	200.0	-0.36	0.01	0.000
480	P-019	39	N-088	N-084	200.0	0.36	0.01	0.000
484	P-020	52	N-030	N-025	200.0	-0.36	0.01	0.000
498	P-021	111	N-013	N-025	200.0	-0.36	0.01	0.001
476	P-022	54	N-010	N-011	200.0	-0.38	0.01	0.003
629	P-023	64	N-023	N-026	200.0	0.38	0.01	0.000
639	P-024	175	N-104	N-099	250.0	-0.60	0.01	0.002
483	P-025	43	N-032	N-029	200.0	0.40	0.01	0.003
759	P-026	89	N-004	N-108	250.0	0.28	0.01	0.000
772	P-027	194	N-108	N-006	250.0	-0.92	0.02	0.003
482	P-028	42	N-090	N-083	200.0	-0.45	0.01	0.000
764	P-029	153	N-061	N-108	250.0	-0.60	0.01	0.001
897	P-030	32	N-081	PRV-2	250.0	0.84	0.02	0.000
898	P-031	187	PRV-2	N-096	250.0	0.84	0.02	0.002
553	P-032	63	N-070	N-058	200.0	-0.54	0.02	0.002
487	P-033	55	N-044	N-048	250.0	-1.02	0.02	0.003
641	P-034	167	N-097	N-103	250.0	0.90	0.02	0.003
477	P-035	37	N-033	N-042	200.0	-0.60	0.02	0.004
486	P-036	52	N-040	N-035	200.0	0.60	0.02	0.006
497	P-037	103	N-034	N-042	200.0	-0.60	0.02	0.004
885	P-038	83	PRV-19	N-082	250.0	0.60	0.01	0.002
884	P-039	40	N-076	PRV-19	250.0	0.60	0.01	0.000
856	P-040	55	N-074	N-068	250.0	-0.31	0.01	0.003
603	P-041	107	N-094	N-091	400.0	-2.73	0.02	0.003
769	P-042	122	N-006	N-038	250.0	1.19	0.02	0.005
500	P-043	118	N-011	N-019	250.0	-0.16	0.00	0.000
628	P-044	65	N-019	N-023	200.0	0.76	0.02	0.007
888	P-045	157	PRV-20	N-059	250.0	-1.57	0.03	0.008
887	P-046	65	N-088	PRV-20	250.0	-1.57	0.03	0.007
636	P-047	49	N-099	N-097	250.0	-1.21	0.02	0.003

