Town of Canmore

2022 Utility Master Plan

CAP 7203 C04-00496

Feb 2024

Town of Canmore

2022 Utility Master Plan

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Review and submission register			
Review No.	Reviewed by	Date	Description of the change or submission
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FINAL	JP / SD	June 5, 2023	Final Report
FINAL Rev 2	JP / SD	Dec. 12, 2023	Minor Revisions to Final Report
FINAL Rev 3	JP / SD	Feb 14, 2024	Revision to Project EX W1 cost share

Executive Summary

Introduction

In March 2022, the Town of Canmore retained CIMA+ to prepare an updated Utility Master Plan (UMP). This Utility Master Plan update will encompass a review of the water and wastewater infrastructure under existing conditions and constraints, as well as under future demands at growth projections of 5, 15, and 25 years.

This Utility Master Plan will assess the following infrastructure elements:

+ Wastewater collection and transmission
+ Water supply, treatment, storage and distribution

This report was developed to assist the Town's administrators to direct and plan for development, improve system utilization and plan for future upgrades. This study will also assist the Town's Administrators to develop projects that will apply to the Town's Offsite Levy Model.

A collection of existing infrastructure plans, studies and planning documents have been reviewed and incorporated into this study.

The stated objectives of the Utility Master Plan are as follows:

+ To conduct a detailed assessment of the existing water and sanitary systems' capacities. This will be done using real and historical data collected from the Town of Canmore's facilities and networks.
+ To identify system deficiencies and provide recommendations for system improvements.
+ To develop a servicing strategy for future growth and development for the 5 Year, 15 Year, and 25 Year growth scenarios.
+ To develop a list of capital projects that serve to improve system resiliency and facilitate development. The list will include a high–level estimated cost, an approximate timeline for implementation over the planning period, and inform on the application of these projects to the Town's Offsite Levy Model.

Methodology

The following methodology was used to meet the objectives of the UMP:

+ Work with the Town of Canmore to establish the projected growth in the Town over the next 25 years and establish the expected locations and gross developable area of the projected growth. These growth projections needed to align with the Town's Offsite Levy Model, with discrete growth in each of the 17 Offsite Levy Areas in the Town.
    - Participate in round-table meetings with members of BOWDA (Bow Valley Builders and Developers Association). This input was taken into consideration when preparing the Growth Projections and Design Basis Memo
+ Collect and review historical data and onsite measurements. SCADA logs of facilities were collected and processed to extract data-driven demand information used to populate the hydraulic models.

  - Analyze customer water meter demands for periodic demand information and assign water model demands to the specific locations throughout the Town.
  - Review lift station draw down tests, water distribution meter data, water service meter data, meter reading routes and other available data.
  - Install a total of 5 temporary wastewater flow monitors, which in tandem with lift stations with flow meters, were used to chart the flows in the wastewater system during dry weather and wet weather / high groundwater periods.
- Create/update hydraulic models for the water and wastewater systems that reflect the existing systems. This was completed using information from the Town's previous water model, the Town's GIS system and record drawings.
  - New in this version of the Utility Master Plan - the wastewater hydraulic model was updated to an extended period simulation to better account for inflow and infiltration's affect on the Town's existing system.
- Conduct a capacity evaluation of the Wastewater Treatment Plant to inform this Utility Master Plan on any limitations of the existing facility to service future populations, performed as a separate submission.
- Evaluate the existing systems against design criteria established with the Town and utility operators to identify deficiencies.
- Expand the hydraulic model to service future developments and identify utility improvements required to support growth and development
- Provide a prioritized list of required projects along with cost estimates, project triggers, and forecasted need.

Water System

The Town of Canmore has two primary water sources; two deep wells which supply ground water to the Pumphouse 1 Treatment Plant, and surface water from the Rundle Forebay which supplies the Pumphouse 2 Treatment Plant.

The treated water is then stored and distributed from five storage reservoirs and five pump stations / booster stations. The distribution system is divided into three supply areas: Western, Central, and Eastern.

The distribution system can be further divided into a total of 18 pressure zones, which are controlled through Pressure Reducing Valves (PRVs) and pump stations.

Wastewater System

The existing wastewater infrastructure has four main components; gravity (manholes and pipes), pumping (lift stations), pressure (forcemains) and treatment. These four systems all operate in conjunction to collect and treat the wastewater at the wastewater treatment plant and ultimately discharge clean water to the Bow River.

The first component of the system is the gravity system which collects the wastewater from its many sources (residential, institutional, commercial and industrial). The gravity system starts at the private property line where services are collected and conveys it through a pipe and manhole system to a lift station at the low point. The gravity pipes are mostly PVC with some sections of concrete, steel and unknown (unconfirmed) materials. The pipe diameters range from 100mm to 600mm.

In addition to the gravity collection system, there are a number of low pressure forcemain systems with individual grinder pumps at each service. These low pressure systems typically discharge into the gravity collection system.

The second component of the piped system are the forcemains. The forcemains convey the wastewater from a series of lift stations to the wastewater treatment plant. The forcemains are mostly made of PVC and HDPE pipe, though some sections of forcemain are unknown (unconfirmed). The size of the forcemains range in diameter from 100 mm to 500 mm.

The third component of the wastewater system are the 13 lift stations operated by the Town of Canmore.

The final component of the wastewater system is wastewater treatment plant. A full wastewater treatment plant assessment and capacity evaluation was performed in tandem with the UMP.

To determine wastewater flow generation rates, diurnal usage patterns, and assess groundwater infiltration and rainfall derived infiltration, a flow monitoring program was developed. Inline flow monitors were installed in key locations.

A total of 5 flow monitors were installed across the Town of Canmore, which in tandem with lift stations that have flow meters installed on their discharge, was used to chart the flows in the wastewater system during dry weather and wet weather periods. The flow monitors were in place from April 12, 2022 to July 20, 2022.

Generally, it was observed that the Town is split into two areas with different wet weather influences. The valley bottom, generally bounded by the Bow River to the southwest, and Highway 1 to the northeast, is influenced through inflow and infiltration into the system by ground water, which raises significantly during the spring snow melt.

The valley slopes, generally bounded by being southwest of the Bow River, and northeast of Highway 1, have minimal groundwater influence. Inflow and infiltration would be caused by rain events, with runoff water entering the system through manholes and some pipe infiltration from local soil saturation.

Water System Projects

A total of 16 water system projects were identified to meet the Town’s service criteria, support future growth, or will need to be replaced due to aging infrastructure. They are summarized as follows:

Projects recommended to meet recommended service criteria:

+ EX W1 – Grassi Booster Station Capacity Upgrade (Phase 1)
+ EX W2 – WTP2 Upgrades. Backwash Water Reuse
+ W1 – TeePee Town Water Line Upgrade

+ W3 – Canyon Ridge Booster Station Decommissioning

Projects recommended to support growth and development:

+ W2 – Smith Creek Reservoir and Booster Station
+ W4 – Silvertip Trail Looping
+ W6 – Grassi Booster Station Waterline Twinning
+ W7 – Grassi Storage Reservoir Capacity Upgrade
+ W8 – Grassi Booster Station Capacity Upgrade (Phase 2)
+ W9 – Smith Creek Booster Station Upgrade (Phase 2)

Projects recommended due to end of estimated service life:

The following project were identified because the pipes will exceed the anticipated 75-year life span before the 25-year horizon considered in this report.

+ EX W3 – PumpHouse #1 Gas Chlorine Disinfection Replacement to Liquid Chlorine
+ W10 – South Canmore Waterline Replacement
+ W11 – Downtown Canmore Waterline Replacement
+ W12 – 7th Avenue Waterline Replacement
+ W13 – Rundle Waterline Replacement
+ W14 – TeePee Town / Railway Ave Waterline Replacement

Wastewater System Projects

A total of 11 wastewater system projects were identified to meet the Town's service criteria, support future growth, or will need to be replaced due to aging infrastructure. They are summarized as follows:

Projects recommended to meet recommended service criteria:

+ EX S1 – Lift Station 3 Replacement

Projects recommended to support growth and development:

+ S1 – Bow Valley Trail Sewer Upgrade
+ S2 – Lift Station Upgrade Phase 1
+ S3 – Lift Station 8 Upgrade
+ S4 – Lift Station 10 Upgrade
+ S5 – Lift Station 11 Upgrade

Projects recommended due to end of estimated service life:

+ S6 – South Canmore Sewer Line Replacement
+ S7 – Downtown Canmore Sewer Line Replacement
+ S8 – 7th Avenue Sewer Line Replacement
+ S9 – Rundle Sewer Line Replacement

+ S10 – TeePee Town / Railway Ave / Bow Valley Trail Sewer Line Replacement

Previous UMP Projects

The following major projects have been completed or are currently underway since identified in the 2016 Utility Master Plan.

+ Project WW1 – LS2 Upgrade
+ Project WW2 – LS6 Upgrade
+ Project WW10 – BVT at Benchlands Trail
+ Project W1 and W2 – Pumphouse 2 Upgrade
+ Project W7 – South Bow River Loop
+ Project W8 – Spring Creek Loop
+ Project W9 – Hubman Water Pressure / PRV

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1. Introduction

1.1 Authorization and Terms of Reference

In March 2022, the Town of Canmore retained CIMA+ to prepare an updated Utility Master Plan (UMP). This Utility Master Plan update will encompass a review of the water and wastewater infrastructure under existing conditions and constraints, as well as under future demands at growth projections of 5, 15, and 25 years.

This Utility Master Plan will assess the following infrastructure elements:

+ Wastewater collection and transmission
+ Water supply, treatment, storage and distribution

1.2 Background

This report was developed to assist the Town's administrators to direct and plan for development, improve system utilization and plan for future upgrades. This study will also assist the Town's Administrators to develop projects that will apply to the Town's Offsite Levy Model.

A collection of existing infrastructure plans, studies and planning documents have been reviewed and incorporated into this study.

1.3 Objectives

The stated objectives of the Utility Master Plan are as follows:

+ To conduct a detailed assessment of the existing water and sanitary systems' capacities. This will be done using real and historical data collected from the Town of Canmore's facilities and networks.
+ To identify system deficiencies and provide recommendations for system improvements.
+ To develop a servicing strategy for future growth and development for the 5 Year, 15 Year, and 25 Year growth scenarios.
+ To develop a list of capital projects that serve to improve system resiliency and facilitate development. The list will include a high–level estimated cost, an approximate timeline for implementation over the planning period, and inform on the application of these projects to the Town's Offsite Levy Model.

2. Growth and Development Analysis

In order to assist the development of the Utility Master Plan, a technical memo outlining the growth projections and water and wastewater demands design basis was prepared and finalized in May 2022. The full memo can be found in Appendix A – Growth Projections and Design Basis Memo.

2.1 Summary of Existing Planning Documents

CIMA+ reviewed available planning documents and discussed growth goals with Town staff to better understand the development goals for the study area. The following planning documents and studies were reviewed:

- Town of Canmore UMP Report Final (EPCOR- December 2010)
- Town of Canmore UMP Report 2016 (CIMA+)
- Town of Canmore Sanitary Master Plan (Stantec - June 2010)
- Municipal Census (various years)
- Town of Canmore – Engineering Design & Construction Guidelines
- Area Structure Plans
  - Stewart Creek
  - Indian Flats
  - Silvertip
  - Three Sisters Village
  - Smith Creek
- Area Restructure Plans
  - Bow Valley Trail
  - Spring Creek
  - TeePee Town

2.2 Growth Areas and Projections

CIMA+ worked with the Town of Canmore's planning staff to establish the anticipated growth in the Town over the next 25 years and delineate the expected locations and gross developable area of the projected growth. The growth projections are intended to be very high level and are not intended to anticipate the precise locations of growth in each Offsite Levy Area.

These growth projections align with the Town's Offsite Levy Model, with discrete growth in each of the 17 Offsite Levy Areas in the Town.

Growth was divided into three horizons, 5 Years, 15 Years, and 25 Years.

The projected growth is established as units of the following land use types:

+ Industrial, Commercial, Institutional (ICI)
+ Hotels
+ Low Density Residential
+ Medium / High Density Residential

ICI and Hotel land uses do not have a population equivalent assigned to them, and as such water and wastewater demands will be assigned on a per unit basis.

Residential land uses are assumed to have 2.5 people per unit, which is consistent with the previous UMP and previous planning directives from the Town. This includes non-permanent occupancy along with full time residents. Water and wastewater demands for these land uses will be assigned on a per capita basis.

Each land use type has an associated per unit density, in order to determine the gross developable area. The densities, in units per hectare, are as follows:

Table 2-1 Land Use Unit Densities

Land Use	Units Per Hectare
Industrial, Commercial, Institutional (ICI)	37
Hotels	109
Residential - Low Density	14
Residential - Medium / High Density	43

The following table shows the projected growth for each land use type, for each growth horizon. The projected growth in each offsite levy area can be found in Appendix A – Growth Projections and Design Basis Memo.

Figures showing the projected growth in each offsite levy area for each growth horizon can be found in Appendix B – Figures G1 to G3

Table 2-2 Growth Projections Summary

Land Use	5 Year	15 Year	25 Year
	Units	Units	Units
ICI	319	575	938
Hotels	1,104	2,325	3,545
Residential - Low Density	186	478	770
Residential - Medium / High Density	1,060	2,499	3,937
Total	**2,669**	**5,877**	**9,190**

The gross developable areas for each land use type, under each growth horizon, are summarized in the following table:

Table 2-3 Gross Developable Area Summary

Land Use	5 Year	15 Year	25 Year
	Area (ha)	Area (ha)	Area (ha)
ICI	8.5	16.8	25.1
Hotels	10.1	21.3	32.5
Residential - Low Density	13.1	33.7	54.2
Residential - Medium / High Density	24.5	57.7	90.9
Total	**56.2**	**129.5**	**202.7**

2.3 Development Community Engagement

To facilitate consensus on the growth projections and design basis with the Canmore area development community, CIMA+ and the Town of Canmore held roundtable meetings with members of BOWDA (Bow Valley Builders and Developers Association).

In these discussions, the methodology of developing the growth projections and design basis was outlined to BOWDA, whose members provided feedback and comments. This input was taken into consideration when preparing the Growth Projections and Design Basis Memo.

2.4 Offsite Levy Cost Allocation Methodology

To determine cost allocation for projects recommended in the UMP which feed into the offsite levy model, a cost allocation strategy needed to be created. This should account for projects that are initiated by development, whether existing areas benefit directly from the upgrades, and the impact that remaining lifecycle of existing infrastructure has on the cost allocation.

The two primary project elements are:

+ Facilities, such as wastewater lift stations, and water pump stations
+ Linear infrastructure, such as wastewater lines, water lines, and related appurtenances

The cost sharing methodology will have two components when an asset is considered for replacement due to growth. The first component will consider the costs of replacing an existing asset, like for like, and will be known as the “Base Cost”. This involves performing a residual value calculation based on remaining asset lifecycle. The reasoning behind this is that without growth triggering an asset replacement, the Town would not have to incur any capital costs until the end of its lifecycle. The newer the asset is, the larger the share of the cost of replacement should be borne by developers. Facilities are estimated to have a total life cycle of 50 years. Linear infrastructure has a lifecycle of 75 years.

The residual value of the asset is the ratio of the service life remaining to the life span of the asset, multiplied by the base cost, and is the developer’s share of the cost. The inverse of this is the Town’s share.

The second component will consider the full upgrade cost of the asset, and will be known as the “Upgrade Cost”. The difference between the Town’s share of the Base Cost, and the Upgrade Cost, will be fully borne by developers. The reasoning behind this is that these are costs that would not need to be incurred by the Town without growth.

The formula for the cost sharing methodology is as follows:

$$UpgradeCost - \left(1 - \frac{ServiceLifeRemaining}{LifeSpan}\right) * Basecost = DeveloperCost$$

Calculation Example

A 25 year old 200 mm water line is recommended to be upgraded to 300 mm in order to service future growth. A direct replacement with a new 200 mm water line is estimated to cost $1,000,000, and the upgraded 300 mm water line is estimated to cost $1,200,000. With a 75 year life cycle, the water line would have 50 years of service life remaining.

$$\$1{,}200{,}000 - (1 - \frac{50}{75}) * \$1{,}000{,}000 = \sim\$870{,}000$$

As the water line still has the majority of it’s service life remaining, it has a high residual value, and as such a lower Town’s share of the cost. In this example, the residual value of the asset would be approximately $670,000 and Town’s share would be approximately $330,000. Subtracting the Town’s share from the upgrade cost of $1,200,000 results in a developers share of approximately $870,000.

3. Water System

3.1 System Characterization

The Town of Canmore has two primary water sources; two deep wells which supply ground water to the Pumphouse 1 Treatment Plant, and surface water from the Rundle Forebay which supplies the Pumphouse 2 Treatment Plant.

The treated water is then stored and distributed from five storage reservoirs and five pump stations / booster stations. The distribution system is divided into three supply areas: Western, Central, and Eastern.

The distribution system can be further divided into a total of 18 pressure zones, which are controlled through Pressure Reducing Valves (PRVs) and pump stations. The Pressure zones can be seen in Appendix C – Figure W1

3.1.1 Pipe Diameters, Material and Age

The water mains in Canmore consist of approximately 65% PVC and 30% ductile iron. The average age of the water lines in the system are approximately 30 years old. The following tables show the distribution by age, diameter, and pipe material of Canmore's water system. The existing water system can be seen in Figure W2 (Appendix C)

Table 3-1 Water Pipe Age

Age	Length (km)	% of Total
>50 Years	11.9	10%
41-50 Years	9.9	8%
31-40 Years	20.9	18%
21-30 Years	39.5	34%
11-20 Years	22.9	19%
0-10 Years	10.5	9%
Unknown	2.0	2%
Total	**118**	**100%**

Table 3-2 Water Pipe Materials

Material	Length (km)	% of Total
PVC	76.2	65%
DI	35.4	30%
PE	1.5	1%
CON	0.1	0.1%
UNK	4.4	4%
Total	**118**	**100%**

Table 3-3 Water Pipe Diameters

Diameter (mm)	Length (km)	% of Total
<100/Unknown	3.3	3%
100	0.8	1%
150	30.8	26%
200	31.5	27%
250	12.1	10%
300	16.1	14%
350	10.2	9%
400	11.3	10%
450	1.6	1%
Total	**118**	**100%**

3.1.2 System Elevations and Pressure Zones

Due to large elevation differences across the Town of Canmore, the water distribution system is divided into multiple pressure zones to deliver normal water pressures across the Town's distribution system.

In total, there are 18 pressure zones, named from Zone 2 to Zone 19, with Zone 1 not currently in use. Zone 18 was a recent addition, with three new PRVs installed near Miskow Close and Our Lady of the Snows school, creating a new pressure zone along Hubman Landing, and Zone 19 was created when the WWTP was connected to the new South Bow River Loop.

There are a total of 40 PRVs across the Town, with two of them considered to be private, two inactive and one closed.

Table 3-4 PRV Settings

Label	Description	Elevation (m)	HGL Setting (m)	Pressure Setting (kPa)
PRV 1	Above 100 Grassi	1345.29	1381.81	358
PRV 2	West side Benchlands, #126	1389.13	1430.68	407
PRV 3	East side Benchlands near 210 Benchlands Terrace	1380.88	1421.73	488
PRV 4	Benchlands Reservoir	1394.95	1454.81	586
PRV 5	Glacier Dr. and Sandstone Terrace (Glacier Dr.) - East	1332.43	1381.72	483
PRV 6	Boulder Crescent and 200 Glacier Dr. - West	1332.08	1381.38	486
PRV 8	Homesteads Phase I, Mountain Greens Emergency Rd. (14 205 Carey)	1332.99	1364.49	308
PRV 9	Homesteads Phase I (177 Carey near the intersection of Carey and Three Sisters)	1342.50	1384.75	414
PRV 10	Homesteads Phase II Upper (167 McNeil Dr.)	1346.03	1384.75	379
PRV 11	Highway 1A (Near 516 Bow Valley Trail)	1309.36	1362.00	515
PRV 12	Alley off of Rundle Crescent (Mount Rundle Penstock Station)	1312.25	1355.00	489

PRV 13	Olympic Dr. Rundle View	1346.12	1364.49	180
PRV 14	Near 16 Prospect Heights	1316.34	1364.49	471
PRV 15	Pump House 1 - West Feed	1309.68	1362.00	512
PRV 17	Silvertip - Block 7 (Blue Grouse and Silvertip Rd.)	1395.11	1472.57	759
PRV 19	Three Sisters Dr. and 200 Grassi Pl.	1330.26	1364.49	335
PRV 20	Outside Three Sisters Booster Station	1383.70	1417.49	331
PRV 21	Lions Park CTFM	1312.73	1362.00	482
PRV 22	Behind Recreation Centre CTFM	1312.96	1355.00	480
PRV 23	On the line from Grassi Reservoir to Miskow	1384.46	Inactive	Inactive
PRV 24	Cairns on the Bow Three Sisters Parkway	1323.78	1371.06	482
PRV 25	Three Sisters Mountain Village (Fitzgerald)	1345.16	1372.97	272
PRV 26	Ridge Rd and Elkrun Blvd (Modelled as Closed)	1357.80	Closed	Closed
PRV 27	Near 561 Silvertip road	1457.80	1510.68	518
PRV 28	Not modelled- considered a private PRV	1340.43	-	-
PRV 29	Not modelled- considered a private PRV	1340.48	-	-
PRV 30	Montane Rd. near Lincoln Park	1324.47	1361.90	367
PRV 31	Bow Valley Trail (near Ray McBride St. CTFM)	1315.90	1362.00	451
PRV 32	Palliser Trail By Cross Z ranch	1326.70	1389.94	656
PRV 33	Near Spring Creek Gate. (Currently inactive)	1307.31	Inactive	Inactive
PRV 34	Branched off from Grassi line near Miskow Close	1359.80	1395.01	405
PRV 35	Branched off from Grassi line near Hubman Landing	1362.00	1409.89	469
PRV 36	Near Stewart Creek Dr and Out Lady of the Snows school	1366.00	1401.21	345
PRV DMF	Dead Man's Flats	1295.30	1362.20	655
PRV T1	Morris and Van Horne Intersection	1316.54	1364.49	469
PRV WWTP	Wastewater Treatment Plan off of South Bow River Loop	1303.96	1367.34	621
PRV SBL	Off of South Bow River Loop near Montane Road	1321.45	1389.76	707

A number of the PRV settings were revised within the model during the calibration process of the 2020 Water Model Update performed by CIMA+, where hydrant flow tests were performed across the Town. The PRV settings were changed within the model in order to have the model results match real world observations.

3.1.3 Raw Water Supply

The Town has two primary raw water supplies, which supply the Town's two water treatment plants: Pumphouse 1 and Pumphouse 2. Pumphouse 1 is supplied through two deep groundwater wells, and Pumphouse 2 is supplied with surface water from the Rundle Forebay.

Pumphouse 1 has a maximum annual diversion of 2,121,965 m^3 at a combined maximum rate of 589.5 L/s. Diversion from Well #2 under license 31682 is subject to instream flow objectives in the Bow River. Flow objectives are stated on a weekly basis.

Table 3-5 Pumphouse 1 Licenses

License #	31681	31682	**Total**
Description	Well #1	Well #2	
Point of Diversion	SW33-024-10-W5		
Source		Policeman Creek	
Max Annual Diversion (m3)	1,195,620	926,345	2,121,965
Max Rate of Diversion	49.5 L/s	540 L/s	589.5 L/s
Notes		Instream Objectives – License Amendment 2	

Pumphouse 2 has a maximum annual diversion of 2,994,329 m^3, and a combined maximum diversion rate of 760 L/s as stated on the two licenses. However, during the design process of Pumphouse 2 treatment upgrades, it was discovered that there is a superseding agreement with TransAlta, who provided the original licenses for diversion from the Rundle Forebay for the Town. In those agreements, there is a maximum stated diversion rate of 6 cubic feet per second (cfs), or 170 L/s.

In discussions with TransAlta, it was determined that the limitations from this earlier license agreement still stand, and as such the maximum diversion rate is capped at 170 L/s. There were no limitations on annual diversion volume in this agreement, and as such the annual volumes on the current licenses still stand.

Table 3-6 Pumphouse 2 Licenses

License #	31000	31001	356706	Total
Description			For use by Canmore and Deadman's Flat	
Point of Diversion	SW30-022-10-W5 and re-diverted at SE31-024-10-W5 (Rundle Forebay)			
Source	Spray River through the works of TransAlta Utilities Corporation			
Max Annual Diversion (m3)	1,110,134	1,554,195	280,000	2,944,329
Max Rate of Diversion	363 L/s	380 L/s	17 L/s	760 L/s
Notes	Due to superseding Transalta Agreement, Max diversion rate from Rundle Forebay is capped at 6 cfs (170 L/s)			

Licenses 30999 and 31682 were originally intended to supply water to the wastewater treatment plant through a well on the plant site. The wastewater treatment plant has since been connected to the Town's water distribution network through the South Bow River Loop project, and as such these licenses are not actively being drawn against. Transferring these licences to be utilized by Pumphouse 1 should be investigated.

Table 3-7 WWTP Supplemental Licenses

License #	30999	31682	Total
Description	Wastewater Plant Well	Wastewater Plant Supplemental Flow	
Point of Diversion	SW28-24-10-W5		
Source	Bow River		
Max Annual Diversion (m3)	3,700	71,300	75,000
Max Rate of Diversion	3 L/s	3 L/s	3 L/s
Notes	Instream Objectives – License Amendment 2		

The following table shows the summary of the active licenses in the Town, and their respective withdrawal rates.

Table 3-8 Water Licenses Summary

License Use	Total Annual Diversion (m^3)	Average Daily Diversion (m^3)	Max Daily Diversion (m^3)
Pumphouse 1	2,121,965	5,814	50,933
Pumphouse 2	2,944,329	8,067	14,705
WWTP Supplemental	75,000	205	259

3.1.4 Water Treatment Systems

Water is treated at Pump House 1 by adding gas chlorine to the well water and then storing it in a contact tank. After sufficient contact time, treated water is pumped into the distribution system.

Pump House 2 is a direct filtration treatment plant that treats water from Rundle Forebay. The plant's treatment processes include coagulation, filtration, chlorination and UV disinfection systems.

Pumphouse 1 has a treatment capacity of approximately 93 L/s, and Pumphouse 2 has a current treatment capacity of approximately 94 L/s.

There are current plans to upgrade the Pumphouse 2 treatment capacity to 170 L/s, with construction occurring in 2023.

Table 3-9 Existing Water Treatment System

Facility	Pumphouse 1	Pumphouse 2
Treatment Process	Disinfection by Chlorination	+ Coagulation and flocculation + Rapid Sand Filtration + Four filters for a total rate of 94 L/s + Disinfection by ultraviolet (UV) light. Limited to 126 L/s maximum through each of two reactors + Disinfection by chlorination
Treatment Rate	8,000 m³/day (92.6 L/s) based on 2010 / 2016 UMP	+ Four filters for a total rate of 94 L/s + UV process limited to 126 L/s maximum through each of two reactors. + Existing Limit: 94 L/s
Treatment Levels	+ 4-Log reduction for viruses + 3-Log reduction for Giardia and Cryptosporidium	

3.1.5 Potable Water Storage

There are a total of five potable water storage reservoirs in the Town of Canmore.

- Pumphouse 1 – Primarily serves the Central and Eastern supply zones
- Benchlands Reservoir - Primarily serves the Central and Eastern supply zones. Is typically filled by Pumphouse 1, however the South Bow River Loop PRV, which was recently commissioned, can fill Benchlands using a flow control valve on the PRV.
- Silvertip Reservoir – Primarily serves the Eastern supply zone. It is filled from Benchlands
- Pumphouse 2 – Primarily services the Western and Central supply zones, and can service the Eastern supply zone up to Benchlands
- Grassi Reservoir – Primarily Services the Western and Central supply zones. It is filled by an inline booster station that is supplied by Pumphouse 2.

Table 3-10 Potable Storage Reservoirs

Facility	Supply Zone	Volume (m^3)
Pumphouse 1	Central, East	166
Pumphouse 2	West, Central	1,100
Benchlands	East, Central	7,300
Silvertip	East	5,400
Grassi	West, Central	5,000
Total		**18,966**

Previous documents reported that Benchlands Reservoir had a volume of 11,200 m^3. However, a review of the original design drawings indicated the total active volume of the reservoir is calculated to be 7,300 m^3.

3.1.6 Water Distribution Systems

The Town operates six water distribution facilities. Four of them are pump stations, and two of them discharge through gravity. The following table summarizes these facilities.

Table 3-11 Distribution Facility Summary

Facility	Treatment	Distribution Type
Pumphouse 1	Yes	Pump
Pumphouse 2	Yes	Pump
Benchlands Reservoir	No	Pump and Gravity
Silvertip Reservoir	No	Gravity
Grassi Reservoir	No	Gravity with booster fill
Pumphouse 5 (Canyon Ridge Booster Station)	No	Pump

3.1.6.1 Pumphouse 1

Pumphouse 1 has six vertical turbine pumps that pump water from the clear well into the distribution system.

Table 3-12 Pumphouse 1 Existing Pump Summary

Pump	Manufacturer	Model	Motor HP	Design Flow (L/s)
1	Grundfos		30	16.2
2	Grundfos		30	16.2
3	Grundfos		30	16.2
4	Floway	10 LKM	50	28.1
5	Floway	10 LKM	50	28.1
6	Floway	10 LKM	50	28.1

The pumps at Pumphouse 1 are staged off and on according to the water level in Benchlands Reservoir. The pump staging set points for the distribution pumps, as reproduced from the PH1 Control Philosophy Revision H, are listed in the table below:

Table 3-13 Pumphouse 1 Pump Staging Set Points

Pumps In Order of sequence	Distribution Pump Start Level Set Point	Distribution Pump Stop Level Set Point
1st	3.65 meters	3.80 meters
2nd	3.49 meters	3.80 meters
3rd	3.35 meters	3.60 meters
4th	3.20 meters	3.55 meters
5th	3.04 meters	3.55 meters
6th	2.90 meters	3.45 meters

A PRV located in the pump station controls the pressure entering the Central Supply Zone / downtown area, ensuring appropriate pressures are maintained.

3.1.6.2 Pumphouse 2

Pump House 2 has three vertical turbine pumps that pump water from the clear well into the distribution system. The pump station discharges at approximately 165 kPa because it is located at a high elevation in its pressure zone. These three pumps are also used to backwash the filters at Pump House 2.

Pumphouse 2 has planned pump capacity upgrades, where the pumping capacity will be increased to approximately 200 L/s (300 L/s with Backwash pumps discharging into the distribution header). The pump capacity upgrades are planned to be constructed in 2023.

Table 3-14 Pumphouse 2 Existing Pump Summary

Pump	Manufacturer	Model	Motor HP	Design Flow (L/s)
1	Aurora	12RM	15	66.3
2	Aurora	12RM	15	66.3
3	Aurora	12RM	15	66.3

3.1.6.3 Benchlands Reservoir

The Benchlands Reservoir has three vertical turbine pumps which supply water to the Silvertip reservoir, the Silvertip area, and areas around the Benchlands reservoir, where a PRV is used to maintain service pressures. The reservoir also backfeeds water through the supply line, providing water to the lower elevation areas that Pumphouse 1 also distributes to.

Table 3-15 Benchlands Pump Summary

Pump	Manufacturer	Model	Motor HP	Design Flow (L/s)
1	Peerless	12 LTD	100	39.7
2	Peerless	13 LTD	100	39.7
3	Peerless	14 LTD	100	39.7

3.1.6.4 Silvertip Reservoir

The Silvertip Reservoir distributes water through gravity, by being at a higher elevation than the downstream service area. Water from this reservoir is supplied by the Benchlands Reservoir pump station. Water from Silvertip is distributed to the downstream system utilizing the same supply line. Due to the facility configuration at Benchlands, water cannot be transferred from Silvertip back to Benchlands.

3.1.6.5 Grassi Reservoir

The Grassi reservoir supplies water to the same areas as Pumphouse 2, and serves to provide fire flows and fire storage. The Grassi reservoir is filled by a booster station near Grassi Peaks, along Peaks Dr.

Table 3-16 Grassi Reservoir Booster Existing Pump Summary

Pump	Manufacturer	Model	Motor HP	Design Flow (L/s)
1	Grundfos	CR60-30U	15	20.2
2	Grundfos	CR60-30U	15	20.2

3.1.6.6 Pumphouse 5 (Canyon Ridge Booster)

Pumphouse 5, also known as the Canyon Ridge Booster Station, has three inline booster pumps which provide water to its own pressure zone in a higher elevation area. This booster station can be supplied water from both Pumphouse 1 and the Benchlands Reservoir gravity line.

Table 3-17 Pumphouse 5 Existing Pump Summary

Pump	Manufacturer	Model	Motor HP	Design Flow (L/s)
1	Peerless	C-610-AMBF	5	3.2
2	Peerless	C1215-AMBF	15	12.6
3	Peerless	4AE11	ENGINE	69.4

3.2 Design Criteria

This section outlines the criteria that will be used to evaluate the current and future systems and details the evaluation of each component of the system. The design criteria are based on the most recent version of the Canmore Engineering Design and Construction Guidelines (EDCG) and Alberta Environment and Protected Areas (AEPA) Standards and Guidelines.

3.2.1 Water Demands Criteria

Existing average day water demands were developed by assessing the total volume of water distributed to the Town over a period of several years, and reviewing SCADA data and daily water distribution records.

Future water demands will be based on the unit rates established in the EDCG, the 2017 Utility Master Plan, analysis of consumption rates by land use, and the projected growth for each growth scenario and horizon. The water demands were updated to include unit rates for ICI and Hotel land uses, which were previously only present in the Wastewater portion of the EDCG. The ICI landuse area based unit rates were updated, as the unit density was assessed against unit consumption, and was shown to be significantly higher than the EDCG. The Hotels land use consumption rates were also updated from that shown in the EDCG, following an analysis of water demands by land use performed by the Town of Canmore.

Table 3-18 Water System Unit Demands

Demand Type	Rate	Units
Water Treatment Plant Production (composite rate)	360	L/c/d
Residential	250	L/c/d
Hotels	700	L/unit/d
ICI	30 810	m^3/ha/d L/unit/day
Maximum Day Demand Peaking Factor (per EDCG)	2 x ADD	PF
Peak Hour Demand Peaking Factor (per EDCG)	4 x ADD	PF

3.2.2 Water Supply Requirements

Alberta Environment and Protected Areas requires that a community's water supply must be capable of the maximum day demand (MDD).

Water supply will be assessed individually at each of Pumphouse 1 and Pumphouse 2. Deficits at Pumphouse 1 water supply can be supported by Pumphouse 2, as the Western supply zone can feed into the Central supply zone.

3.2.3 Level of Service Criteria

One of the intentions of the master plan is to maintain an adequate level of service for the existing and future systems. The level of service criteria has been set in accordance with the Canmore EDCG, which are in line with the recommendations from the AEPA Standards and Guidelines.

The service pressure in the Town should be between 350 kPa (50 psi) and 620 kPa (90 psi). The Town may accept minimum pressures of 280 kPa (40 psi) when it is clearly demonstrated that the target minimum pressure of 350 kPa cannot be achieved due to existing boundary conditions.

The maximum pressure in the Downtown pressure zone should not exceed 496 kPa (72 psi)

Table 3-19 Level of Service Summary

Parameter	Design Criteria
Minimum Pressure in Distribution System	350 kPa (50 psi)
Maximum Pressure in Distribution System	620 kPa (90 psi)
Maximum Pressure in Downtown Pressure Zone	496 kPa (72 psi)
Maximum Allowable Velocity in Distribution System	3.0 m/s

3.2.4 Available Fire Flow Criteria

The Municipal Government Act does not categorize Fire Protection as a core service. Therefore, it is at the discretion of municipalities to choose to provide the service or not, and if so to what level. There are many guidelines throughout North America, the basic precept is that a municipality chooses a level of service for Fire Protection and then ensures they meet or exceed that level.

The fire flow requirements that were developed were based on land use designation and building type. The required fire flows for large residential, commercial or industrial developments shall be determined in accordance with the latest edition of the Fire Underwriters Survey Guide to Recommended Practice. However, the required fire flows shall not be less than those specified for general land use categories or types of development indicated in Table 3-20.

Table 3-20 Available Fire Flow Requirements

Land Use Category or Development Type	Fire Flow (L/s)	Design Criteria Time)
Detached and Duplex Residential	85 L/s	2 h
Multi-Family, Small to Medium Size Units	120 L/s	2 h
Commercial, Institutional, Industrial – adequately separated, 3 floors or less	200 L/s	2.5 h
Multi-Family, Medium Density (4-plex to 6-plex)	200 L/s	2.5 h
High Density, Multiple Closely Spaced or Contiguous Buildings of 3 or More Floors	300 L/s	3.5 h

The available fire flow is calculated in the hydraulic model by assessing how much water can be pulled from each system node, before another system node reaches 140 kPa (20 psi).

3.2.5 Water Distribution / Pumping Requirements

Alberta Environment and Protected Areas requires that a water distribution pumping system should be able to provide the greater of PHD or MDD + Fire Flow.

AEPA also requires that the water distribution system facility be designed to deliver maximum design flow with the largest pump out of service to maintain system redundancy.

As the Town for Canmore has several reservoirs that are filled and supported by pump stations, the pump stations should also be able to provide MDD to the reservoirs and their associated service areas.

3.2.6 Water Storage Requirements

AEPA guidelines recommend the storage requirements where the supply of treated water is only capable of satisfying the maximum daily design flow.

For a storage facility to meet these recommendations it must be sufficiently sized to store the sum of the following, using the formula S = A + B + C

+ A - Fire storage (As per fire flow requirements)
+ B - Equalization storage (25% MDD)
+ C - Contingency storage (15% ADD)

3.3 Water Demand Analysis

3.3.1 Existing Water Demands

Average daily water demands were developed by assessing the total volume of water distributed to the Town over the past four years. These were assigned to the hydraulic model through geolocated customer water meters data, which has been scaled such that the total volume of consumption is equivalent to the total volume of distribution. This accounts for any water losses in the water distribution system, or any unaccounted for flows, and ensures appropriate distribution of water demands.

Maximum daily water demands were developed by reviewing SCADA data and daily water distribution records to find the day with the highest volume of water distributed. This maximum day, divided by the average day, will determine the Maximum Day Demand peaking factor for the existing system and will only be applied to existing demands. Peak hour demands will be assumed to be 2x Maximum Day Demands, in line with the EDCG.

The following table shows the annual water consumption as recorded by customer water meters, versus the annual water distribution volumes. The loss factor is the ratio between the two total volumes, and can be comprised of system losses, fire hydrant operations, and unmetered water connections that the Town might control. In total, approximately 30% of the water distributed in Canmore is unmetered.

Table 3-21 Water Consumption Versus Distribution

Year	Consumption (m^3)	Distribution (m^3)	Loss Factor
2018	1,814,544	2,724,788	1.50
2019	1,787,659	2,589,814	1.45
2020	1,827,189	2,512,425	1.38
2021	1,912,420	2,749,175	1.44
Average	1,843,365	2,670,847	1.45

Using the annual water distribution volumes, average day demands were determined for each year. Daily water distribution records and SCADA data were then reviewed to determine the maximum daily demand for each year. The ratio between these are the MDD peaking factors. These values were averaged across the four years to determine the overall systems ADD, MDD and peaking factor.

2021 had a significantly higher max day than previous years due to a high turbidity event which required extensive water line flushing across the system.

Table 3-22 Annual ADD and MDD

Year	ADD (m^3)	MDD (m^3)	Pf
2018	7,465	11,007	1.47
2019	7,095	12,169	1.72
2020	6,865	11,364	1.66
2021	7,532	14,767	1.96
Average	**7,239**	**12,327**	**1.70**

The following table shows the summary of the existing system water demands.

Table 3-23 Existing Water System Demand Summary

Demand Scenario	Demand (L/s)
ADD	84
MDD	143
PHD	285

3.3.2 Future Water Demands

The future water demands are determined by applying the unit rates to the projected growth, in units, for each land use. The units were distributed as shown in the Growth Projections and Design Basis Memo. There are three growth horizons, 5 years, 15 years, and 25 years, and two separate growth scenarios. MDD Peaking factor is 2x ADD, and PHD is 4x ADD, as per the design criteria.

Dead Man's Flats was projected as linear growth, where the 25 Year Horizon maxes out the current Memorandum of Agreement for water supply, which is 8.8 L/s ADD and 17.6 L/s MDD. The existing ADD is approximately 1 L/s.

The following are the system wide demands for each growth horizon, which represents the full projected growth across 25 years.

The following table shows the system wide demands for the 5 Year

Table 3-24 5 Year Horizon Water Demands

Land Use	ADD (L/s)	MDD (L/s)	PHD (L/s)
Existing	83.8	142.7	285.3
Commercial	1.9	3.9	7.7
Hotels	8.9	17.9	35.8
Residential - Low Density	1.3	2.7	5.4
Residential - Medium / High Density	7.7	15.3	30.7
Dead Man's Flats	1.6	3.2	6.4
Total	**105**	**186**	**371**

The following table shows the system wide demands for the 15 Year Horizon.

Table 3-25 15 Year Horizon Water Demands

Land Use	ADD (L/s)	MDD (L/s)	PHD (L/s)
Existing	83.8	142.7	285.3
Commercial	5.2	10.5	21.0
Hotels	18.8	37.7	75.3
Residential - Low Density	3.5	6.9	13.8
Residential - Medium / High Density	18.1	36.1	72.3
Dead Man's Flats	4.7	9.4	18.7
Total	**134**	**243**	**486**

The following table shows the system wide demands for the 25 Year Horizon.

Table 3-26 25 Year Horizon Water Demands

Land Use	ADD (L/s)	MDD (L/s)	PHD (L/s)
Existing	83.8	142.7	285.3
Commercial	8.6	17.1	34.2
Hotels	28.7	57.4	114.9
Residential - Low Density	5.6	11.1	22.3
Residential - Medium / High Density	28.5	57.0	113.9
Dead Man's Flats	8.8	17.6	35.2
Total	**164**	**303**	**606**

3.3.3 Water Demands Summary

The following is a summary of the system wide water demands for each growth scenario.

Table 3-27 Water Demands Summary

Demand Scenario	Existing	5 Year Horizon (L/s)	15 Year Horizon (L/s)	25 Year Horizon (L/s)
ADD	84	105	134	164
MDD	143	186	243	303
PHD	285	371	486	641

3.4 Hydraulic Model Development

3.4.1 Existing Water Model Update

In 2020/2021 CIMA+ updated the Town's hydraulic water model from the one developed for the 2016 UMP using the software Bentley WaterCAD. Water system assets were updated using the most recent GIS provided by the Town, including water lines, PRVs, and pumping stations. Asset information such as pipe diameters and materials were updated, and new assets were included.