FlexTable: Pipe Table

Active Scenario: MDD - Dev 1397 - Base Scenario

ID	Label	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
518	P-048	437	N-077	N-073	200.0	1.43	0.05	0.018
745	P-049	165	N-078	N-004	250.0	0.87	0.02	0.003
556	P-050	103	N-003	N-052	400.0	12.41	0.10	0.033
754	P-051	234	N-024	N-068	250.0	2.37	0.05	0.015
550	P-052	473	N-056	N-041	400.0	14.40	0.11	0.044
551	P-053	58	N-041	N-003	400.0	14.40	0.11	0.043
699	P-054	37	HGL Connection	N-056	400.0	14.40	0.11	0.045
733	P-055	76	N-059	N-046	250.0	-1.93	0.04	0.010
485	P-056	54	N-058	N-052	200.0	0.36	0.01	0.003
739	P-057	161	N-046	N-076	250.0	2.47	0.05	0.017
1022	P-058	51	N-047	N-003	200.0	-1.99	0.06	0.032
751	P-059	158	N-068	N-078	250.0	1.47	0.03	0.007
625	P-060	106	N-011	N-012	250.0	-0.60	0.01	0.001
620	P-061	109	N-020	N-028	250.0	-1.37	0.03	0.005
566	P-062	202	N-040	N-062	200.0	-1.68	0.05	0.024
626	P-063	92	N-012	N-015	250.0	-0.97	0.02	0.002
1045	P-064	93	N-006	N-109	250.0	-2.70	0.05	0.019
1046	P-065	137	N-109	N-024	250.0	-2.70	0.05	0.020
504	P-066	141	N-042	N-052	200.0	-1.33	0.04	0.015
491	P-067	90	N-065	N-075	250.0	-1.80	0.04	0.010
953	P-068	115	N-050	N-111	250.0	1.10	0.02	0.004
623	P-069	63	N-015	N-020	250.0	-1.35	0.03	0.007
815	P-070	225	N-073	N-077	400.0	-12.67	0.10	0.034
560	P-071	35	N-071	N-072	400.0	-13.35	0.11	0.038
814	P-072	50	N-072	N-073	400.0	-13.35	0.11	0.038
900	P-073	29	N-094	PRV-3	250.0	2.73	0.06	0.020
901	P-074	194	PRV-3	N-097	250.0	2.73	0.06	0.020
544	P-075	196	N-102	N-071	400.0	-24.79	0.20	0.120
568	P-076	295	N-102	N-098	400.0	24.79	0.20	0.119
572	P-077	694	N-098	N-100	400.0	24.79	0.20	0.119
575	P-078	432	N-100	N-101	400.0	24.79	0.20	0.120
578	P-079	592	N-101	N-105	400.0	24.79	0.20	0.119
581	P-080	536	N-105	N-106	400.0	24.79	0.20	0.120
644	P-081	169	N-111	N-020	250.0	-0.57	0.01	0.002
490	P-082	87	N-062	N-077	200.0	-2.28	0.07	0.043
738	P-083	122	N-025	N-046	250.0	4.76	0.10	0.055
1019	P-084	46	PRV-37	N-091	400.0	7.19	0.06	0.013
1018	P-085	510	N-106	PRV-37	400.0	7.19	0.06	0.012
702	P-086	322	N-077	N-080	400.0	-17.12	0.14	0.060
836	P-087	316	N-080	PRV-1	400.0	-17.12	0.14	0.060
837	P-088	90	PRV-1	N-074	400.0	-17.12	0.14	0.060
645	P-089	72	N-020	N-018	250.0	-0.94	0.02	0.002
708	P-090	293	N-074	N-021	400.0	-15.30	0.12	0.049
757	P-091	78	N-017	N-024	250.0	5.67	0.12	0.077
1020	P-092	103	N-016	N-018	250.0	1.31	0.03	0.006
893	P-093	27	N-069	PRV-22	250.0	1.82	0.04	0.011