Pump curves for pumping and booster stations, PRV settings and reservoir elevations were carried over from the previous model and verified against record information.

Hydrant flow testing was performed by AltaWest in 9 different locations throughout Canmore, distributed to capture major pressure zones in each supply area. The model was then calibrated against the hydrant flow tests, and PRV settings were adjusted as needed to match the field tests.

The water demands were updated by taking the previous three years of geolocated customer water meters that were scaled to equal the total water distribution volume using the loss factor of 1.45 as discussed in Section 3.3. These were assigned to the nearest node in the water model. This results in proportional demands across the system according to water usage, that sum to the system wide ADD of 84 L/s.

ADD, MDD and PHD demand scenarios were established, using the existing system peaking factors.

3.4.2 Future Water System

The growth projections have individual projections for each of the OSL areas for all the land uses. The breakdown for each of the OSL areas can be found in Appendix B. The unit demands described in Section 3.2.1 were set up in the hydraulic model. Six demand scenarios were developed, covering the three growth horizons for each of the growth projection options.

Approximate water networks were added for the major ASP / ARDP areas according to their servicing drawings, including the following:

+ Three Sisters Village
+ Smith Creek
+ Spring Creek Mountain Village
+ Silvertip

As the exact phasing of the future development areas are unknown, the full buildout network of each ASP area will be assumed for all growth horizons. Developers will be required to validate the level of service each phase of development will provide on a case by case basis.

Under each growth horizon, the number of units for each land use were added into the model at the boundaries of the existing system. The unit counts and unit demands added into the model results in the ADD, as per the locations shown in Appendix B – Growth Figures.

Peaking factors for future demands were 2x ADD for MDD, and 4x ADD for PHD.

3.5 Existing System Evaluation

3.5.1 Water Supply Analysis

The water supply analysis was performed at each of the water treatment plants individually, as they tend to operate independently. Maximum day demand and annual demand was determined by reviewing annual water reports from 2018 – 2021, which records the water distributed from each plant. The average of these four years was used for this analysis.

Table 3-28 Pumphouse 1 & 2 Annual Demands

Year	Pumphouse 1 (m^3/year)	Pumphouse 2 (m^3/year)	Total (m^3/year)	PH2/Total
2018	758,455	1,885,914	2,644,369	0.71
2019	819,398	1,770,416	2,589,814	0.68
2020	1,047,926	1,428,552	2,476,478	0.58
2021	1,181,917	1,516,778	2,698,695	0.56
Average	**951,924**	**1,650,415**	**2,602,339**	**0.63**

Table 3-29 Pumphouse 1 & 2 Maximum Day Demands

Year	Pumphouse 1 MDD (m^3/day)	Pumphouse 1 MDD (L/s)	Pumphouse 2 MDD (m^3/day)	Pumphouse 2 MDD (L/s)
2018	3,734	43	7,273	84
2019	5,296	61	6,873	80
2020	5,044	58	6,320	73
2021	7,208	83	7,559	87
Average	**5,321**	**62**	**7,006**	**81**

Pumphouse 1 has an annual diversion of 951,924 m^3, and a maximum diversion rate of 62 L/s. Pumphouse 2 has an annual diversion of 1,650,415 m^3, and a maximum diversion rate of 81 L/s.

Pumphouse 1 has a total annual licensed diversion of 2,121,965 m^3, at a maximum rate of 589.5 L/s over two licenses. However, the license for Well #2, which accounts for 44% of the total annual diversion, and 92% of the maximum diversion rate, is subject to instream objectives. If the instream objectives are not met, Well #2 cannot be relied upon. On-going analysis of water from Well #2 will be presented to AEPA in 2023 and if found not to be GWUDI (ground water under direct influence of surface water) then the expectation is that the instream objective limitation will be removed.

Table 3-30 Pumphouse 1 Water Supply Analysis

	Current Demand	License (Well #1)	License (Well #2)	License (Total PH1)
Annual Demand (m^3/year)	951,924	1,195,620	926,345	2,121,985
Maximum Day Demand (L/s)	62	50	540	589.5

With Well #2 not operating, either due to instream objectives or operational issues, Pumphouse 1 may not meet the water supply criteria

Pumphouse 2 has a total annual licensed diversion of 2,944,329 m^3 over three licenses, and a maximum diversion rate of 170 L/s, as per the standing restrictions from the TransAlta agreement which supersedes those stated on the newer licenses.

Table 3-31 Pumphouse 2 Water Supply Analysis

	Current Demand	License (Total)
Annual Demand (m^3/year)	1,650,415	2,944,329
Maximum Day Demand (L/s)	81	170

Pumphouse 2 meets the water supply criteria and has the capacity to supplement Pumphouse 1 in instances of Well #2 not meeting instream objectives, or during operational challenges. This ability to supplement Pumphouse 1 was further reinforced by the recent completion of the South Bow River Loop project, which connects into the Central supply zone southeast of Kananaskis Way.

3.5.2 Water Treatment Analysis

As defined in the design criteria, a water treatment plant should be able to supply a community with its maximum day demand. The maximum day demand for each pumphouse is shown in Table 3-32 and Table 3-33.

Pumphouse 1

Pumphouse 1 has a treatment capacity of approximately 8000 m^3 per day, or 92.6 L/s. This value is based on the 2010 Canmore UMP Update report, which states: "A review of operational data from the last few years suggests that the maximum capacity for Pump House 1 is approximately 8,000 m^3/day."

Table 3-32 Pumphouse 1 Water Treatment Analysis

	Current Demand	Treatment Capacity
Maximum Day Demand (L/s)	62	92.6
Maximum Day Demand (m^3/day)	5,321	8,000

Pumphouse 1 is currently using approximately 70% of it's available treatment capacity on a max day, as calculated over the past four years. However, in August 2021 there was a turbidity event which required significant system flushing, resulting in an abnormally high period of water usage. The max day during that event was still within the treatment capacity, and occurred during the August long weekend, which is typically the period of highest water usage each year.

Pumphouse 2

Pumphouse 2 has a treatment capacity of approximately 94.4 L/s, or 360 m^3/hour. The treatment is currently limited by the filtration system, with the next bottleneck being the UV system, with a capacity of 126 L/s.

Table 3-33 Pumphouse 2 Water Treatment Analysis

	Current Demand	Treatment Capacity
Maximum Day Demand (L/s)	81	94
Maximum Day Demand (m^3/day)	7,006	8,156

Pumphouse 2 is currently using approximately 86% of it's available treatment capacity on a max day, as calculated over the past four years. Pumphouse 2 also experienced an abnormally high max day in August 2021 due to the noted turbidity event, however the increase was measurably less than at Pumphouse 1, as the majority of the flushing occurred in the Central and Eastern supply zones.

Pumphouse 2 has a treatment capacity upgrade planned for 2023 or 2024, which will increase the capacity up to 170 L/s.

3.5.3 Level of Service Analysis

Figure W3 (Appendix C) shows the hydraulic model results for the existing system at Peak Hour Demand. Pressure nodes that are below the standard minimum pressure requirement of 350 kPa (50 psi) as set out in the design criteria are shown in orange. Pressures below the conditional minimum pressure of 280 kPa (40 psi) are shown in red. Pressures above the 625 kPa (90 psi) limit are shown in purple.

In total there are four areas that fall below the conditional minimum pressure of 280 kPa (40 psi), which would have an impact on the level of service.

+ Coyote Way
+ Downstream of Pumphouse 5
+ Northwest Extent of Silvertip Trail
+ Olympic Drive and Prendergast Place
+ Canmore Nordic Centre

Coyote Way

The northeast corner of Coyote Way has a minimum pressure of approximately 245 kPa (36 psi), which is below the Town's minimum.

The 2016 UMP recommended a project (Water Project 10) which created a new pressure zone for the Coyote Way and Kodiak Road area, by connecting it to Pressure zone 5 which is supplied by the Benchlands pump station and installing a PRV along Cougar Creek Drive.

There is no record of customer complaints of low service pressure in that area, so the Town may find it acceptable to leave the system in that area as is.

Downstream of Pumphouse 5

The water line on the downstream end of Pumphouse 5, along Elk Run Blvd, has a minimum pressure of approximately 200 kPa (29 psi). There are no services directly connected to this low pressure area, however there have been incidences of the booster pumps at Pumphouse 5 crashing or being unable to maintain pressure during high flow events nearby, such as during water line flushing, or fire events.

The 2016 UMP recommended a project (Water Project 10) which, along side the Coyote Way improvement, created a new pressure zone for the Canyon Road and Lady MacDonald areas by connecting it to Pressure zone 5, decommissioning Pumphouse 5, and installing a PRV along Lady MacDonald Road.

Further review of Water Project 10 from the 2016 UMP indicates that the project might not be the best avenue for overall system reliability and operational costs, as it removes the northern connection of the Avens area across Cougar Creek from Pumphouse 1 and the Benchlands gravity line. If there were a failure or operational issue with the southern crossing of Cougar Creek, adjacent to Highway 1, the entirety of the Avens neighbourhood would be reliant on the Benchlands pump station.

An alternative to the proposed Water Project 10 that can still allow for the decommissioning of Pumphouse 5 would be to connect pressure zone 5 directly to the inlet side of Pumphouse 5 with a new water line crossing Cougar Creek, along the same alignment as the current crossing on Elk Run Blvd. The additional costs of crossing Cougar Creek would likely be offset by only requiring one new PRV, instead of the three or four that would be needed in the previously proposed project.

This would maintain the current system redundancy, with the trade off that current Coyote Way pressures would be maintained.

Northwest Extent of Silvertip Trail

The northwest extent of Silvertip Trail has a minimum pressure of approximately 220 kPa (32 psi). As this is at the extent of the system, and pressures are currently bounded by the height of the Silvertip reservoir, there is no practical way to increase pressures to that area through changes to the existing system.

Development at or past that extent may require a booster station to provide adequate service pressures.

Olympic Drive and Prendergast Place

The area along Olympic Drive and Prendergast Place, downstream of PRV 13, has a minimum pressure of approximately 180 kPa (26 psi) immediately downstream of the PRV, and 255 kPa (37 psi) where services tie in.

Inspection reports from EPCOR of PRV 13 indicate a downstream pressure of 320 kPa (50 psi), however this does not line up with field observations. During the 2021 Water Model Update, a hydrant test was performed along Van Horne and Prospect Heights, which is in the same pressure zone as Prendergast Place. The observed static pressure was 65 psi, and all PRV settings for the pressure zone were adjusted to a set point that result in that pressure (1364.49 m Hydraulic Grade Line). If PRV 13 were operating at the 320 kPa (50 psi) set point as noted, the residual measured at the hydrant would be approximately 590 kPa (85 psi).

The pressures at Prendergast Place are marginally below the conditional minimum of 280 kPa (40 psi). As there are no records of complaints from the public regarding low service pressures, the Town can consider leaving the pressures as it. However, if public complaints do arise, the Town could consider increasing the pressure set point for PRVs 8, 13, 14, 19 and T1.

This would increase the pressures in zone 8 on the west side of the Bow River, and have a minimal impact on the Downtown portion of zone 8. This is due to the long 150 mm pipe along Rundle Place that connects this portion of zone 8 to Downtown. Pressures drop rapidly in long portions of small diameter pipe, and would have a negligible impact on the pressures in Downtown.

Canmore Nordic Center

The custody transfer point for the Canmore Nordic Centre water supply has a minimum pressure of approximately 200 kPa (29 psi). The Nordic Centre is supported by a booster station that fills an on site reservoir.

The existing pressures appear to be adequate for the current booster station set up, however if upgrades to the booster station are required in the future for further servicing, the lower supply side pressures will need to be considered.

3.5.4 Fire Flow Analysis

Figure W4 (Appendix C) shows the hydraulic model results for the MDD+ Fire Flow scenario. The water model was used to calculate the available fire flow at each node while maintaining at least 138 kPa (20 psi) residual at every point in the distribution system. The nodes are color coded corresponding to whether or not the fire flow requirements were met, based on the surrounding land use.

There are five main areas in the existing system that are not meeting the fire flow requirements according to their land use:

+ Bow Valley Trail northwest of 15th Street
+ Elk Run Industrial Area
+ Railway Ave adjacent to the rail line
+ Industrial Place / 8th Avenue
+ Hospital

There is a single node in the water model that has a significant impact on the available fire flow for the existing system, which is very sensitive to the discharge pressure from Pumphouse 2. It is on the service line that leads to the Canmore Nordic Center. Due to the high elevation on the end of the line, its connection to the cross town feeder main, and the low discharge pressure of Pumphouse 2, high flows out of Pumphouse 2 can drop the hydraulic grade line low enough for that service line to go below the minimum pressure requirements during fire flow runs. If this service line were to be ignored in the modelling, the fire flow results in the affected areas increase dramatically, however this would impact the service to the Nordic Center.

The proposed distribution capacity upgrade to Pumphouse 2 resolves this issue, and allows the first three affected areas to meet the design criteria for fire flow.

The hospital has an available fire flow of approximately 160 L/s along the 150 mm line that services it, when 200 L/s is required. This is largely due to the small pipe size of the line, as the connection points on Hospital Place and Bow Valley Trail have available fire flows above the requisite 200 L/s. It may not be worth the risk of service disruption to the hospital to facilitate a moderate increase in fire flows to the hospital, however when the water main servicing it is nearing its lifecycle, it should be replaced with a larger diameter pipe.

The fire flow capacity of the existing system is otherwise adequate and meets the design criteria. There are some other minor areas that do not meet the fire flow targets, however these are largely along dead end lines from small diameter pipes, which would not be practical to loop or to upsize.

Figure W5 shows the available fire flow after the Pumphouse 2 distribution capacity upgrade has been implemented.

3.5.5 Distribution System Condition

Pipe Lifecycle

The Town of Canmore's water distribution system contains aging water distribution infrastructure, particularly in the Downtown area. The service life of water mains, as per Canmore's asset management standards, is 75 years.

Currently there are pipes dating back to 1965, making the oldest pipes in the system approximately 58 years old. Figure W6 (Appendix C) shows the pipes according to age.

Currently no pipes in the system are approaching the end of their lifecycle, however replacement programs should be considered in the future when pipe lifecycle is approaching its end.

Pipe Turbidity

In August 2021, there was a significant turbidity event that occurred around Kananaskis Way, Cougar Creek and Avens neighbourhoods. This turbidity event occurred during the commissioning of the South Bow River Loop. It was suspected that the high flows through the pipe disturbed settled material in pipes that were previously experiencing low flows.

Historically Canmore has not had an active pipe flushing program, and when low velocity flushing was performed during the turbidity incident, and follow up high velocity flushing, significant turbidity was encountered. This indicates that deposited material is likely an issue across the Town's water network, particularly in older areas like Downtown.

The Town should develop an active pipe flushing program to mitigate future turbidity risks.

3.5.6 Pump Station Analysis

The level of service analysis and available fire flow analysis demonstrate that the Town's water distribution system can provide adequate service pressures during PHD and available fire flow during MDD, however these scenarios have gravity assisted reservoirs supplementing flows into the system.

An investigation into the ability for the Town's system to fill the storage reservoirs while providing MDD to the reservoirs and their associated service areas is also necessary to ensure adequate and reliable service.

Currently there are three storage reservoirs which are filled by pump stations, and supply the system with water through gravity or pumping:

+ Grassi Reservoir
+ Benchlands Reservoir
+ Silvertip Reservoir

SCADA data of the reservoir levels was reviewed to determine approximately the observed fill rate of each of the reservoirs.

The MDD of each reservoir was determined in the model by running each demand scenario without the reservoirs being filled. The modelled discharge from each reservoir represents the reservoir's MDD.

Table 3-34 Existing System Pump Station Analysis – Reservoir Demands

Reservoir	Required MDD (L/s)	Available MDD (L/s)
Grassi	30	20
Silvertip	3	70
Benchlands + Silvertip	28	50

Grassi Reservoir

The Grassi reservoir is supplied by a booster station on Peaks Drive, south of Lawrence Grassi Ridge. The booster station is in turn supplied by Pumphouse 2.

The Grassi booster station is noted as having two pumps, each of which have a capacity of approximately 20 L/s. The SCADA data indicates that Grassi has two different fill rates. It regularly fills at approximately 15 - 20 L/s, and after high demand periods fills at roughly 30 L/s with both pumps running.

With both pumps running, the booster station for the Grassi reservoir would not meet the design criteria for pump stations, where the largest pump should be considered offline for the purpose of redundancy. An upgrade to the booster station, with a redundant pump or higher pumping capacity should be considered, and should cover up to the 15 Year horizon, which as shown in Section 3.6.6.2, is a rate of approximately 80 L/s. The existing booster station also is noted as not having a backup generator, and the nearby PRV 20 is noted as needing repairs. These should be included in the booster station upgrade.

With the booster station operating at 30 L/s in the MDD scenario, Pumphouse 2 is able to provide adequate water to the station and maintain the required level of service for the rest of its service area.

Silvertip Reservoir

The Silvertip reservoir is filled by the Benchlands pump station. Modelling predicts that Benchlands can fill it at a rate of approximately 80 L/s, and SCADA data indicates a fill rate of approximately 70 L/s.

The current demand on the reservoir is quite low, with a total pumping requirement of 5 L/s to serve the ADD and MDD of the Silvertip area. During ADD, benchlands also has a demand of 5 L/s to the area directly supported by it. As such, it should be capable of a minimum of 10 L/s in order to fill the Silvertip reservoir, which it is more than capable of.

Benchlands Reservoir

The Benchlands reservoir is supplied by Pump Station 1. Pumphouse 1 fills Benchlands reservoir by staging pumps on and off depending on the reservoir level. Modelling predicts that Pumphouse 1 can fill it at a rate of approximately 50 L/s, and the SCADA indicates a fill rate of approximately 50 L/s.

For MDD there were 2 small pumps online and 5 L/s from the SBRL PRV. The MDD also included the demands from Silvertip.

According to both the SCADA fill rates, and the modelled fill rates, Pumphouse 1 has sufficient pumping capacity to fill Benchlands reservoir while still supplying an adequate level of service to its service area.

3.5.7 Water Storage Analysis

The Town's water system is a dynamic network where pressure zones can be serviced from multiple storage reservoirs at once. In order to simplify these interactions, the distribution system is divided into three supply areas; Western, Central, and Eastern.

The ADD and MDD of each supply zone was determined by summing up the demands in the model.

Table 3-35 Existing Supply Zone Demands

Supply Zone	ADD (L/s)	MDD (L/s)
Western Supply Zone	13.6	23.2
Central Supply Zone	45.5	77.3
Eastern Supply Zone	21.7	33.7
Silvertip	1.9	3.2
Total	**82.7**	**137.4**

The Western supply zone relies solely on Pumphouse 2 and Grassi Reservoir, and as such the volume required for the Western supply zone will be reserved from those reservoirs in this analysis.

The Central supply zone and portions of the Eastern supply zone can be supported by Pumphouse 2, Grassi Reservoir and Benchlands, however with Grassi and Pumphouse 2 reserved, the majority of the storage will come from Benchlands. Any remaining capacity in the Western supply zone can be attributed to the Central and Eastern supply zones.

The Silvertip area is part of the Eastern supply zone, and can be supplied by both Benchlands and Silvertip, but the Silvertip reservoir has no practical way to transfer water back into Benchlands. As such, the Silvertip area will be considered separately.

Table 3-36 Existing System Water Storage Analysis

	Western Supply Zone	Central and Eastern Supply Zone	Silvertip
ADD (m^3/day)	1,177	5,803	164
MDD (m^3/day)	2,002	9,866	279
Fire Storage (300 L/s for 3.5 hours)	3,780	3,780	3,780
Equalization Storage - 25% MDD (m^3/day)	500	2,466	70
Emergency Storage - 15% ADD (m^3/day)	177	870	25
Recommended Storage (m^3)	4,457	7,117	3,874
Available Storage (m^3)	6,100	7,300	5,400

Overall, all supply zones have adequate water storage. The Central and Eastern zones are approaching the limit of the Benchlands reservoir, however since the Central and Eastern Zones can be supported by the Western supply zone, which has approximately 1,350 m^3 excess capacity, this can be added to the 7,300 m^3 storage capacity of Benchlands.

3.6 Future System Evaluation

3.6.1 Water Supply Analysis

Future water demands were divided between the two water treatment plants dependant on what supply zone the demands fall in. Demands in the Western supply zone, which represent the bulk of the growth in Canmore, were assigned to Pumphouse 2. Demands in the Central and Eastern Supply Zones were assigned to Pumphouse 1.

Table 3-37 Future System Annual Demands

Horizon	Pumphouse 1 ADD (m^3/day)	Pumphouse 1 Annual Consumption (m^3/year)	Pumphouse 2 ADD (m^3/day)	Pumphouse 2 Annual Consumption (m^3/year)
5 Year Horizon	3,796	1,385,544	5,307	1,937,235
15 Year Horizon	4,654	1,698,665	6,870	2,507,406
25 Year Horizon	5,559	2,029,005	8,519	3,109,397

Table 3-38 Future System Maximum Day Demands

Horizon	Pumphouse 1 MDD (m^3/day)	Pumphouse 1 MDD (L/s)	Pumphouse 2 ADD (m^3/day)	Pumphouse 2 MDD (L/s)
5 Year Horizon	7,697	89	8,578	99
15 Year Horizon	9,412	109	11,702	135
25 Year Horizon	11,222	130	15,001	174

5 Year Horizon

Under typical conditions, Pumphouse 1 meets the water supply criteria under the 5 Year Horizon, however if instream objectives are not met for Well #2 during a maximum day event, Pumphouse 1 would not be able to receive adequate water supply.