FlexTable: Pipe Table

Active Scenario: MDD - Dev 1397 - Base Scenario

ID	Label	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
894	P-094	33	PRV-22	N-064	250.0	1.82	0.04	0.009
860	P-095	55	N-025	N-021	250.0	-5.85	0.12	0.084
756	P-096	52	N-021	N-017	250.0	6.26	0.13	0.092
615	P-097	106	N-016	N-022	250.0	-1.75	0.04	0.008
695	P-098	153	N-083	N-069	250.0	2.27	0.05	0.014
503	P-099	129	N-079	N-063	250.0	-1.55	0.03	0.007
683	P-100	165	N-051	N-065	250.0	2.41	0.05	0.016
680	P-101	61	N-005	N-051	250.0	2.74	0.06	0.019
493	P-102	85	N-027	N-022	250.0	2.64	0.05	0.018
600	P-103	419	N-091	N-087	400.0	2.23	0.02	0.001
692	P-104	100	N-093	N-083	250.0	3.17	0.06	0.027
1036	P-105	181	N-007	N-005	250.0	3.08	0.06	0.025
612	P-106	55	N-066	N-063	250.0	2.43	0.05	0.016
890	P-107	60	N-093	PRV-21	250.0	-3.62	0.07	0.032
891	P-108	62	PRV-21	N-043	250.0	-3.62	0.07	0.034
674	P-109	89	N-032	N-037	250.0	3.24	0.07	0.029
495	P-110	97	N-037	N-007	250.0	3.47	0.07	0.031
651	P-111	125	N-028	N-050	400.0	3.33	0.03	0.004
1021	P-112	164	N-053	N-066	250.0	2.87	0.06	0.022
593	P-113	184	N-067	N-086	400.0	0.00	0.00	0.000
594	P-114	49	N-086	N-092	400.0	0.00	0.00	0.000
597	P-115	56	N-087	N-092	400.0	0.00	0.00	0.000
907	P-116	37	PRV-4	N-067	400.0	0.00	0.00	0.000
906	P-117	41	N-050	PRV-4	400.0	0.00	0.00	0.000
671	P-118	60	N-036	N-032	250.0	3.64	0.07	0.032
584	P-119	229	N-106	N-107	400.0	17.60	0.14	0.064
585	P-120	23	N-107	N-001	400.0	17.60	0.14	0.064
687	P-121	64	N-057	N-053	250.0	3.20	0.07	0.026
668	P-122	55	N-043	N-036	250.0	4.04	0.08	0.041
686	P-123	79	N-065	N-057	250.0	3.87	0.08	0.038
714	P-124	362	N-021	N-031	400.0	-27.41	0.22	0.144
650	P-125	232	N-027	N-028	400.0	6.93	0.06	0.011
717	P-126	116	N-031	N-049	400.0	-29.11	0.23	0.162
718	P-127	134	N-049	N-045	400.0	-29.11	0.23	0.161
608	P-128	71	N-081	N-079	400.0	8.89	0.07	0.017
659	P-129	74	N-048	N-055	400.0	11.40	0.09	0.028
662	P-130	30	N-055	N-064	400.0	11.40	0.09	0.030
656	P-131	194	N-043	N-048	400.0	12.42	0.10	0.033
666	P-132	371	N-075	N-081	400.0	10.86	0.09	0.026
919	P-133	37	PMP-4	N-027	400.0	10.00	0.08	0.024
1007	P-134	244	N-079	N-110	400.0	10.00	0.08	0.023
1008	P-135	48	N-110	PMP-4	400.0	10.00	0.08	0.022
665	P-136	209	N-064	N-075	400.0	13.22	0.11	0.037
653	P-137	60	N-045	N-043	400.0	20.08	0.16	0.082
700	P-138	55	New Reservoir	N-008	450.0	49.19	0.31	0.240
775	P-139	80	N-008	N-009	450.0	49.19	0.31	0.239

FlexTable: Pipe Table

Active Scenario: MDD - Dev 1397 - Base Scenario

ID	Label	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Flow (L/s)	Velocity (m/s)	Headloss Gradient (m/km)
776	P-140	375	N-009	N-045	450.0	49.19	0.31	0.240

FlexTable: Junction Table

Active Scenario: MDD - Dev 1397 - Base Scenario

ID	Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
547	N-001	1,295.43	17.60	1,396.62	144
537	N-002	1,359.71	0.00	1,396.97	53
536	N-003	1,364.37	0.00	1,396.98	46
528	N-004	1,361.01	0.59	1,410.77	71
522	N-005	1,364.60	0.33	1,410.86	66
510	N-006	1,374.69	0.59	1,410.77	51
496	N-007	1,373.32	0.40	1,410.86	53
473	N-008	1,409.05	0.00	1,410.99	3
472	N-009	1,397.17	0.00	1,410.97	20
471	N-010	1,390.10	0.38	1,425.83	51
470	N-011	1,388.73	0.38	1,425.83	53
469	N-012	1,385.36	0.38	1,425.83	57
468	N-013	1,380.67	0.36	1,410.78	43
467	N-014	1,379.83	0.44	1,425.83	65
466	N-015	1,378.66	0.38	1,425.83	67
465	N-016	1,378.57	0.44	1,425.83	67
463	N-017	1,377.54	0.59	1,410.78	47
462	N-018	1,376.00	0.38	1,425.83	71
461	N-019	1,375.82	0.38	1,425.83	71
460	N-020	1,375.38	0.38	1,425.83	72
459	N-021	1,374.65	0.00	1,410.79	51
458	N-022	1,374.57	0.44	1,425.83	73
457	N-023	1,374.04	0.38	1,425.83	74
456	N-024	1,372.13	0.59	1,410.77	55
455	N-025	1,371.87	0.36	1,410.78	55
454	N-026	1,371.10	0.38	1,425.83	78
453	N-027	1,370.49	0.44	1,425.83	79
452	N-028	1,370.42	2.23	1,425.83	79
451	N-029	1,369.12	0.40	1,410.87	59
449	N-030	1,368.81	0.36	1,410.78	60
448	N-031	1,368.69	1.70	1,410.84	60
447	N-032	1,367.08	0.00	1,410.87	62
446	N-033	1,366.88	0.60	1,396.97	43
445	N-034	1,365.91	0.60	1,396.97	44
444	N-035	1,365.77	0.60	1,396.97	44
443	N-036	1,365.58	0.40	1,410.87	64
442	N-037	1,365.54	0.40	1,410.87	64
441	N-038	1,365.41	0.59	1,410.77	64
440	N-039	1,365.22	0.44	1,410.85	65
439	N-040	1,364.90	0.60	1,396.97	46
438	N-041	1,364.37	0.00	1,396.98	46
437	N-042	1,364.30	0.60	1,396.97	46
435	N-043	1,363.21	0.00	1,410.87	68
434	N-044	1,363.17	0.40	1,410.87	68
433	N-045	1,362.61	0.00	1,410.88	69
432	N-046	1,362.18	0.36	1,410.77	69
431	N-047	1,361.80	0.54	1,396.97	50

FlexTable: Junction Table

Active Scenario: MDD - Dev 1397 - Base Scenario

ID	Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
430	N-048	1,361.57	0.00	1,410.87	70
429	N-049	1,361.57	0.00	1,410.86	70
428	N-050	1,360.40	2.23	1,425.83	93
427	N-051	1,359.72	0.33	1,410.86	73
426	N-052	1,359.71	0.00	1,396.97	53
425	N-053	1,359.52	0.33	1,410.85	73
423	N-054	1,357.43	0.33	1,410.85	76
422	N-055	1,357.11	0.00	1,410.86	76
421	N-056	1,357.01	0.00	1,397.00	57
420	N-057	1,356.92	0.33	1,410.85	77
418	N-058	1,356.84	0.54	1,396.97	57
417	N-059	1,356.83	0.36	1,410.77	77
416	N-060	1,355.98	0.59	1,410.77	78
415	N-061	1,355.64	0.59	1,410.77	78
414	N-062	1,355.63	0.60	1,396.97	59
413	N-063	1,355.46	0.44	1,410.85	79
412	N-064	1,355.44	0.00	1,410.86	79
411	N-065	1,355.05	0.33	1,410.85	79
410	N-066	1,354.88	0.44	1,410.85	79
409	N-067	1,354.53	0.00	1,396.63	60
408	N-068	1,353.60	0.59	1,410.77	81
407	N-069	1,353.16	0.45	1,410.86	82
406	N-070	1,352.59	0.54	1,396.97	63
405	N-071	1,352.40	0.00	1,396.97	63
404	N-072	1,352.18	0.00	1,396.97	64
403	N-073	1,351.71	0.74	1,396.97	64
402	N-074	1,351.24	0.00	1,410.77	84
401	N-075	1,349.82	0.56	1,410.86	87
400	N-076	1,349.33	0.36	1,410.77	87
399	N-077	1,348.21	0.74	1,396.98	69
398	N-078	1,347.81	0.59	1,410.77	89
397	N-079	1,346.69	0.44	1,410.84	91
396	N-080	1,344.74	0.00	1,397.00	74
395	N-081	1,344.71	1.12	1,410.85	94
394	N-082	1,341.74	0.36	1,410.77	98
392	N-083	1,340.99	0.45	1,410.87	99
391	N-084	1,340.36	0.36	1,410.77	100
390	N-085	1,339.90	0.36	1,410.77	101
389	N-086	1,339.89	0.00	1,396.63	81
388	N-087	1,339.59	2.23	1,396.63	81
387	N-088	1,339.12	0.36	1,410.77	102
386	N-089	1,338.39	0.36	1,410.77	103
385	N-090	1,338.37	0.45	1,410.87	103
384	N-091	1,337.34	2.23	1,396.63	84
383	N-092	1,336.21	0.00	1,396.63	86
382	N-093	1,335.76	0.45	1,410.87	107
381	N-094	1,332.77	0.00	1,396.63	91