Table 3-39 5 Year Horizon Pumphouse 1 Water Supply Analysis

	5 Year Demand	License (Well #1)	License (Well #2)	License (Total PH1)
Annual Demand (m^3/year)	1,385,544	1,195,620	926,345	2,121,985
Maximum Day Demand (L/s)	89	50	540	589.5

Pumphouse 2 meets the water supply criteria under the 5 Year Horizon, and has enough additional spare capacity to support Pumphouse 1 during events where Well #2 cannot be relied on.

Table 3-40 5 Year Horizon Pumphouse 2 Water Supply Analysis

	5 Year Demand	License (Total)
Annual Demand (m^3/year)	1,937,235	2,944,329
Maximum Day Demand (L/s)	99	170

15 Year Horizon

Under typical conditions, Pumphouse 1 meets the water supply criteria under the 15 Year Horizon, however if instream objectives are not met for Well #2 during a maximum day event, Pumphouse 1 would not be able to receive adequate water supply.

Pumphouse 2 no longer has the spare capacity to support Pumphouse 1 during these events. Prior to the 15 year horizon, the Town should consider investigating increasing the maximum allowable flow from Well #1, or constructing a new well that would not be subject to instream flow objectives.

The alternative is to have Pumphouse 2 support Pumphouse 1, however limitations in the maximum withdrawal rate by the previous TransAlta agreement means that is not feasible until those limitations are renegotiated.

Table 3-41 15 Year Horizon Pumphouse 1 Water Supply Analysis

	15 Year Demand	License (Well #1)	License (Well #2)	License (Total PH1)
Annual Demand (m^3/year)	1,698,665	1,195,620	926,345	2,121,985
Maximum Day Demand (L/s)	109	50	540	589.5

Pumphouse 2 meets the water supply criteria under the 15 Year Horizon, however it no longer has enough additional spare capacity to support Pumphouse 1 during events where Well #2 cannot be relied on. Pumphouse 2 is nearing the annual withdrawal limit of the existing licenses.

Table 3-42 15 Year Horizon Pumphouse 2 Water Supply Analysis

	15 Year Demand	License (Total)
Annual Demand (m^3/year)	2,507,406	2,944,329
Maximum Day Demand (L/s)	135	170

25 Year Horizon

Under typical conditions, Pumphouse 1 meets the water supply criteria under the 25 Year Horizon, however if instream objectives are not met for Well #2 during a maximum day event, Pumphouse 1 would not be able to receive adequate water supply. The annual withdrawal limits are at approximately 95% of capacity.

Table 3-43 25 Year Horizon Pumphouse 1 Water Supply Analysis

	25 Year Demand	License (Well #1)	License (Well #2)	License (Total PH1)
Annual Demand (m^3/year)	2,029,005	1,195,620	926,345	2,121,985
Maximum Day Demand (L/s)	130	50	540	589.5

Pumphouse 2 does not meet the water supply criteria under the 25 Year Horizon, with both the annual withdrawal limits and the maximum rate of withdrawal. In order to support the 25 year horizon, additional water licences may have to be acquired, and the existing withdrawal limit under the TransAlta agreement would have to be extended. However, these deficiencies are very minor, and should be re-examined when further development in Canmore has occurred, allowing for better water demand projections.

Table 3-44 25 Year Horizon Pumphouse 2 Water Supply Analysis

	25 Year Demand	License (Total)
Annual Demand (m^3/year)	3,109,397	2,944,329
Maximum Day Demand (L/s)	174	170

3.6.2 Water Treatment Analysis

As defined in the design criteria, a water treatment plant should be able to supply a community with its maximum day demand. The maximum day demand for each pumphouse and each growth horizon was shown in Table 3-38.

Pumphouse 1

Pumphouse 1 currently has a treatment rate of approximately 8,000 m^3/day, or 92.6 L/s.

According to the way demands were distributed for future growth, Pumphouse 1 will exceed it's treatment capacity shortly after the 5 year horizon. Pumphouse 2 will be able to supplement Pumphouse 1 with spare capacity in its treatment rate past the 15 year growth horizon. By the end of the 25 year horizon, Pumphouse 2 will no longer be able to make up this treatment deficit.

Table 3-45 Future System Water Treatment Analysis for Pumphouse 1

	Future Demand	Treatment Capacity
5 Year -Maximum Day Demand (L/s)	89	93
15 Year - Maximum Day Demand (L/s)	109	93
25 Year - Maximum Day Demand (L/s)	130	93

Pumphouse 2

Pumphouse 2 is slated to have the treatment capacity upgraded to 170 L/s in the near future and is assumed to be complete for the future system evaluations.

Pumphouse 1 has a 37 L/s deficit for treatment in the 25 year horizon, so if Pumphouse 1 were to remain as-is, Pumphouse 2 would need to be capable of treating that alongside its max day demand, for a total of 211 L/s. Pumphouse 2 was initially planned to have a treatment rate of 225 L/s, but was reduced to 170 L/s in accordance with the licence limitations. If that withdrawal rate is ever increased, the Pumphouse 2 design will be able to accommodate an additional filter, which could bring the treatment rate up to 225 L/s. However this space could be used for the proposed backwash reuse system, which would serve to reduce the overall raw and treated water demands.

Table 3-46 Future System Water Treatment Analysis for Pumphouse 2

	Current Demand	Treatment Capacity
5 Year -Maximum Day Demand (L/s)	99	170
15 Year - Maximum Day Demand (L/s)	135	170
25 Year - Maximum Day Demand (L/s)	174	170

25 Year Horizon Water Treatment Deficit Options

The following are some potential options to address the treated water deficit for the 25 year horizon. A water supply and treatment study should be performed prior to the 15 year horizon in order to determine the best course of action for the Town.

+ Increased withdrawal from the Rundle Forebay and additional treatment at Pumphouse 2
  - Withdrawal rates from the Rundle Forebay are currently constrained by a third party. At this time it does not seem likely that the third party would allow the increase.
+ Additional Storage
  - In order to supplement the peak demands that are higher than the treatment rate, additional storage could possibly be used. No design criteria has been defined for this use case, however a conservative approach would be to allow for at least two consecutive max days of water demand. This would mean additional storage equal to two times the current max day deficit of 40 L/s, which equals a volume of approximately 7,000 m^3. This would be a significant increase in the required storage volume in the Town, and would be reflected by a very high capital cost.
+ Pumphouse 1 Upgrades
  - Pumphouse 1 could possibly be upgraded to increase the treatment capacity. If the water supply can be officially designated as not under the direct influence of surface water, which is supported by a report being submitted to Alberta Environment, then the treatment system of chlorine contact time can remain the same. Pumphouse 1 is nearing life cycle, so the upgrade would likely involve a completely new treatment plant. A new raw water well would also likely be required.

3.6.3 Level of Service Analysis

Figures W7 – W9 (Appendix C) shows the hydraulic model results for each of the future growth horizons at Peak Hour Demand. Pressure nodes that are below the standard minimum pressure requirement of 350 kPa (50 psi) as set out in the design criteria are shown in orange. Pressures below the conditional minimum pressure of 280 kPa (40 psi) are shown in red. Pressures above the 625 kPa (90 psi) limit are shown in purple.

The full buildout network for the growth areas has been implemented for all growth horizons.

5 Year Horizon

The five year horizon contains two major modifications to the Canmore water distribution system; Pumphouse 2 upgraded to >225 L/s distribution capacity, and Pumphouse 5 (CRBS) decommissioned and its service area connected to Pressure zone 5, which is supported by Benchlands.

Modifying Pressure Zone 8 was also investigated in order to raise the service pressure at Prendergast Place, as noted in Section 3.5.3. It was found that this encouraged flows into Downtown through the communities along Rundle Drive, instead of the crosstown feeder through PRV 12. If PRV 12 were adjusted upwards to promote flows through it, a marked increase in the Downtown pressures was observed. As such, it is recommended that the PRVs be maintained at their current pressure set points, barring any customer complaints from the low-pressure area in Prendergast Place.

The pressures along Elk Run Blvd in the existing line that previously connected to the CRBS are still below the 40 psi minimum, however there is no longer any service connections in the low pressure area. Down the hill along Lady McDonald Dr, enough elevation is lost to maintain adequate service pressures. The areas that were served by the CRBS now have consistent, adequate service pressures with the booster station decommissioned.

15 Year Horizon

The fifteen-year horizon contained no major modifications to the Town's water distribution system, and the only deficient areas were the ones originally indicated in the existing system analysis.

25 Year Horizon

The twenty-five-year horizon contained no major modifications to the Town's water distribution system, and the only deficient areas were the ones originally indicated in the existing system analysis.

3.6.4 Fire Flow Analysis

Figures W10 – W13 (Appendix C) shows the hydraulic model results for the MDD+Fire Flow scenario for each of the growth horizons. The water model was used to calculate the available fire flow at each node while maintaining at least 138 kPa (20 psi) residual at every point in the distribution system. The nodes are color coded corresponding to whether or not the fire flow requirements were met, based on the surrounding land use.

The full buildout network for the growth areas has been implemented for all growth horizons. All growth areas were assumed to have a 200 L/s fire flow requirement.

5 Year Horizon

The 5 year horizon included the following upgrades to the Town's water distribution system and network:

+ Pumphouse 2 upgraded to 225 L/s capacity
+ CRBS decommissioned and supply area connected to Pressure zone 5
+ Bow Valley Trail water line upgraded to 250 mm up to Hospital Place

In addition to these upgrades, the TeePee town area also has a land use change to high density according to the growth projections, and as such has the available fire flow requirement increased to 200 L/s. Previously available fire flows were at approximately 120 L/s in the area and met the fire flow requirements. With the density increase, an upgrade to the main waterline along 1 Ave from 150 mm to 250 mm will be required. This has been implemented for the analysis.

The southeast extent of the Smith Creek development does not meet the estimated 200 L/s available fire flow. This is in part due to the assumed pressure zone distribution, with the high level network in the ASP this area is serviced off of a single line from the new reservoir as it is not a looped system. That is likely what is creating the limitation in available fire flow. This will have to be a consideration when developers begin designing the neighbourhood.

15 Year Horizon

The fifteen year horizon contained no major modifications to the Town's water distribution system, and the only deficient areas were the ones originally indicated in the existing system analysis.

25 Year Horizon

The twenty five year horizon contained no major modifications to the Town's water distribution system, and the only deficient areas were the ones originally indicated in the existing system analysis.

3.6.5 Distribution System Condition

The lifecycle of pipes are approximately 75 years in the Town. Pipes approaching the 75 year lifecycle should be considered for replacement.

5 Year Horizon

No pipes are approaching their lifecycle in the 5 year horizon.

15 Year Horizon

By the end of the 15 year horizon, the earliest recorded pipes in the water network (Installed in 1965) are approaching their end of their lifecycle, however no replacement programs are required under this growth horizon.

25 Year Horizon

A replacement program should be developed for pipes installed between 1965 and 1972, to be executed starting from the end of the 15 year horizon and replacing sections of pipe each year. This would ensure that there are no assets older than the 75 year lifecycle by the end of the 25 year horizon, and are represented by pipes that are currently older than 50 years.

There are approximately 12 km of water lines older than 50 years. They are primarily located in the Downtown area, Railway Ave, TeePee town, and Rundle Drive.

150 mm pipes should be replaced with 200 mm pipes where possible. 150 mm pipes are hydraulically restrictive, and generally can't provide the required fire flows needed for future densification.

The replacement program will be broken out into five separate areas, for the purposes of project time lines and cost estimates. They are as follows:

+ South Canmore (6^{th} Street to 3^{rd} Street) – 2 km
+ Downtown (6^{th} Street to 10^{th} Street) – 3 km
+ 7^{th} Avenue (10^{th} St to Industrial Place) – 2.5 km
+ Rundle (Bridge Road to Three Sisters Drive) – 2 km
+ Teepee Town / Railway Ave – 1.5 km

3.6.6 Pump Station Analysis

Along with the three existing reservoirs assessed in Section 3.5.7 for the existing system, the proposed Smith Creek reservoir was also assessed in the future system evaluation.

The MDD of each reservoir and its associated service area was determined in the model by running each demand scenario without the reservoirs being filled. The modelled discharge from each reservoir represents the reservoir's MDD.

The Grassi and Smith Creek reservoirs are fully reliant on Pumphouse 2 to deliver water to them, with daisy chained booster stations required to fill Smith Creek reservoir.

In order to consider the impacts of Dead Man's Flats with consideration for existing infrastructure agreements, the Grassi Booster Station was additionally reviewed with no contribution from Dead Man's Flats.

3.6.6.1 5 Year Horizon

The following are the MDD demands of each of the reservoirs under the 5 year horizon.

Table 3-47 5 Year Horizon Pump Station Analysis

Reservoir	Required MDD (L/s)	Available MDD (L/s)
Grassi + Smith	47	80
Grassi + Smith (No DMF)	44	80
Silvertip	8	80
Benchlands + Silvertip	39	50
Smith Creek	6	0

Grassi Reservoir

The Grassi booster station needs a pumping capacity of 47 L/s to support the Grassi and Smith Creek reservoirs. The existing system identified the Grassi booster station as not meeting standards and it is recommended that the pump station be upgraded to satisfy the 15 year horizon., which has a pumping rate of 80 L/s. Without demands from Dead Man's Flats, 44 L/s pumping capacity would be required.

With the booster station operating at 80 L/s, Pumphouse 2 is able to provide adequate flow to the system during MDD, and the pump stations are able to maintain adequate levels of service.

Smith Creek Reservoir

The Smith Creek reservoir will require a booster station to fill it. The need for the booster station and reservoir is dependent on development staging and the elevations that phases are being built at, however it is assumed that the reservoir will be required at the start of development for the portion of Smith Creek that is on the east side of the cross valley corridor.

Initially a booster station in Smith Creek capable of 6 L/s is required to support the Smith Creek reservoir. However, construction of the booster to support up to the 15 Year horizon, for a capacity of 20 L/s, is recommended.

With the Smith Creek booster station operating at 20 L/s, the Grassi booster upstream can provide adequate flow to the system, and the pump stations are able to maintain adequate levels of service.

Silvertip Reservoir

During MDD, the Silvertip reservoir can fill at a rate of 80 L/s from the Benchlands pump station, satisfying the MDD requirements of 8 L/s.

Benchlands Reservoir

The operating conditions for Benchlands for each demand scenario were as follows. For ADD there were two small pumps online at Pumphouse 1 and the new PRV from the South Bow River Loop (SBRL) online with a flow control valve set to 5 L/s in place. For MDD there were two small pumps online and 5 L/s from the SBRL PRV. MDD also included the demands from Silvertip.

In the reservoir filling scenario, Benchlands fills at a modelled rate of 50 L/s, which satisfies the MDD requirement of 39 L/s.

3.6.6.2 15 Year Horizon

The following are the ADD and MDD demands of each of the reservoirs under the 15 year horizon.

Table 3-48 15 Year Horizon Pump Station Analysis

Reservoir	MDD (L/s)	Available MDD (L/s)
Grassi + Smith	78	80
Grassi + Smith (No DMF)	68	80
Silvertip	17	81
Benchlands + Silvertip	49	50
Smith Creek	18	20

Grassi Reservoir

The Grassi booster station needs a pumping capacity of 78 L/s in order to support the Grassi and Smith Creek reservoirs. The existing system evaluation identified the Grassi booster station as not meeting standards, and it is recommended that the pump station be upgraded to 80 L/s to satisfy this 15 year horizon. Without demands from Dead Man's Flats, 68 L/s pumping capacity would be required.

With the booster station operating at 80 L/s, Pumphouse 2 is able to provide adequate flow to the system during MDD, and the pump stations are able to maintain adequate levels of service.

Of the 80 L/s required pumping capacity, 30 L/s is from the existing system, 38 L/s is from OSL areas 13 and 14, and 10 L/s is from Dead Man's Flats.

Smith Creek Reservoir

The Smith Creek booster station needed a pumping capacity of 18 L/s in order to support the Smith Creek reservoir, and was recommended in the 5 year horizon to be constructed to support up to 20 L/s. With the booster station operating at 20 L/s, the Grassi booster upstream is able to provide adequate flow to the system, and the pump stations are able to maintain adequate levels of service.

Silvertip Reservoir

During ADD, the Silvertip reservoir fills at a modelled rate of 80 L/s from the Benchlands pump station, satisfying the MDD requirements of 17 L/s.

Benchlands Reservoir

The operating conditions for Benchlands for each demand scenario were as follows. For ADD there were two small pumps online at Pumphouse 1 and the new PRV from the South Bow River Loop (SBRL) online with a flow control valve set to 5 L/s in place. For MDD there were two small pumps online and 5 L/s from the SBRL PRV. MDD also included the demands from Silvertip.

In the reservoir filling scenario, Benchlands fills at a modelled rate of 50 L/s, which satisfies the MDD requirement of 49 L/s.

3.6.6.3 25 Year Horizon

The following are the MDD demands of each of the reservoirs under the 25 year horizon.

Table 3-49 25 Year Horizon Pumping Analysis

Reservoir	MDD (L/s)	Available MDD (L/s)
Grassi -+ Smith Creek	133	80
Grassi + Smith (No DMF)	115	80
Silvertip	27	80
Benchlands + Silvertip	59	50
Smith Creek	45	20

Grassi Reservoir

The Grassi booster station needed a pumping capacity of 133 L/s in order to support the Grassi and Smith Creek reservoirs and will require an upgrade. Without demands from Dead Man's Flats, 115 L/s pumping capacity would be required, which will still result in an upgrade. 135 L/s is the recommended upgrade target, an increase of 55 L/s.

Of the 55 L/s upgrade, 47 L/s is from OSL areas 13 and 14, and 8 L/s is from Dead Man's Flats.

With the booster station operating at 135 L/s, an adequate level of service is not able to be maintained. The draw to fill both Grassi and Smith Creek reservoirs at max day demand creates low pressures along Three Sisters Drive, and is a result of the headlosses created by the high flows from Pumphouse 2 along Three Sisters Drive.

Increasing the pumping capacity at Pumphouse 2 does not resolve this, and as such the upgraded pumping capacity at Pumphouse 2 is adequate. The main issue is that the discharge pressure out of Pumphouse 2 is too low to combat the headlosses created during this high flow event.

Dependant on its risk tolerance, the Town may want to consider only filling one of the Grassi or Smith Creek reservoirs at a time, or filling them at a maximum rate of less than MDD, such as 1.5 times ADD. However this does result in the potential for the reservoirs to trend downwards in volume during abnormally high demand periods.

In order to meet these design criteria, one of the following would need to be implemented:

+ Higher Discharge Pressure – Pumphouse 2 would have to discharge at ~5 psi higher than it currently is to match the pressure losses caused during peak demand and meet the minimum level of service. This does not resolve low pressures on the suction side of the Grass booster station, and would have to be a consideration in its design, and the accompanying PRV.
+ New water line from Pumphouse 2 to Grassi Booster – A new water line which would connect Pumphouse 2 to the Grassi booster, effectively twinning the existing water line, would reduce the headlosses from the high flow scenario dramatically, and resolve what is currently a long single point of failure in the water network. Everything supplied by the Grassi reservoir is reliant on the water line that runs along Spray Lakes Rd and Three Sisters Dr.

While increasing the discharge pressure out of Pumphouse 2 would be the simplest solution, a new water line from Pumphouse 2 to the Grassi Booster would provide the best balance between resolving the level of service and improving system redundancy, and when implemented allows enough flow to reach the Grassi booster to supply it at the needed fill rate.

As the proposed water line would have the benefit of redundancy for the Town as a whole, a benefitting areas assessment was performed as an alternative to the cost allocation methodology. This compares the existing developed area to the gross developable area at the 25 year growth horizon for all offsite levy areas with projected growth. The following table shows the benefitting area and their relative percentages of the total area, which can be attributed to cost allocation.

Table 3-50 Grassi Reservoir Twinned Line Benefitting Areas

OSL Zone	Area (ha)	% of Total
Existing	750.0	73.1%
1	21.7	2.1%
2	20.5	2.0%
6	8.4	0.8%
7	3.0	0.3%
9	10.5	1.0%
10	5.3	0.5%
13	56.9	5.5%
14	70.1	6.8%
15 (DMF)	75.0	7.3%
16	2.3	0.2%
17	2.7	0.3%
Total Growth	**276.2**	**26.9%**
Total Area	**1026.2**	

Smith Creek Reservoir

The Smith Creek booster station needed a pumping capacity of 45 L/s in order to service the Smith Creek reservoir. The booster station, which was recommended to be designed to service up to the 15 year horizon, would need to be upgraded.

With the booster station operating at 45 L/s, the Grassi booster upstream is able to provide adequate flow to the system, and the pump stations are able to maintain adequate levels of service, when the proposed water line from Pumphouse 2 to Grassi booster is implemented.

Silvertip Reservoir

During ADD, the Silvertip reservoir fills at a modelled rate of 80 L/s from the Benchlands pump station, satisfying the MDD requirements of 27 L/s.

Benchlands Reservoir

The operating conditions for Benchlands were as follows. For MDD there were three small pumps online and 5 L/s from the SBRL PRV. The MDD also included the demands from Silvertip.

In the reservoir filling scenario, Benchlands fills at a modelled rate of 50 L/s, which does not satisfy the MDD requirement of 59 L/s.

Adjusting the flow rate at the Flow Control Valve on the SBRL PRV was investigated, and modelling indicated it could provide a maximum of 30 L/s.