FlexTable: Junction Table

Active Scenario: MDD - Dev 1397 - Base Scenario

ID	Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (psi)
379	N-095	1,330.41	0.36	1,410.77	114
378	N-096	1,330.02	1.12	1,370.01	57
376	N-097	1,326.87	0.61	1,370.01	61
375	N-098	1,323.77	0.00	1,396.91	104
373	N-099	1,320.90	0.61	1,370.01	70
372	N-100	1,318.70	0.00	1,396.83	111
370	N-101	1,313.52	0.00	1,396.77	118
369	N-102	1,313.21	0.00	1,396.94	119
368	N-103	1,312.61	0.61	1,370.01	81
367	N-104	1,308.90	0.61	1,370.01	87
366	N-105	1,305.21	0.00	1,396.70	130
364	N-106	1,296.47	0.00	1,396.64	142
362	N-107	1,295.43	0.00	1,396.62	144
361	N-108	1,366.54	0.59	1,410.77	63
1044	N-109	1,382.85	0.00	1,410.77	40
1006	N-110	1,364.27	0.00	1,410.84	66
952	N-111	1,368.84	0.38	1,425.83	81

Fire Flow Node FlexTable: Fire Flow Report

Active Scenario: MDD+FF Dev 1395 - Base Scenario

Label	Zone	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (L/s)	Fire Flow (Available) (L/s)	Pressure (Calculated Residual) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Junction w/ Minimum Pressure (System)	Is Fire Flow Run Balanced?
N-001	D	True	244.60	250.00	130	41	N-034	N-008	True
N-004	B	True	85.00	200.00	51	25	N-109	N-008	True
N-005	B	True	85.00	200.00	53	36	N-109	N-008	True
N-006	B	True	85.00	200.00	32	23	N-109	N-008	True
N-007	B	True	85.00	200.00	43	36	N-109	N-008	True
N-010	A	True	85.00	200.00	54	69	N-011	N-008	True
N-011	A	True	85.00	200.00	69	67	N-010	N-008	True
N-012	A	True	85.00	200.00	74	69	N-010	N-008	True
N-013	B	True	85.00	147.94	20	34	N-109	N-008	True
N-014	A	True	85.00	200.00	78	74	N-010	N-008	True
N-015	A	True	85.00	200.00	85	71	N-010	N-008	True
N-016	A	True	85.00	200.00	86	74	N-010	N-008	True
N-017	B	True	85.00	200.00	35	29	N-109	N-008	True
N-018	A	True	85.00	200.00	91	73	N-010	N-008	True
N-019	A	True	85.00	200.00	88	69	N-010	N-008	True
N-020	A	True	85.00	200.00	93	72	N-010	N-008	True
N-022	A	True	85.00	200.00	94	74	N-010	N-008	True
N-023	A	True	85.00	200.00	75	69	N-010	N-008	True
N-024	B	True	85.00	200.00	42	27	N-109	N-008	True
N-025	B	True	85.00	200.00	43	30	N-109	N-008	True
N-026	A	True	85.00	200.00	64	69	N-010	N-008	True
N-027	A	True	200.00	250.00	94	66	N-010	N-008	True
N-028	A	True	200.00	250.00	91	64	N-010	N-008	True
N-029	B	True	85.00	200.00	42	36	N-109	N-008	True
N-030	B	True	85.00	200.00	35	30	N-109	N-008	True
N-031	B	True	85.00	200.00	54	34	N-109	N-008	True
N-032	B	True	85.00	200.00	55	36	N-109	N-008	True
N-034	D	True	85.00	137.65	20	35	N-042	N-008	True
N-035	D	True	85.00	153.04	20	29	N-040	N-008	True

Fire Flow Node FlexTable: Fire Flow Report

Active Scenario: MDD+FF Dev 1395 - Base Scenario

Label	Zone	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (L/s)	Fire Flow (Available) (L/s)	Pressure (Calculated Residual) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Junction w/ Minimum Pressure (System)	Is Fire Flow Run Balanced?
N-036	B	True	85.00	200.00	58	36	N-109	N-008	True
N-037	B	True	85.00	200.00	57	36	N-109	N-008	True
N-038	B	True	85.00	200.00	41	24	N-109	N-008	True
N-039	B	True	85.00	200.00	40	36	N-109	N-008	True
N-040	D	True	85.00	196.99	21	20	N-035	N-008	True
N-042	D	True	85.00	200.00	26	24	N-034	N-008	True
N-044	B	True	85.00	200.00	61	36	N-109	N-008	True
N-046	B	True	85.00	200.00	56	30	N-109	N-008	True
N-047	D	True	85.00	200.00	40	40	N-034	N-008	True
N-050	A	True	200.00	250.00	104	63	N-010	N-008	True
N-051	B	True	85.00	200.00	61	36	N-109	N-008	True
N-053	B	True	85.00	200.00	60	36	N-109	N-008	True
N-054	B	True	85.00	200.00	61	36	N-109	N-008	True
N-057	B	True	85.00	200.00	65	36	N-109	N-008	True
N-058	D	True	85.00	200.00	47	40	N-034	N-008	True
N-059	B	True	85.00	200.00	60	30	N-109	N-008	True
N-060	B	True	85.00	200.00	54	24	N-109	N-008	True
N-061	B	True	85.00	200.00	55	24	N-109	N-008	True
N-062	D	True	85.00	200.00	43	33	N-035	N-008	True
N-063	B	True	85.00	200.00	65	36	N-109	N-008	True
N-065	B	True	85.00	200.00	70	36	N-109	N-008	True
N-066	B	True	85.00	200.00	66	36	N-109	N-008	True
N-068	B	True	85.00	200.00	69	28	N-109	N-008	True
N-069	B	True	200.00	237.73	71	35	N-109	N-008	True
N-070	D	True	85.00	200.00	38	40	N-034	N-008	True
N-073	D	True	85.00	200.00	60	40	N-034	N-008	True
N-077	D	True	85.00	200.00	65	40	N-034	N-008	True
N-078	B	True	85.00	200.00	72	26	N-109	N-008	True
N-079	B	True	200.00	237.82	78	35	N-109	N-008	True

Fire Flow Node FlexTable: Fire Flow Report

Active Scenario: MDD+FF Dev 1395 - Base Scenario

Label	Zone	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (L/s)	Fire Flow (Available) (L/s)	Pressure (Calculated Residual) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Junction w/ Minimum Pressure (System)	Is Fire Flow Run Balanced?
N-081	B	True	200.00	237.82	81	35	N-109	N-008	True
N-082	B	True	85.00	200.00	81	30	N-109	N-008	True
N-084	B	True	85.00	200.00	70	30	N-109	N-008	True
N-085	B	True	85.00	200.00	75	30	N-109	N-008	True
N-086	D	True	200.00	250.00	76	41	N-034	N-008	True
N-087	D	True	200.00	250.00	76	41	N-034	N-008	True
N-088	B	True	85.00	200.00	81	30	N-109	N-008	True
N-089	B	True	85.00	200.00	84	30	N-109	N-008	True
N-090	B	True	85.00	200.00	83	36	N-109	N-008	True
N-091	D	True	200.00	250.00	76	41	N-034	N-008	True
N-092	D	True	200.00	250.00	81	41	N-034	N-008	True
N-093	B	True	200.00	237.74	95	35	N-109	N-008	True
N-094	D	True	200.00	250.00	82	41	N-034	N-008	True
N-095	B	True	85.00	200.00	94	30	N-109	N-008	True
N-096	E	True	85.00	200.00	51	58	N-097	N-008	True
N-097	E	True	85.00	200.00	55	54	N-096	N-008	True
N-099	E	True	85.00	200.00	62	54	N-096	N-008	True
N-103	E	True	85.00	200.00	75	53	N-096	N-008	True
N-104	E	True	85.00	200.00	79	53	N-096	N-008	True
N-108	B	True	85.00	200.00	43	24	N-109	N-008	True
N-109	B	True	85.00	200.00	22	33	N-013	N-008	True
N-111	A	True	85.00	200.00	101	72	N-010	N-008	True

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