Pumphouse 1 may be able to achieve the required flow rates by raising the discharge pressure out of the station. The current set point is 120 psi, increasing this to 125 psi would allow for sufficient flow to fill the Benchlands reservoir at the required MDD. Testing would need to be performed to ensure the pumps are capable of this, however that flow rate and discharge pressure does fall on the current pump curves.

3.6.7 Water Storage Analysis

In addition to the three supply zones previously analysed in the existing system, a new reservoir will be required to support the growth in the Smith Creek development. This new reservoir will be sized and assessed separately from the Western supply zone.

The ADD and MDD of each supply zone was determined by summing up the demands in the model for the supply area, including the future demands for each growth horizon.

Table 3-51 Future Supply Zone Demands

Supply Zone	Demand Scenario	5 Year Horizon	15 Year Horizon	25 Year Horizon
East	ADD (m^3/day)	2,126	2,424	2,769
	MDD (m^3/day)	3,689	4,285	4,976
Central	ADD (m^3/day)	4,638	4,792	4,946
	MDD (m^3/day)	8,098	8,407	8,714
West	ADD (m^3/day)	1,963	3,525	5,091
	MDD (m^3/day)	3,573	6,697	9,828
Smith Creek	ADD (m^3/day)	129	389	648
	MDD (m^3/day)	259	777	1,296
Silvertip	ADD (m^3/day)	227	633	1,039
	MDD (m^3/day)	454	1,266	2,077

The Western supply zone relies solely on Pumphouse 2 and Grassi Reservoir, and as such the volume required for the Western supply zone will be reserved from those reservoirs in this analysis.

The Central supply zone and portions of the Eastern supply zone can be supported by Pumphouse 2, Grassi Reservoir and Benchlands, however with Grassi and Pumphouse 2 reserved, the majority of the storage will come from Benchlands. Any remaining capacity in the Western supply zone can be attributed to the Central and Eastern supply zones.

The Silvertip area is part of the Eastern supply zone, and can be supplied by both Benchlands and Silvertip, but the Silvertip reservoir has no practical way to transfer water back into Benchlands. As such, the Silvertip area will be considered separately.

5 Year Horizon

Under the five-year horizon, all the supply zones have adequate storage when considering the dynamic system. The Eastern and Central supply zones have a storage volume requirement greater than just Benchlands reservoir, however Grassi and Pumphouse 2 have sufficient spare capacity to supplement those areas.

Table 3-52 5 Year Horizon Water Storage Analysis

	Western Supply Zone	Central and Eastern Supply Zone	Silvertip
ADD (m^3/day)	1,963	7,216	391
MDD (m^3/day)	3,573	12,691	733
Fire Storage (300 L/s for 3.5 hours)	3,780	3,780	3,780
Equalization Storage - 25% MDD (m^3/day)	893	3,173	183
Emergency Storage - 15% ADD (m^3/day)	294	1,082	59
Recommended Storage (m^3)	4,968	8,035	4,022
Available Storage (m^3)	6,100	7,300	5,400

The Central and Eastern zones are above the limit of the Benchlands reservoir, however since the Central and Eastern Zones can be supported by the Western supply zone, which has approximately 1,100 m^3 excess capacity, this can be added to the 7,300 m^3 storage capacity of Benchlands for an available storage of approximately 8,400 m^3.

15 Year Horizon

Under the 15 year horizon, there is no longer adequate storage across the supply zones. The Western supply zone is approaching the limit of the available storage, and can no longer spare sufficient capacity to supplement the Eastern supply zone

Table 3-53 15 Year Horizon Water Storage Analysis

	Western Supply Zone	Central and Eastern Supply Zone	Silvertip
ADD (m^3/day)	3,525	7,216	797
MDD (m^3/day)	6,697	12,691	1,545
Fire Storage (300 L/s for 3.5 hours)	3,780	3,780	3,780
Equalization Storage - 25% MDD (m^3/day)	1,674	3,173	386
Emergency Storage - 15% ADD (m^3/day)	529	1,082	120
Recommended Storage (m^3)	5,983	8,035	4,286
Available Storage (m^3)	6,100	7,300	5,400

Ultimately an expansion to the existing reservoirs should be constructed to support the future growth in Canmore. An expansion of the Grassi reservoir would have the greatest impact, as it has the capability to support all of the supply zones.

In the interim, a new water line along Silvertip Trail can be constructed, connecting pressure zones 3 and 4 together. This would allow the system to utilize the remaining capacity in the Silvertip reservoir and defer the Grassi reservoir expansion.

With the pressure zones connected along Silvertip Trail, the design criteria for water storage can be met. There is approximately 1,100 m^3 excess capacity in the Silvertip reservoir, allowing for an available storage in the Central and Eastern zones of 8,400 m^3.

25 Year Horizon

In the 25 Year Horizon, there is insufficient storage capacity in both the Western and Central/Eastern supply zones.

Table 3-54 25 Year Horizon Water Storage Analysis

	Western Supply Zone	Central and Eastern Supply Zone	Silvertip
ADD (m^3/day)	5,091	7,716	1,203
MDD (m^3/day)	9,828	13,690	2,242
Fire Storage (300 L/s for 3.5 hours)	3,780	3,780	3,780
Equalization Storage - 25% MDD (m^3/day)	2,457	3,423	560
Emergency Storage - 15% ADD (m^3/day)	764	1,157	180
Recommended Storage (m^3)	7,001	8,360	4,521
Available Storage (m^3)	6,100	7,300	5,400

Prior to the buildout of the 25-year horizon, an expansion to the Grassi Reservoir will be required to service the Town's supply zones.

Overall, approximately 2,000 m^3 of additional storage is required to meet the design criteria for water storage.

The storage expansion will be required once the MDD of the Western supply zone reaches approximately 40 L/s, which is projected to occur shortly after the 15-year horizon.

In order to account for Dead Man's Flats contribution to the additional storage requirement, following table shows the storage needed for the Dead Man's Flats 25 Year demands. No fire storage was considered, as that was allocated in the existing system.

Table 3-55 25 Year Dead Man's Flats Storage Requirements

	Dead Man's Flats
ADD (m^3/day)	760
MDD (m^3/day)	1520
Equalization Storage - 25% MDD (m^3/day)	380
Emergency Storage - 15% ADD (m^3/day)	114
Storage Required (m^3)	494

This shows that Dead Man's Flats accounts for approximately 25% of the total volume of additional recommended storage.

Smith Creek Reservoir

To support the Smith Creek development area, a new reservoir will be required to service the higher elevation portions of the ASP area.

Table 3-56 Smith Creek Reservoir

	5 Year	15 Year	25 Year	Full Buildout
ADD (m^3/day)	129	389	648	1,800
MDD (m3/day)	259	777	1,296	3,600
Fire Storage (300 L/s for 3.5 hours)	3,780	3,780	3,780	3,780
Equalization Storage - 25% MDD (m^3/day)	65	194	324	900
Emergency Storage - 15% ADD (m^3/day)	19	58	97	270
Recommended Storage (m^3)	3,864	4,033	4,201	4,950

The water network has a hydraulic grade line of approximately 1398 m near Dead Man's Flats. Therefore, the highest elevation that can be developed from the existing network while maintaining a minimum service pressure of 320 kPa (50 psi) is approximately 1360 m.

The reservoir should be located at an elevation such that it can provide adequate service pressures to the development area. The highest point in the Smith Creek ASP area is approximately 1400 m, so a gravity reservoir should be placed at a point higher than approximately 1435 m to provide a minimum of 50 psi to the highest points of the network.

The ASP has a full buildout population of approximately 4,500 people, and 20 ha of ICI for an approximate ADD of 1,800 m^3 per day. The reservoir should be sized to accommodate the full buildout of the ASP area. As per the reservoir design criteria, this is a reservoir of approximately 5,000 m^3 in volume.

3.7 Water Projects

3.7.1 EX W1 – Grassi Booster Station Capacity Upgrade (Phase 1)

Formerly part of UMP2016 – Project W3

Project Description

Upgrade the Three Sisters / Grassi Booster Station to have a firm pumping capacity that meets both existing and 15 Year Horizon demands, for a firm pumping capacity of approximately 80 L/s.

Project Rationale

Currently the booster station utilizes both pumps present in the station to achieve higher flow rates for filling the Grassi reservoir. This is not in line with the design criteria for pump stations, which dictates that the largest pump should be considered offline for the purpose of redundancy.

The booster station should be upgraded so that it's firm pumping capacity (with one pump offline) can meet the existing and 15-year demands.

Upgrading the booster station would likely involve new electrical equipment, process equipment, and standby generator, and could be considered a full replacement.

Considerations should be made that would allow for upgrading to the full buildout pumping requirements.

Project Details

+ Upgrade to firm pumping capacity of 80 L/s
+ New electrical and process equipment
+ New standby generator
+ New building, if additional space is required

Project Trigger

+ Triggered by existing conditions
+ Triggered by growth in OSL Zone 13, 14 and 15
+ Recommended Project Year – 2024-2025

Project Cost

Engineering	$	233,000.00
Implementation	$	1,550,000.00
Contingency	$	530,000.00
Total	**$**	**2,310,000.00**

Project Cost Sharing

This project is necessary for both existing and growth-related conditions. As the upgrade is initially triggered through existing conditions, the Town should be responsible for the costs of a full replacement of the facility, and developers should be responsible for additional construction and engineering costs to bring the replacement facility from existing flows to future flows.

+ Base Replacement Cost = $1,950,000
+ Upgraded Replacement Cost = $2,310,000
+ $2,310,000 – $1,950,000 = $360,000 developer cost

Using the cost sharing methodology, 15.6% of the total cost should be borne by development, and 84.4% of the cost should be borne by the Town of Canmore.

Of the recommended 80 L/s pumping capacity, 48 L/s is attributable to growth. Of that, 38 L/s is from OSL Areas 13 and 14, and 10 L/s is from OSL Area 15 (DMF)

+ 79% of developer cost (12.3% of project cost) should be borne by OSL Areas 13 and 14 ($284,000)
+ 21% of developer cost (3.3% of project cost) should be borne by OSL Area 15 ($75,000)

3.7.2 EX W2 – Pumphouse 2 Upgrades Backwash Water Reuse

New

Project Description

Add a clarifier for WTP2 backwash water treatment. Provide associated piping and pumping to add the treated backwash water upstream of Direct Filtration Trains.

Project Rationale

The existing water diversion license limits the instantaneous flow to WTP2

WTP2 filtration system utilizes 6 – 8% of the treated water for filters backwash. The backwash water is stored on site and slowly released to the Town sewer system.

A backwash reuse system may by designed to recover and reuse between 50 to 80% of the backwash water. Therefore, up to 5% of raw water diversion volume could potentially be saved.

Project Details

+ Install a clarifier with approximately 17 L/s flow (10% of the total WTP2 capacity)
+ Add a small pump to Backwash Tank
+ Piping, flowmeters and control valves to supply clarified water to the upstream of Direct Filtration Trains.
+ Electrical. Controls

Project Trigger

+ The Maximum Daily Flow reaches the capacity of WTP2
+ Recommended Project Year – 2035

Project Cost

Engineering	$	150,000.00
Implementation	$	1,000,000.00
Contingency	$	350,000.00
Total	**$**	**1,500,000.00**

Project Cost Sharing

This project will initially be considered 100% borne by the Town, however this project could assist with growth related conditions. Cost allocation will be further considered in the propose Water Treatment and Supply Study. Potential to explore governmental grant programs for water reuse.

3.7.3 EX W3 – Pumphouse 1 Gas Chlorine Disinfection Replacement to Liquid Chlorine

New

Project Description

Existing Pumphouse #1 uses gas chlorine for disinfection. Gas chlorine is potentially dangerous to handle and store.

Chlorination can be accomplished with liquid chlorine (Sodium Hypochlorite) which is safer.

Project Rationale

Pumphouse #1 is located in Canmore downtown. Any incident with gas chlorine storage on site may require evacuation of the surrounding communities.

Additionally, the Water Treatment Plant #2 after the upgrade will use Sodium Hypochlorite for disinfection. Bulk liquid chlorine delivery to both WTP2 and PH1 by the same tanker truck will make the chemical delivery cheaper.

Project Details

+ Add a room to existing PH1 for Sodium Hypochlorite storage
+ Provide storage and day tanks, metering and transfer pumps
+ Remove existing gas chlorine injection equipment and scrubber

Project Trigger

+ The project can be initiated when the existing gas chlorine equipment require lifecycle replacement.

Project Cost

Engineering	$	100,000.00
Implementation	$	700,000.00
Contingency	$	200,000.00
Total	**$**	**1,000,000.00**

Project Cost Sharing

This is existing infrastructure and is 100% attributable to the Town of Canmore.

3.7.4 W1 – TeePee Town Waterline Replacement

New

Project Description

Upgrade approximately 750 m of existing water line from 150 mm to 250 mm along 1st Ave, connecting to Bow Valley Trail.

This project was assumed to be coordinated with a roadworks program, and only captured deep utility installation costs.

Project Rationale

Redevelopment of Teepee town is projected in the next 5 years, with Medium-High density residential development units projected. Due to the land use change, higher available fire flows will be required to service the area. To achieve these higher fire flows, an upgrade to the existing pipe size will be required.

Project Details

- 750 m of 150 mm to 250 mm water pipe upgrade

Project Trigger

- This project should be completed prior to redevelopment of Teepee town, and before any roadworks programs
- Triggered by growth, OSL Zone 7
- Recommended Project Year – 2024

Project Cost

Engineering	$	90,000.00
Implementation	$	600,000.00
Contingency	$	210,000.00
Total	**$**	**900,000.00**

Project Cost Sharing

This project is necessary for growth-related conditions.

Deep utility assets have a prescribed life cycle of 75 years. The recorded installation date for the water lines is 1966, resulting in a remaining lifecycle of 19 years.

As per the cost allocation methodology, the formula is as follows:

$$UpgradeCost - \left(1 - \frac{ServiceLifeRemaining}{LifeSpan}\right) * Basecost = DeveloperCost$$

Where:

- Base Cost = $870,000
- Upgrade Cost = $900,000
- Service Life Remaining = 19 Years
- Life Span = 75 Years
- $\$900{,}000 - (1 - \frac{19}{75}) * \$870{,}000 = \$250{,}000$

Using the cost sharing methodology, 28% of the total cost should be borne by development, and 72% of the cost should be borne by the Town of Canmore.

3.7.5 W2 – Smith Creek Reservoir and Booster Station

Formerly UMP2016 – Project W6

Project Description

Construct a new 5000 m^3 storage reservoir and a booster station capable of being upgraded to 45 L/s, which can support the full 25-year growth horizon.

Initial stages of the booster station would require a flow rate of 20 L/s to fill the reservoir and support the surrounding area while filling, which would fulfill the requirements up to the 15 year horizon.

Project Rationale

The Smith Creek ASP area has areas that are higher elevation than what can be serviced off the existing system. A new reservoir and supplementary booster station will be required to service the full development area.

Project Details

+ 5000 m^3 storage reservoir
+ Booster station capable of 20 L/s, upgradeable to 45 L/s
+ All requisite mechanical, electrical, and process equipment

Project Trigger

+ This project should be completed prior to development of Smith Creek ASP area
+ Triggered by growth, OSL Zone 14
+ Recommended Project Year – 2027

Project Cost Sharing

This is new infrastructure, and is 100% attributable to growth

Project Cost

Engineering	$	1,283,000.00
Implementation	$	8,550,000.00
Contingency	$	2,950,000.00
Total	**$**	**12,780,000.00**

3.7.6 W3 – Canyon Ridge Booster Station Decommissioning

Formerly part of UMP2016 – Project W10

Project Description

Decommission the Canyon Ridge Booster Station (Pumphouse 5) and connect the service area to pressure zone 5. This connection would completed by drilling a new water line underneath Cougar Creek, along Elk Run Blvd.

Project Rationale

The CRBS currently only operates on a narrow band of pressure on the suction side of the booster station and has crashed during recent high flow events when the suction side pressure has dropped too low. To remove the reliance on the booster station, the area that it currently services can be adequately serviced by connecting it to pressure zone 5.

Project Details

+ 220 m of 200 mm water line, tunnelled or directional drilled underneath Cougar Creek
+ One new PRV
+ Decommissioning of existing booster station

Project Trigger

+ This project resolves an existing deficiency, and should be completed in the next 5 years
+ Recommended year of construction: 2026-2027

Project Cost

Engineering	$	120,000.00
Implementation	$	800,000.00
Contingency	$	280,000.00
Total	**$**	**1,200,000.00**

Project Cost Sharing

This is existing infrastructure, and is 100% attributable to the Town of Canmore

3.7.7 W4 – Silvertip Trail Looping

Formerly UMP2016 – Project W5

Project Description

Connect Pressure Zone 2 to Pressure Zone 4 by installing a new water line and PRV along Silvertip Trail.

Project Rationale

The net water storage for the central supply area will be running low by the 15-year horizon. Connecting the Silvertip reservoir in the Eastern Supply Zone to the Central Supply Zone will expand the available capacity available to the system and delay the need for significant reservoir upgrades.

Project Details

+ 400 m of 300 mm water line along Silvertip Trail
+ One new PRV

Project Trigger

+ Development of the following number of units in the Central Supply Zone (Based on 5-year growth horizon):
  - 110 ICI Units
  - 680 Hotel Units
  - 560 Medium / High Density Residential Units
+ MDD of 12,700 m^3/day on the Central and Eastern Supply Zone
+ Recommended Project Year: 2027-2028
+ Triggered by OSL Zones 2, 6, 7, 9, 10, 16 and 17

Project Cost

Engineering	$	130,000.00
Implementation	$	860,000.00
Contingency	$	300,000.00
Total	**$**	**1,290,000.00**

Project Cost Sharing

This is new infrastructure that is 100% attributed to growth.

3.7.8 W5 – Grassi Booster Station Waterline Twinning

New

Project Description

Construct a new water line, from Pumphouse 2 to the Grassi booster station, that effectively twins the existing water line. The line would follow the alignment of Spray Lakes Rd / Three Sisters Parkway.

Project Rationale

To support the peak flows seen during a reservoir filling scenario for Grassi and Smith Creek reservoirs, an additional water line should be constructed. The high flows needed to support the upgraded Grassi booster result in low pressures upstream of it, particularly on Three Sisters Drive. A new waterline would reduce the headlosses seen during high flows and increase system redundancy.

Project Details

+ 2,200 m of new 400 mm water line
+ 5 connections to the existing system

Project Trigger

+ Development of the following number of units in OSL Area 13 and 14:
  - 265 ICI Units
  - 920 Hotel Units
  - 440 Low Density Residential Units
  - 2215 Medium / High Density Residential Units
+ MDD of 60 L/s from Grassi Reservoir and 20 L/s from Smith Creek Reservoir
+ Triggered by growth in OSL Zone 13, 14 and 15
+ Recommended Project Year: 2037-2038

Project Cost

Engineering	$	300,000.00
Implementation	$	1,990,000.00
Contingency	$	690,000.00
Total	**$**	**2,980,000.00**

Project Cost Sharing

As the proposed water line would have the benefit of redundancy for the Town as a whole, a benefitting areas assessment was performed as an alternative to the cost allocation methodology. This compares the existing developed area to the gross developable area at the 25 year growth horizon for all offsite levy areas with projected growth. The following table shows the benefitting area and their relative percentages of the total area, which can be attributed to cost allocation.

OSL Zone	Area (ha)	% of Total
Existing	750.0	73.1%
1	21.7	2.1%
2	20.5	2.0%
6	8.4	0.8%
7	3.0	0.3%
9	10.5	1.0%
10	5.3	0.5%
13	56.9	5.5%
14	70.1	6.8%
15 (DMF)	75.0	7.3%
16	2.3	0.2%
17	2.7	0.3%
Total Growth	**276.2**	**26.9%**
Total Area	**1026.2**	

3.7.9 W6 – Grassi Storage Reservoir Capacity Upgrade

Formerly part of UMP2016 – Project W3

Project Description

Construct a new 2000 m^3 storage reservoir cell in the Grassi reservoir.

Project Rationale

The Western and Central supply zones will eventually run out of available storage capacity and will be unable to meet the design criteria for potable water storage.

The most reasonable place to upgrade the available storage is in the Grassi reservoir, as it has the capability to provide water to all areas of Canmore.

While the storage upgrade will serve all of Canmore, the trigger to upgrade will come from the Western Supply Zone, as it is entirely reliant on the Grassi reservoir and has “priority” on the remaining capacity.

Project Details

+ 2000 m^3 storage reservoir cell

Project Trigger

+ Development of the following number of units in the Western Supply Zone:
  - 265 ICI Units
  - 920 Hotel Units
  - 440 Low Density Residential Units
  - 2215 Medium / High Density Residential Units
+ MDD of 6,700 m3 in the Western Supply Zone
+ Triggered by OSL Zones 2, 6, 7, 9, 10, 13, 14, 15, 16 and 17
+ Recommended Project Year: 2038-2039

Project Cost

Engineering	$	540,000.00
Implementation	$	3,580,000.00
Contingency	$	1,140,000.00
Total	**$**	**5,360,000.00**

Project Cost Sharing

This is new infrastructure, and is 100% attributable to growth. Of the 2000 m^3 upgrade, Dead Man's Flats requires 494 m^3.

- 25% of the project cost should be borne by OSL Area 15 ($ 1,340,000)
- 75% of the project cost should be borne by all other OSL areas ($ 4,020,000)

3.7.10 W7 – Grassi Booster Station Capacity Upgrade (Phase 2)

New

Project Description

Upgrade the Three Sisters / Grassi Booster Station to have a firm pumping capacity that meets the 25-year horizon demands, for a firm pumping capacity of approximately 135 L/s.

Project Rationale

Development in the Three Sisters Resort Area, Stewart Creek, Smith Creek, and Dead Man's Flats drives the needs for higher pumping capacity through the booster station to support Grassi reservoir and its service area.

Project Details

+ Upgrade to firm pumping capacity of 135 L/s

Project Trigger

+ Development of the following number of units in OSL Area 13 and 14:
  - 265 ICI Units
  - 920 Hotel Units
  - 440 Low Density Residential Units
  - 2215 Medium / High Density Residential Units
+ MDD of 60 L/s from Grassi Reservoir and 20 L/s from Smith Creek Reservoir
+ Triggered by growth in OSL Zone 13, 14 and 15
+ Recommended Project Year: 2037-2038

Project Cost

Engineering	$	80,000.00
Implementation	$	500,000.00
Contingency	$	170,000.00
Total	**$**	**750,000.00**

Project Cost Sharing

This is upgrading infrastructure that will be designed to be upgraded, and is 100% attributable to growth

Of the 55 L/s upgrade, 47 L/s is from OSL areas 13 and 14, and 8 L/s is from Dead Man's Flats.

+ 85% of the project cost should be borne by OSL Areas 13 and 14 ($ 640,000)
+ 15% of the project cost should be borne by OSL Area 15 ($ 110,000)

3.7.11 W8 – Smith Creek Booster Station Upgrade (Phase 2)

Formerly part of UMP2016 – Project W6

Project Description

Upgrade the Smith Creek Booster Station to have a firm pumping capacity that meets the 25-year horizon demands, for a firm pumping capacity of approximately 45 L/s.

Project Rationale

Development in the Smith Creek area drives the needs for higher pumping capacity through the booster station to support Smith Creek Reservoir and its service area.

Project Details

- Upgrade to firm pumping capacity of 45 L/s

Project Trigger

- Development of the following number of units in OSL Area and 14 (Smith Creek):
  - 440 Low Density Residential Units
  - 185 Medium / High Density Residential Units
- MDD of 20 L/s from Smith Creek Reservoir
- Triggered by growth in OSL Zone 14
- Recommended Project Year: 2037-2038

Project Cost

Engineering	$	70,000.00
Implementation	$	480,000.00
Contingency	$	170,000.00
Total	**$**	**720,000.00**

Project Cost Sharing

This infrastructure upgrade is fully in a future development area and is 100% attributable to developers.

3.7.12 W9 – South Canmore Waterline Replacement

New

Project Description

Replace aging water infrastructure in the South Canmore area, between 3rd Street and 6th Street.

Project Rationale

Water lines in the older areas of Canmore are nearing their lifecycle, and the Town should begin a program to replace the infrastructure that is nearing its lifecycle. The oldest pipes in Canmore were installed in 1966, and will reach their 75-year lifecycle by 2041, approximately 19 years after this study.

150 mm pipes should be upsized to 200 mm pipes.

For the best use of resources, the utility replacement program should be paired with a roadworks program.

Project Details

- 2,000 m of 200 mm water line replacement
- 12,000 m^2 of road replacement

Project Trigger

- Recommended Project Year: 2037-2038

Project Cost

Engineering	$	860,000.00
Implementation	$	3,430,000.00
Contingency	$	1,720,000.00
Total	**$**	**6,010,000.00**

Project Cost Sharing

This is existing infrastructure replacement that is 100% attributable to the Town of Canmore.

3.7.13 W10 – Downtown Canmore Waterline Replacement

New

Project Description

Replace aging water infrastructure in the Downtown area, between 6th Street and 10th Street.

Project Rationale

Water lines in the older areas of Canmore are nearing their lifecycle, and the Town should begin a program to replace the infrastructure that is nearing its lifecycle. The oldest pipes in Canmore were installed in 1966, and will reach their 75 year lifecycle by 2041, approximately 19 years after this study.

150 mm pipes should be upsized to 200 mm pipes.

For the best use of resources, the utility replacement program should be paired with a roadworks program.

Project Details

+ 3,000 m of 200 mm water line replacement
+ 18,000 m^2 of road replacement

Project Trigger

+ Recommended Project Year: 2038-2039

Project Cost

Engineering	$	1,260,000.00
Implementation	$	5,050,000.00
Contingency	$	2,520,000.00
Total	**$**	**8,830,000.00**

Project Cost Sharing

This is existing infrastructure replacement that is 100% attributable to the Town of Canmore.

3.7.14 W11 – 7th Avenue Waterline Replacement

New

Project Description

Replace aging water infrastructure in the 7th Avenue area, 10th Street and Industrial Place.

Project Rationale

Water lines in the older areas of Canmore are nearing their lifecycle, and the Town should begin a program to replace the infrastructure that is nearing its lifecycle. The oldest pipes in Canmore were installed in 1966, and will reach their 75 year lifecycle by 2041, approximately 19 years after this study.

150 mm pipes should be upsized to 200 mm pipes.

For the best use of resources, the utility replacement program should be paired with a roadworks program.

Project Details

+ 2,500 m of 200 mm water line replacement
+ 15,000 m^2 of road replacement

Project Trigger

+ Recommended Project Year: 2039-2040

Project Cost

Engineering	$	1,050,000.00
Implementation	$	4,190,000.00
Contingency	$	2,100,000.00
Total	**$**	**7,340,000.00**

Project Cost Sharing

This is existing infrastructure replacement that is 100% attributable to the Town of Canmore.

3.7.15 W12 – Rundle Waterline Replacement

New

Project Description

Replace aging water infrastructure in the Rundle area, including Bridge Road, Rundle Plant Lane, Rundle Crescent, Rundle Drive, MacDonald Place and St. Barbara's Terrace. This project would include a river crossing at Bridge Road.

Project Rationale

Water lines in the older areas of Canmore are nearing their lifecycle, and the Town should begin a program to replace the infrastructure that is nearing its lifecycle. The oldest pipes in Canmore were installed in 1966, and will reach their 75 year lifecycle by 2041, approximately 19 years after this study.

150 mm pipes should be upsized to 200 mm pipes.

For the best use of resources, the utility replacement program should be paired with a roadworks program.

Project Details

- 2,000 m of 200 mm water line replacement
- 12,000 m^2 of road replacement

Project Trigger

- Recommended Project Year: 2040-2041

Project Cost

Engineering	$	860,000.00
Implementation	$	3,430,000.00
Contingency	$	1,720,000.00
Total	**$**	**6,010,000.00**

Project Cost Sharing

This is existing infrastructure replacement that is 100% attributable to the Town of Canmore.

3.7.16 W13 – TeePee Town / Railway Ave Waterline Replacement

New

Project Description

Replace aging water infrastructure in the TeePee Town and Railway Ave area, from Gateway Street to Benchlands Trail along Railway Ave. This project also involves crossing Policeman's Creek along 8th Street.

Project Rationale

Water lines in the older areas of Canmore are nearing their lifecycle, and the Town should begin a program to replace the infrastructure that is nearing its lifecycle. The oldest pipes in Canmore were installed in 1966, and will reach their 75 year lifecycle by 2041, approximately 19 years after this study.

150 mm pipes should be upsized to 200 mm pipes.

For the best use of resources, the utility replacement program should be paired with a roadworks program.

Project Details

+ 1,500 m of 200 mm water line replacement
+ 9,000 m^2 of road replacement

Project Trigger

+ Recommended Project Year: 2041-2042

Project Cost

Engineering	$	650,000.00
Implementation	$	2,610,000.00
Contingency	$	1,300,000.00
Total	**$**	**4,560,000.00**

Project Cost Sharing

This is existing infrastructure replacement that is 100% attributable to the Town of Canmore.

3.7.17 W14 – Water Treatment and Supply Study

New

Project Description

Perform an engineering study to determine the optimal way to increase the available water supply and treatment for the Town of Canmore, in order to facilitate growth to the 25 year horizon and beyond.

Project Rationale

There is a projected deficit to the available water treatment rate in Pumphouse 1 and Pumphouse 2 prior to the 25 year horizon, which could potentially limit growth in the Town until it is addressed.

There are several potential options for increasing the water treatment rate, or further ensuring water security, which should be assessed in detail prior to the town committing funds to upgrade their infrastructure.

The three potential options are as follows:

+ Increase the available water withdrawal rate from the rundle forebay and subsequent treatment rate from Pumphouse 2 (Approximate Cost - $3,000,000)
+ Upgrade the withdrawal rates and treatment rates at Pumphouse 1 through a new deep well and a replacement of the treatment facility (Approximate Cost - $12,000,000)
+ Construct a large (~7,000 m^3) storage reservoir which could accommodate the deficits during peak demand. (Approximate Cost - $14,000,000)

Project Trigger

+ Triggered by development in all Offsite Levy Areas
+ Assessment, recommendations and resultant capital projects should be completed prior to a system wide MDD of 260 L/s

Project Cost

Engineering	$	150,000.00
Contingency	$	50,000.00
Total	**$**	**200,000.00**

Project Cost Sharing

The costs for this study will be 100% borne by the Town.

4. Wastewater System

4.1 System Characterization

The Town of Canmore's wastewater system consists of approximately 80 km of gravity sewer, 30km of forcemain, thirteen Town operated lift stations and eight privately operated lift stations. Currently, all of the Town's wastewater is collected at the wastewater treatment plant, treated and discharged into the Bow River.

There are also a few private systems on septic tanks and fields.

4.1.1 Pipe Diameters and Material

Gravity Mains

The wastewater gravity mains in Canmore consist of approximately 70% PVC and 30% unknown material, which is likely a mix of Concrete and Vitreous Clay Tile (VCT) pipe. The average age of the wastewater lines in the system is approximately 30 years old. The following tables shows the break down of the age, diameter, and pipe material of Canmore's wastewater system.

The existing wastewater system can be seen in Figure S1 (Appendix D)

Table 4-1 Wastewater Gravity Pipes Age

Age	Length (km)	% of Total
>50 Years	9.9	12%
41-50 Years	7.6	9%
31-40 Years	18.5	22%
21-30 Years	29.0	34%
11-20 Years	16.1	19%
0-10 Years	3.2	4%
Unknown	0.8	1%
Total	**85.1**	**100%**

Table 4-2 Wastewater Gravity Pipes Diameters

Diameter (mm)	Length (km)	% of Total
100	0.4	0.5%
150	1.3	1%
200	57.0	67%
250	13.8	16%
300	4.9	6%
375	2.2	3%
450	3.3	4%
>450	1.7	2%
Unknown	0.6	1%
Total	**85.1**	**100%**

Table 4-3 Wastewater Gravity Pipes Materials

Material	Length (km)	% of Total
CON	0.3	0.3%
PVC	60.0	70%
VCT	0.5	1%
UNK	24.3	29%
Total	**85.1**	**100%**

Forcemains

The wastewater forcemains in Canmore consist of approximately 40% PVC, 20% HDPE, and the remaining a mix of Ductile Iron, Polyethylene, and Unknown materials. The average age of the wastewater forcemains in the system are approximately 25 years old. The following tables shows the break down of the age, diameter, and pipe material of Canmore's wastewater system

Table 4-4 Wastewater Forcemains Age

Age	Length (km)	% of Total
>50 Years	0.3	1%
41-50 Years	2.0	7%
31-40 Years	10.9	36%
21-30 Years	2.7	9%
11-20 Years	5.3	17%
0-10 Years	7.5	25%
Unknown	1.6	5%
Total	**30**	**100%**

Table 4-5 Wastewater Forcemains Diameter

Diameter (mm)	Length (km)	% of Total
<100	4.8	16%
100	2.1	7%
150	3.4	11%
200	6.7	22%
250	6.4	21%
300	3.0	10%
350	2.5	8%
>350	1.1	4%
Unknown	0.1	1%
Total	**30**	**100%**

Table 4-6 Wastewater Forcemains Material

Material	Length (km)	% of Total
DI	0.7	2%
PE	0.8	3%
HDPE	4.9	17%
PVC	10.8	36%
UNK	12.5	42%
Total	**30**	**100%**

4.1.2 Low Pressure Systems

The southeast area of downtown Canmore is serviced by a low-pressure sanitary sewer system, and is the largest in the Town. Each service has its own wetwell and pump system and discharges into a common forcemain in the roadway. Low pressure systems were not individually modelled, however their contributions to the collection system were included.

The main low-pressure system discharges into the gravity sewer on 2nd Street and on 5th Avenue and then flows by gravity to Lift Station 1.

There are also some homes on Spring Creek Drive, and homes on the north side of 7 Street and east of 6th Avenue that are serviced by a low-pressure system, along with other localized low pressure systems and services across the Town.

4.1.3 Wastewater Collection Areas

There are a total of thirteen lift stations, and fourteen collection areas in the Town of Canmore. Three of the lift stations have other lift stations upstream discharging into its collection area, those areas were included in the downstream lift station collection area. One area of Canmore is not supported by a lift station, and instead the gravity collection system discharges directly into the triple forcemain, with the higher elevation facilitating flow through it. These areas include Benchlands, and portions of Avens and Cougar Creek neighbourhoods.

Table 4-7 Wastewater Collection Areas

Lift Station	Collection Area (ha)	Upstream Lift Stations
LS1	148	LS 3, LS 5
LS 2	107	None
LS 2A	57	None
LS 3	7	None
LS 4	105	LS 9
LS 5	45	None
LS 6	50	None
LS 7	70	None
LS 8	175	LS10, LS 11, LS 12
LS 9	8	None
LS 10	92	LS 11, LS 12
LS 11	14	LS 12
LS 12	5	None
No Lift Station	115	None
Total	**998**	

4.1.4 Lift Stations

The following is a summary of the thirteen lift stations operated by the Town of Canmore. Private lift stations were not included.

Firm pumping capacity is defined as the capacity of the facility with its largest pump out of service. i.e. with one pump running at a two-pump facility, or two pumps running at a three-pump facility. The pumping capacities were determined through a mix of SCADA flow meter information, interpolation from pump curves, and draw down testing that was performed for the previous UMP.

Lift Station 2 was recently replaced, and the new lift station was commissioned in 2019. Lift Station 6 was also replaced since the previous UMP. Two new lift stations, LS 11 and LS 12, were also constructed since the previous UMP.

The lift stations and their respective catchment areas ca be seen in Figure S2 (Appendix D)

Table 4-8 Lift Station Summary

Lift Station	Pumps	Power / Voltage / Phases	Firm Pumping Capacity (L/s)	Discharge Location
Lift Station 1	1 x Vaughan S4K2 2 x Vaughan SE8N5	10HP / 460V / 3 100HP / 460V / 3	200+	WWTP
Lift Station 2	3 x KSB KRTK 150-317	40HP / 600V / 3	130	Triple FM to WWTP
Lift Station 2A	2 x Flygt NP3171.091-453	34HP / 600V / 3	51	WWTP
Lift Station 3	2 x Flygt CP3085.182MT	3.2HP / 460V / 3	Unknown	LS 1 Collection Area
Lift Station 4	2 x Flygt NP3153.181-435	15HP / 208V / 3	85	WWTP
Lift Station 5	1 x Flygt CP3102.180-432 1 x Zoeller 6221 HD Series	5HP / 208V / 3 7.5HP / 208V / 3	40	LS 1 Collection Area
Lift Station 6	2 x Flygt CP3201.180 HT	20HP / 460V / 3	30	Triple FM to WWTP
Lift Station 7	3 x Flygt CP3152.181-436	47HP / 600V / 3	120	Triple FM to WWTP
Lift Station 8	2 x Flygt CP3152.181-436	20HP / 600V / 3	72	WWTP
Lift Station 9	2 x Flygt MP3127.170-212	11HP / 208V / 3	7	LS 4 Collection Area
Lift Station 10	3 x Flygt CP3152.181-454	20HP / 600V / 3	80	LS 8 Collection Area
Lift Station 11	2 X Vaughan S3F-060	7.5 HP / 600V / 3	15	LS 10 Collection Area
Lift Station 12	2 x Lowara 1315M S35	4 HP / 600V / 3	5	LS 11 Collection Area

Most of the lift stations operate on a Start/Stop level control philosophy with the following exceptions; Lift Station 1 operates on a flow control philosophy and ramps the pump speed up and down as needed. Lift Station 4 appears to operate on a hybrid Start/Stop level control at lower flow rates with the pumps operating at lower speeds, and a wet well level control during the day at higher flow rates where the pump speeds are adjusted to maintain a consistent wet well level

The following table summarizes the basic Start and Stop elevations for the main duty pumps at each lift station.

Table 4-9 Lift Station Operating Points

Lift Station	Pump Name	Ground Elevation (m)	Pump Elevation (m)	Pump Start Elevation (m)	Pump Stop Elevation (m)
LS 1	P1	1308.20	1303.20	1304.80	1304.00
LS 2	P101	1309.50	1301.20	1302.50	1301.90
	P102	1309.50	1301.20	1302.50	1301.90
LS 2A	P1	1309.30	1302.05	1303.40	1302.60
LS 3	P1	1311.30	1306.80	1307.70	1307.10
LS 4	P1	1310.10	1304.21	1305.30	1305.00
LS 5	P1	1311.60	1306.37	1307.27	1306.77
LS 6	P1	1313.60	1308.20	1309.60	1309.10
LS 7	P1	1308.60	1305.00	1306.40	1305.60
	P2	1308.60	1305.00	1306.40	1305.60
LS 8	P1	1312.10	1304.50	1305.41	1304.60
LS 9	P1	1383.50	1378.00	1379.00	1378.60
LS 10	P1	1311.04	1304.40	1305.80	1305.35
	P2	1311.04	1304.40	1305.80	1305.35
LS 11	P1	1356.75	1350.2	1350.58	1350.08
LS 12	P1	1358.26	1350.62	1351.82	1351.32

4.1.5 Wastewater Treatment

Alongside the UMP, a full Wastewater Treatment Plant Capacity Evaluation report was performed and is attached in Appendix G.

4.2 Flow Monitoring Program

To determine wastewater flow generation rates, diurnal usage patterns, and assess groundwater infiltration and rainfall derived infiltration, a flow monitoring program was developed. Inline flow monitors were installed in key locations.

A total of 5 flow monitors were installed across the Town of Canmore, which in tandem with lift stations that have flow meters installed on their discharge, was used to chart the flows in the wastewater system during dry weather and wet weather periods. The flow monitors were in place from April 12, 2022 to July 20, 2022. Two rain gauges were also installed for the duration, which tracked rainfall volume and intensity. One was installed on top of Pumphouse 1 and one on top of Pumphouse 2.

Inline flow monitors determine pipe flow by measuring depth and velocity of the water flowing past them and calculate and record flow rate every 5 minutes for the duration of the monitoring period.

SFE Global was contracted to supply, install, maintain, and report on the flow monitors. Their Flow Monitoring Report can be found in Appendix F.

The following is a summary of the flow monitors and lift stations used for the flow analysis. Figure S3 (Appendix D) shows the flow monitor locations and their respective catchment areas.

Flow Monitor 1 (FM1)

Installed in SMH 1414 along 4th Street, the catchment area for this flow monitor is the southwestern portion of the South Canmore / Downtown area. The total catchment area is approximately 22 ha.

Originally one flow monitor was intended to be installed for the Lift Station 1 catchment area, however discussions with SFE Global indicated that the location for this, on the upstream end of the lift station inlet pipe, would not be ideal due to the turbulence created by flow coming from two other directions in the manhole. Flow monitors operate best in manholes with a straight line of flow. As such, it was decided to split the Lift Station 1 catchment area into two flow monitors.

Flow Monitor 2 (FM2)

Installed in SMH 0279 along 5th Street, the catchment area for this flow monitor is the northern portion of the Downtown area, and up to and including the Larch and Industrial Place areas. Lift Stations 3 and 5 both discharge into the catchment area for this flow meter. The total catchment area is approximately 103 ha.

Flow Monitor 3 (FM3)

Installed in SMH 0249 at the upstream end of the triple forcemain, the catchment area for this flow monitor includes the Cougar Creek, Benchlands, and Avens Neighbourhoods. Lift Station 6 also discharges into this catchment area. The total catchment area is approximately 160 ha.

Flow Monitor 4 (FM4)

Installed in SMH 1200 along Silvertip Trail, the catchment area for this flow monitor is the Silvertip area, upstream of Lift Station 7. The total catchment area is approximately 58 ha.

Flow Monitor 5 (FM5)

Installed in SMH 1251 upstream of Lift Station 8, the catchment area for this flow monitor includes Cairns Landing, Miskow Close, Stewart Creek and Dead Man's Flats. Lift stations 10, 11 and 12 discharge into this catchment area. The total catchment area is approximately 100 ha.

Lift Station 2 (LS2)

Lift Station 2 was also utilized to track flow patterns, as it has a flow meter on its discharge. While the lift station operates on a start/stop level control, the hourly averages of the flows recorded in the SCADA system give a good representation of the flows. It's catchment area includes Railway Avenue and Bow Valley Trail, and Harvey Heights discharges into the catchment. The total catchment area is approximately 107 ha.

Lift Station 2A (LS2A)

Originally a sixth flow monitor upstream of Lift Station 2A was planned, however access constraints made it not feasible to install in the field. SCADA data of the lift station water level was instead used to calculate flows and patterns of its catchment area. Using the wet well level recorded in the SCADA system, and the cross-sectional area of the wetwell, the change in volume during each pump and fill cycle can be calculated, which effectively provides the flow rate in and out of the lift station. The hourly averages of these flow rates give a good representation of the flows.

The catchment area for Lift Station 2A includes Kananaskis Way and the southeastern portion of Bow Valley Trail. The total catchment area is approximately 57 ha.

Lift Station 4 (LS4)

Lift Station 4 was also utilized to track flow patterns, as it has a flow meter on its discharge. While the lift station operates on a start/stop level control for lower flows, and a wet well level control for higher flows, the hourly averages of the flows recorded in the SCADA system give a good representation of the flow patterns. The catchment area includes the Rundle, McNeil, and Grassi Peaks areas. Lift Station 9 also discharges into the catchment area. The total catchment area is approximately 107 ha.

Lift Station 6 (LS6)

Lift Station 6 was also utilized to track flow patterns, as it has a flow meter on its discharge. While the lift station operates on a start/stop level control, the hourly averages of the flows recorded in the SCADA system give a good representation of the flows. The catchment area includes the Elk Run Industrial area, and portions of the Avens and Canyon ridge area. The lift station discharges into the FM3 catchment area. The total catchment area is approximately 50 ha.

4.3 Design Criteria

The following criteria are used to assess the existing and future systems.

4.3.1 Flow Generation Criteria

Existing wastewater generation rates were calibrated using SCADA data records and results from the flow monitoring program.

Future wastewater flow is based on the unit rates established in the Canmore Engineering Design Guidelines and the 2017 Utility Master Plan. These unit rates are applied to the hydraulic model using the number of units for each land use type in each of the growth areas. The ICI land use area-based unit rates were updated, as the unit density was assessed against unit consumption, and was shown to be significantly higher than the EDCG.

Table 4-10 Future System Wastewater Flow Generation Parameters

Demand Type	Rate	Units
Wastewater Treatment Plant (Composite Rate)	360	L/c/d
Residential	250	L/c/d
ICI	30	m^3/ha/d
Hotels	700	L/unit/day
Residential Peaking Factor	1+14 / (4+P ½)	Harmon's Formula
Commercial / Industrial Peaking Factor	3.5	PF
Hotel Peaking Factor	4	PF

4.3.2 Collection System Criteria

The gravity collection system of Canmore was modeled using the Peak Wet Weather Flow scenario. The pipes were evaluated based on the following criteria

+ Hydraulic capacity
    - The capacity of a gravity sewer is evaluated based on the peak expected flow and the flow capacity of the pipe which is calculated using pipe slope and diameter at 86% flow depth. Pipe capacity must be greater than the expected peak flow or surcharging of the collection system can occur. This value is represented as a percentage which is calculated by dividing the peak flow by the pipe's flow capacity. A percentage less than 100% means that peak flow is less than the capacity of the pipe.
+ Hydraulic grade line should not exceed the top of the pipe
+ Pipe velocity should not exceed 3.0 m/s

4.3.3 Lift Station Pumping Requirements

Under peak wet weather flow conditions, a lift station should be able to convey peak flows using the station's firm flow capacity (i.e. with the largest pump out of service).

4.4 Wastewater Flow Generation Analysis

Wastewater flow generation in the Town of Canmore was broken into two periods: dry weather period where there was no appreciable rainfall and the river level / groundwater is low, and wet weather period where there is significant rainfall.

4.4.1 Dry Weather Flow Generation

The following sections discuss how the dry weather flows were calculated in the existing system. The average dry weather flows represent the average day, with the diurnal patterns showing the low flows and peak flows throughout the day.

4.4.1.1 Average Day Dry Weather Flows

Dry weather flow generation for the existing system was developed by first establishing baseline flows, which represent the Average Dry Weather Flow (ADWF). This was done in a similar way to the water system.

Average Dry Weather Flows were developed by assessing the total volume of water distributed to the Town over the past four years, versus the total volume of wastewater collected and treated in the same time period. The annual water volumes were scaled to match the annual wastewater collection volumes, which on average was a factor of 1.15 times more wastewater than water each year.

These were assigned to the hydraulic model through geolocated customer water meter data, which has been scaled such that the total volume of consumption is equivalent to the total volume of wastewater collection.

Table 4-11 Wastewater Collection vs Water Distribution

Year	Annual Water (m^3)	Annual Wastewater (m^3)	Wastewater to Water Ratio	Wastewater to Water Meter Ratio
2018	2,724,788	2,943,504	1.08	1.62
2019	2,589,814	3,167,849	1.22	1.77
2020	2,512,425	3,095,458	1.23	1.69
2021	2,749,175	2,971,909	1.08	1.55
Average	2,644,051	3,044,680	1.15	1.67

The flow monitors and lift stations discussed in Section 4.2 were then reviewed to develop diurnal patterns for each of the catchment areas. Diurnal patterns represent the changes in flow through the system throughout the day, with the lowest point typically being during the night and early morning hours, and two peaks during the morning and evening. A separate diurnal pattern for Saturdays, Sundays, and Weekdays were developed, as they all have distinct characteristics.

The dry weather period was determined to be between April 12, 2022 (the day of the flow monitor installation) and May 10, 2022. No significant rainfall events occurred during this period, and there was no visible increase in flows due to groundwater or rising river levels.

The flows for each catchment were developed as an hourly average, and the average of these were taken to create separate diurnal flows for Saturdays, Sundays, and Weekdays. These hourly flows, divided by the average flow for each catchment, were used to develop the diurnal patterns, which act as a multiplier for the baseline demands.

The following table shows the average dry weather flows calculated for each catchment from the customer water meter data, versus the measured average dry weather flows from the flow monitors and lift station SCADA data.

Table 4-12 Average Dry Weather Flows – Calculated vs Measured

Catchment Area	Calculated Average Flow (L/s)	Measured Average Flow (L/s)
FM 1	2.7	1.6
FM 2	8.4	5.1
FM 3	17.0	21.5
FM 4	1.7	1.8
FM 5	7.2	4.2
LS 2	17.0	17.1
LS 2A	7.5	7.6
LS 4	6.6	13.4
LS 6	5.7	4.3
LS 7	4.8	11.2
LS 8	7.6	10.9
LS10	6.3	8.2
WWTP Influent	74.0	74.0

Overall, the calculated average flows and the measured average flows correlate well, but with some notable outliers.

Both FM1 and FM2 catchments had higher calculated flows than measured flows. There are some possible explanations for this, such as increased water usage that does not translate into wastewater generation. To be conservative, the higher calculated average flows will still be used as the baseline flows.

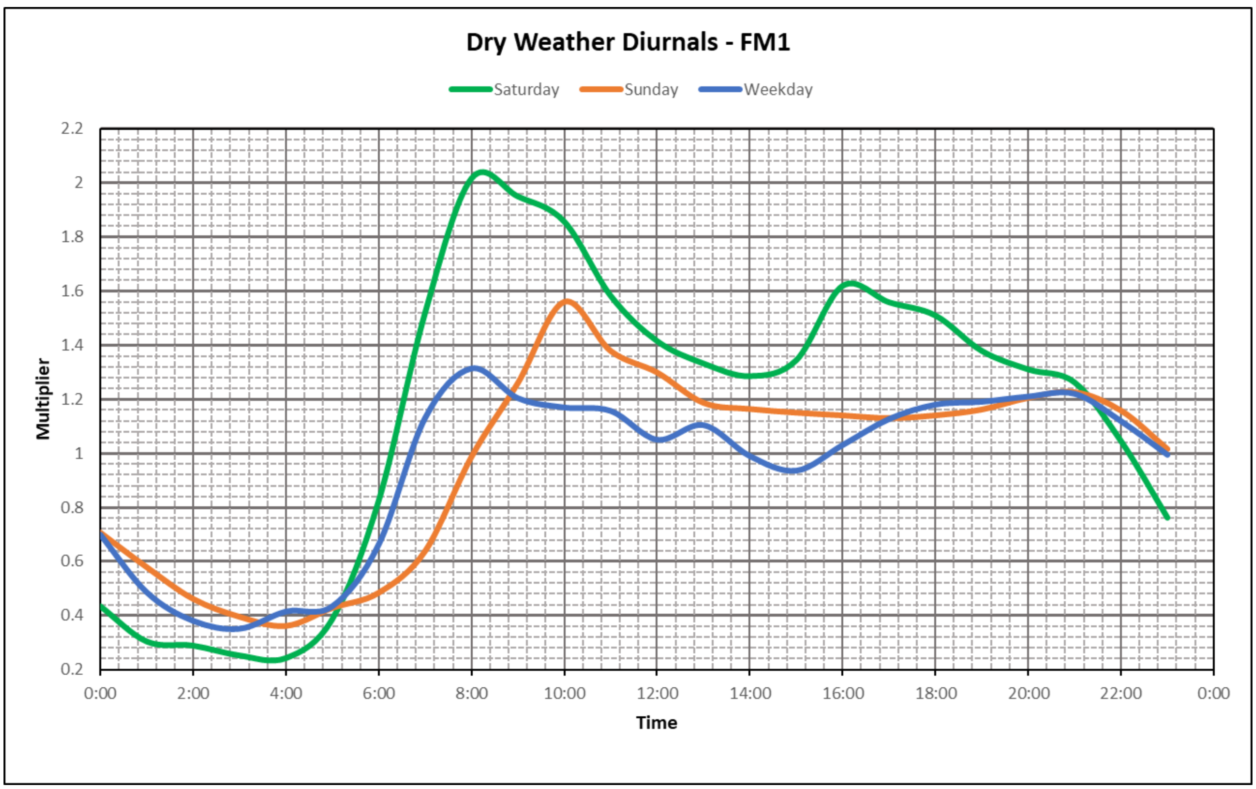
FM5 had notably lower measured flows than calculated flows, and the measured flow was half of that of Lift Stations 8 and 10, which have largely the same catchment areas. The likely explanation for this discrepancy is due to the five-minute recording increment of the flow monitor. The upstream flows all come from Lift Station 10, and the recording increment could be missing the spikes in flows that come from frequent pump cycles. Due to this large discrepancy, information from Lift Station 8 will be used to determine the diurnal patterns of the catchment area. If future flow monitoring programs are executed, efforts should be made to record that catchment at a higher frequency to account for frequent lift station pump cycles.

Lift Station 4 had significantly higher measured flows than calculated flows. This is due to the Pumphouse 2 filter backwash schedule which discharges directly into the Lift Station 4 catchment area. Filter backwash generally happens between 9 am and 3 pm daily, and is observable in the lift station diurnal flow patterns. To account for this, the difference in calculated and measured flows (~7 L/s) will be added to the catchment area near Pumphouse 2 as a separate demand, with its own pattern of entering the system between 9 am and 3 pm. The diurnal pattern of the catchment area is still influenced by this, and as the backwash flows are inconsistent and not tracked, there was no practical way to adjust the pattern to account for this. As such, the Lift Station 4 diurnal patterns do not reflect typical usage patterns but do represent the flows in the catchment area as a whole.

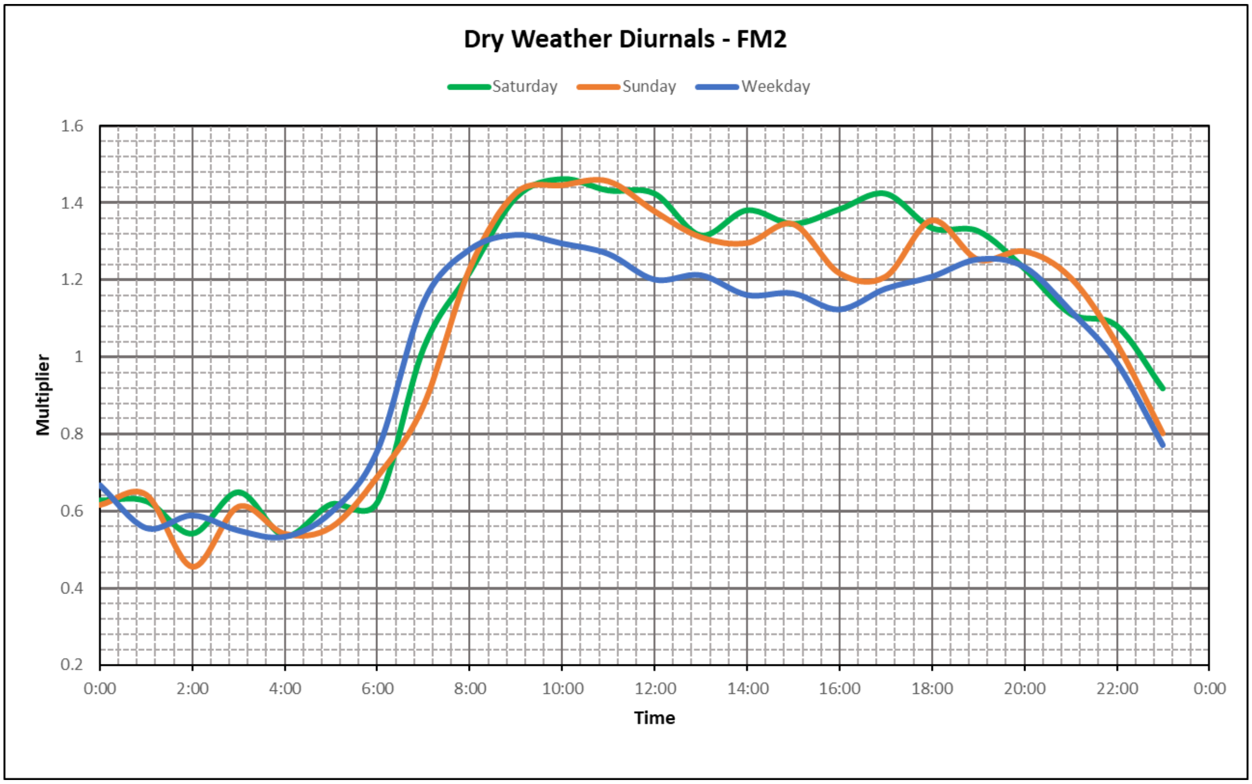
Lift Station 7 had significantly higher measured flows than calculated flows. Upon reviewing the lift station flow patterns, there is no apparent consistency to the flows, and they do not create a discernable diurnal pattern. As such it is assumed that the wet well levels reported to the SCADA system are unreliable. FM4 patterns, which are in the same catchment area, will be applied to any demands downstream of it that enter Lift Station 7.

The following are the diurnal patterns that were developed using the above information, and which will be applied to their respective catchment areas to develop the time based average dry weather flows.

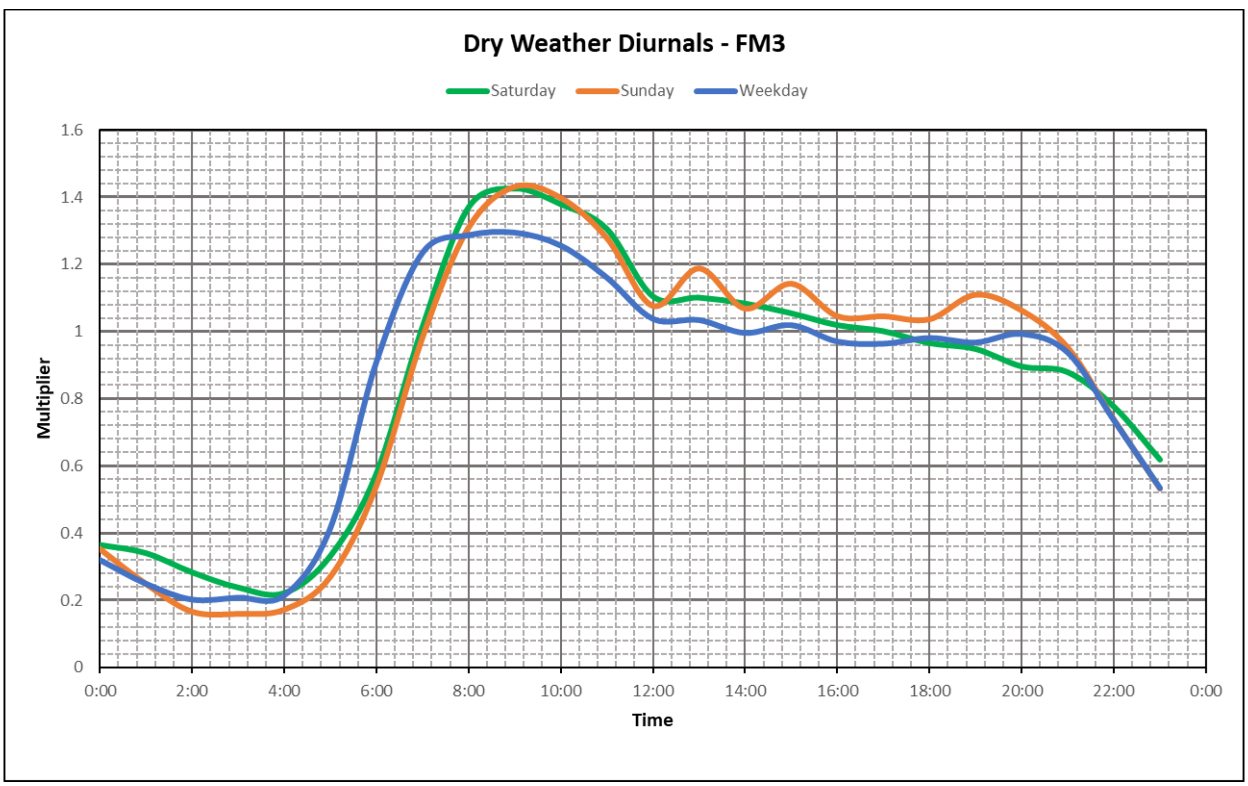
Flow Monitor 1



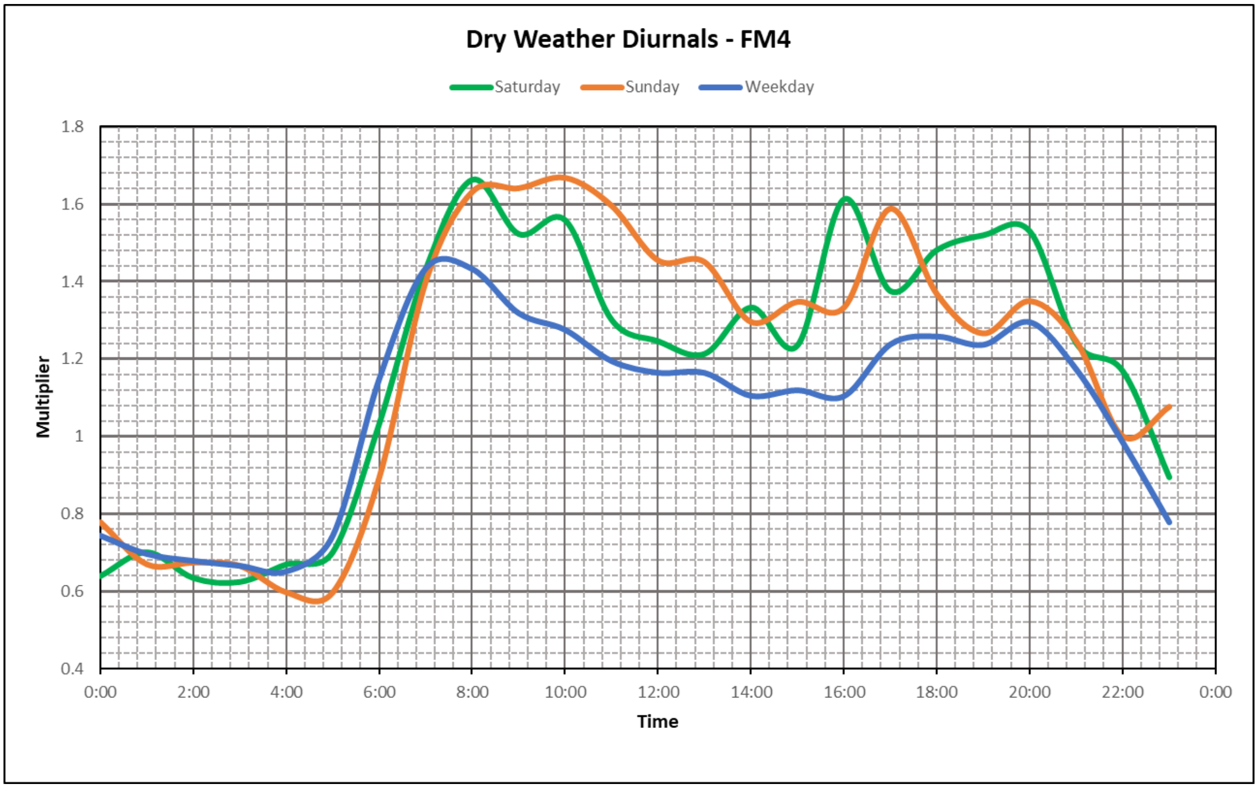
Flow Monitor 2



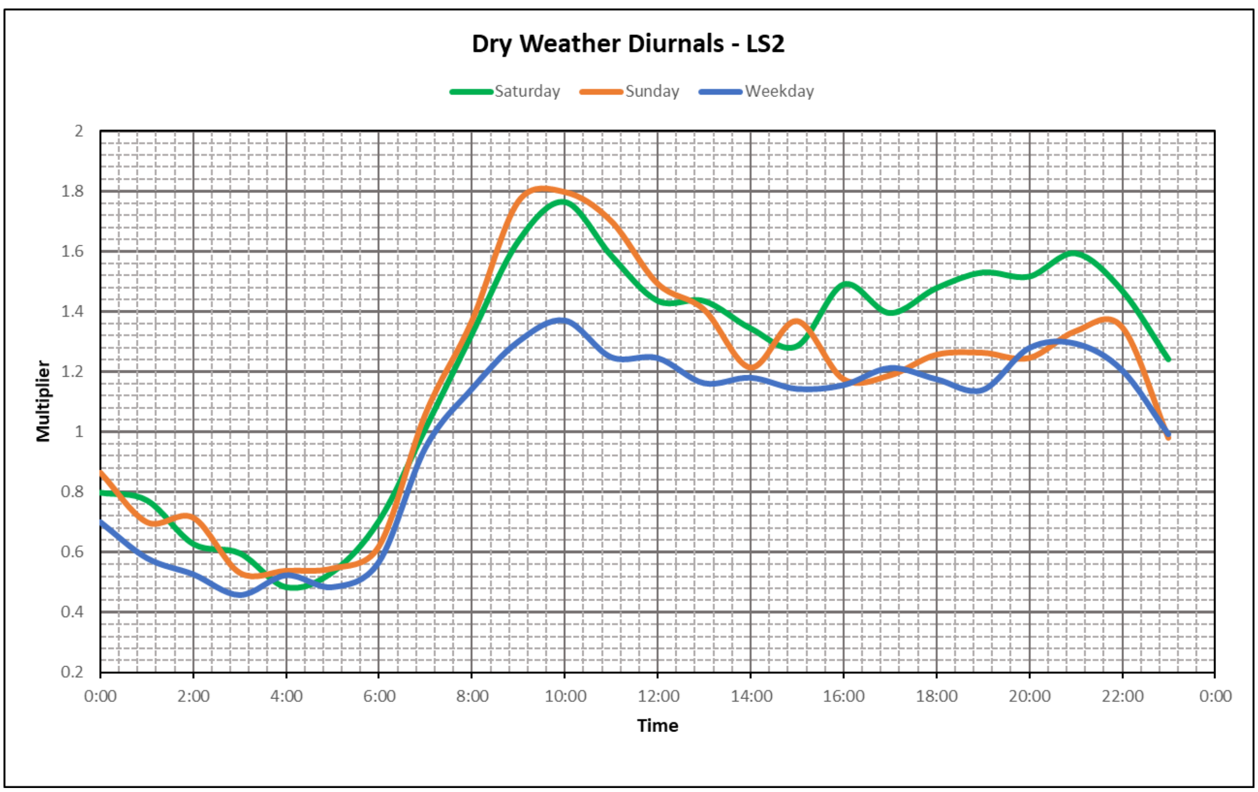
Flow Monitor 3



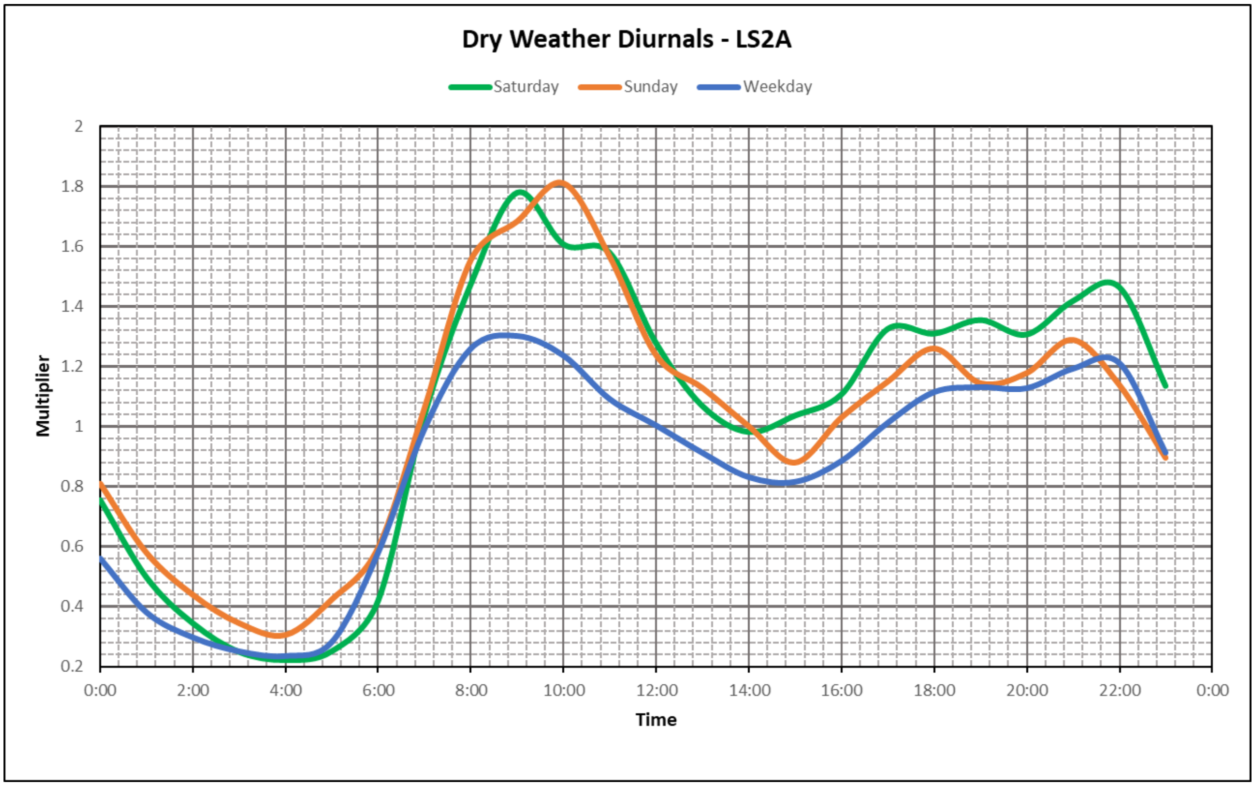
Flow Monitor 4



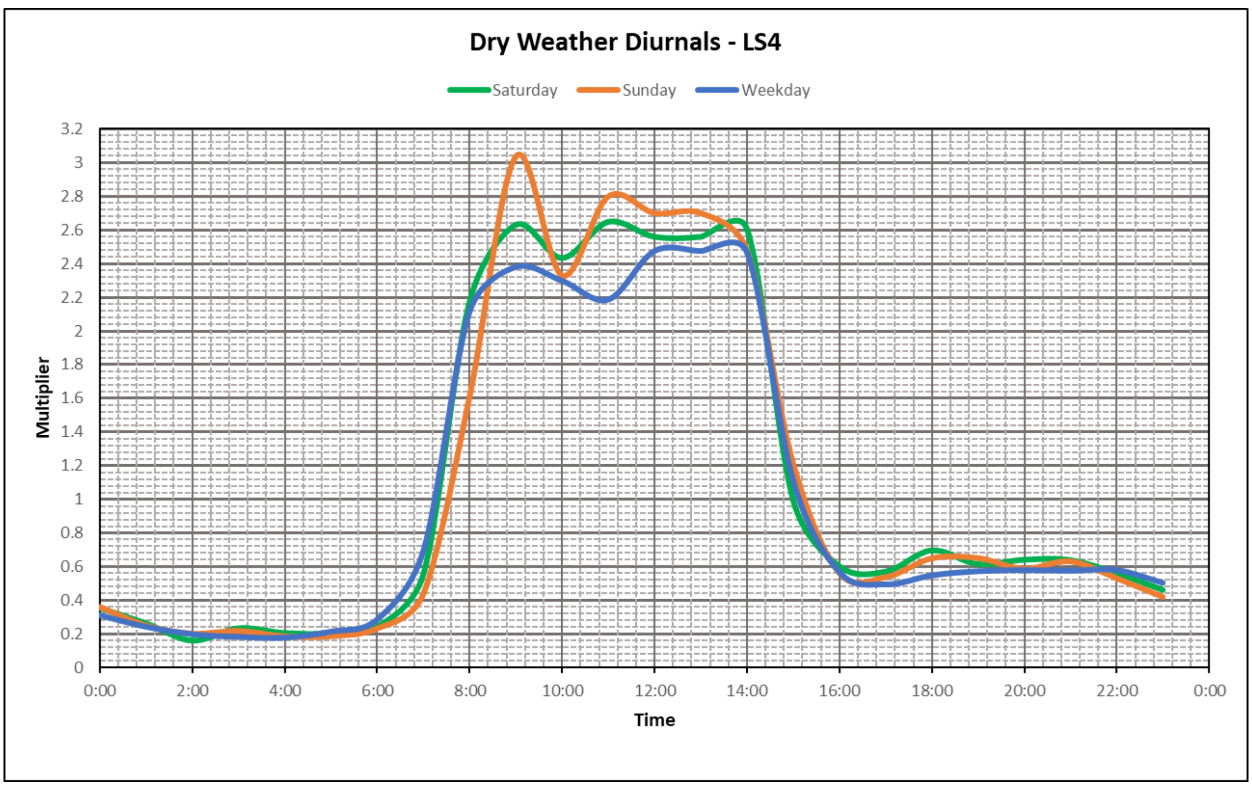
Lift Station 2



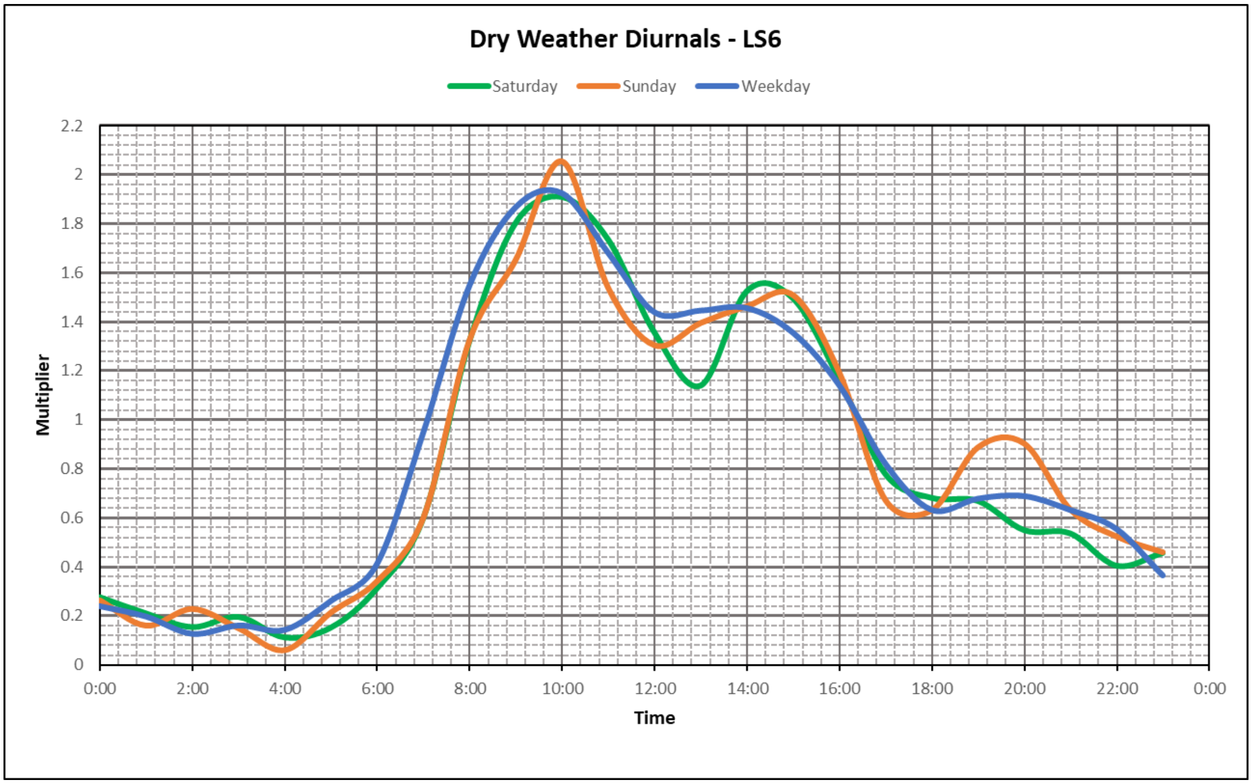
Lift Station 2A



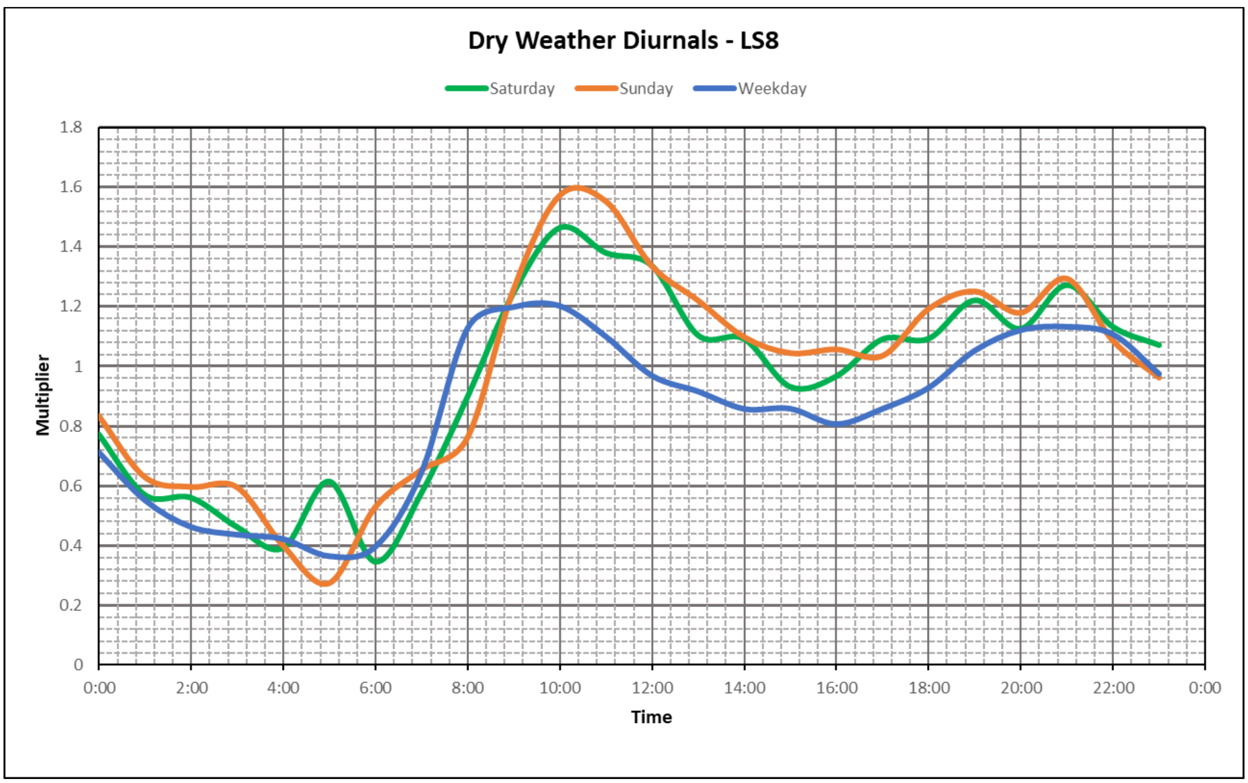
Lift Station 4



Lift Station 6



Lift Station 8



4.4.1.2 Maximum Day Dry Weather Flows

The maximum day flows are an estimate of the same flow patterns as the average days for the highest usage days of the year.

The maximum day flows take the baseline flows, and multiply them by the water Maximum Day Demand peaking factor of 1.7 times. The maximum daily flows entering the wastewater system are not representative of the dry weather flows, as they are heavily influenced by inflow and infiltration that occurs during wet weather periods and high river levels.

The following table shows the maximum day dry weather flows for each catchment area that a diurnal pattern was developed for.

Table 4-13 Maximum Day Dry Weather Flows Summary

Catchment Area	Average Day Dry Weather Flows (L/s)	Maximum Day Dry Weather Flows (L/s)
FM 1	2.7	4.5
FM 2	8.4	14.2
FM 3	17.0	28.9
FM 4	1.7	2.9
LS 2	17.0	28.9
LS 2A	7.5	12.7
LS 4	6.6	11.2
LS 6	5.7	9.6
LS 8	7.6	12.9

4.4.2 Wet Weather Flow Generation

Generally, the Town is split into two areas with different wet weather influences. The valley bottom, generally bounded by the Bow River to the southwest, and Highway 1 to the northeast, is influenced through inflow and infiltration into the system by ground water. During the snowmelt period which can include large rainstorms, a groundwater surge occurs and a dramatic increase in flows can be observed.

The valley slopes, generally bounded by being southwest of the Bow River, and northeast of Highway 1, have minimal groundwater influence. Inflow and infiltration would be caused by rain events, with runoff water entering the system through manholes and some pipe infiltration from local soil saturation.

Valley Bottom

The valley bottom consists of the FM1, FM2, LS2 and LS2A catchment areas, which generally includes downtown Canmore, Bow Valley Trail, and Kananaskis Way.

In reviewing the flow monitors and lift station flow data in the valley bottom, the peak wet weather period was determined to be between June 13, 2022 and June 24, 2022. The figure below shows the trend for increased flows as the river levels rise, peaking between the noted period. This period also contained the most significant rainfall event observed during the monitoring period, which occurred between June 13-June14

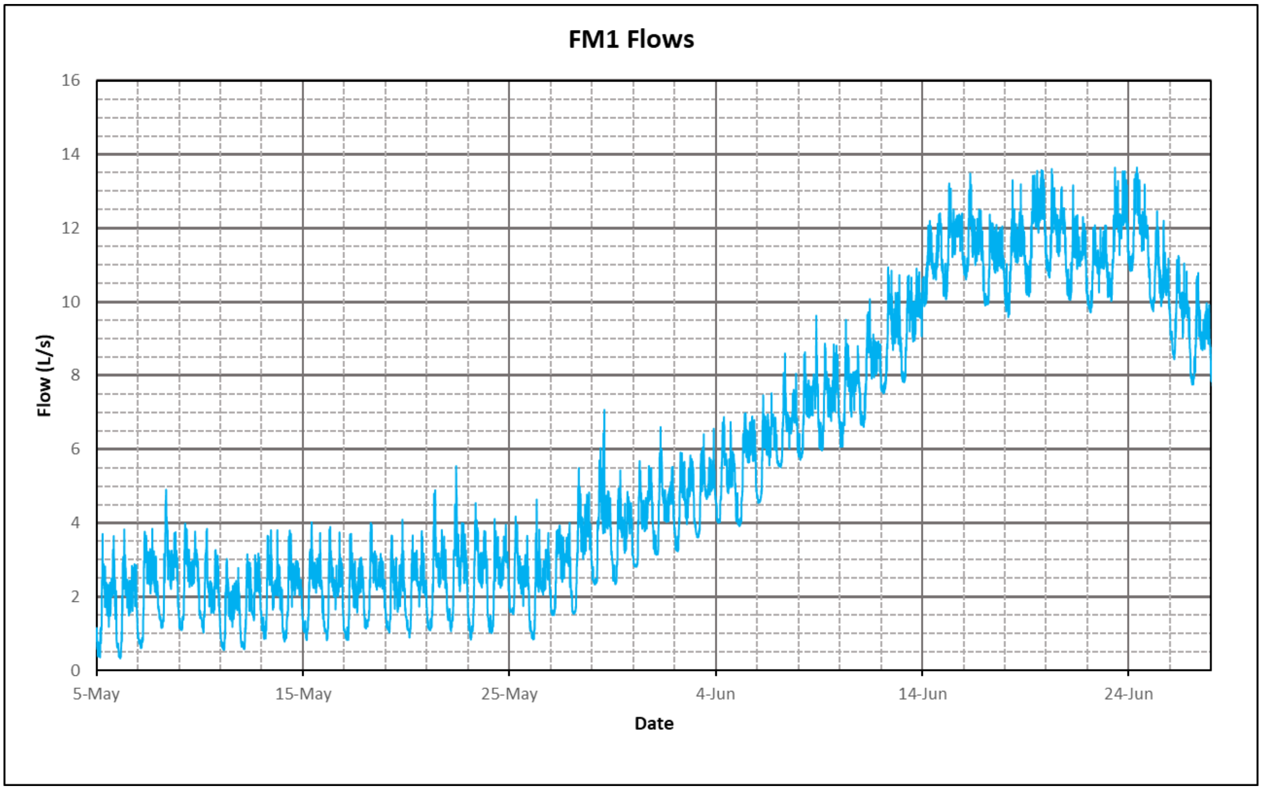


Figure 4-1 FM 1 Flows – Wet Weather Period

The additional wet weather flow for each catchment was determined by reviewing the minimum night flow during the dry weather period and comparing it against the maximum night flow during the wet weather period. Using the night flows ensures that flow generated by connections to the system are at a minimum, allowing for the best comparison.

The following table shows the dry weather and wet weather night flows for each catchment area, and the calculated additional flows due to the wet weather. Also shown are the approximate area based inflow and infiltration rates for each catchment.

Table 4-14 Valley Bottom I&I Rates

Catchment Area	Area (ha)	Night Flow Dry (L/s)	Night Flow Wet (L/s)	I&I (L/s)	I&I Rate (L/s/ha)
FM 1	21.6	0.3	11.0	10.7	0.50
FM 2	105.0	2.3	18.9	16.6	0.16
LS 2	107.3	8.4	63.8	55.4	0.52
LS 2A	48.3	1.6	2.8	1.2	0.02

All catchments in the valley bottom had I&I rates lower than the 0.66 L/s originally determined in the 2014 Flow Monitoring Program, however the FM 1 and LS 2 catchments were still notably high.

The LS 2A catchment had a significantly lower I&I rate, at 0.02 L/s/ha. This is possibly due to the overall newer construction of the area, and a change in underlying soil type. Due to the low I&I rate observed in the catchment, the LS 2A catchment area will have wet weather flow generation applied to it in the same way as the Valley Slopes, which is at a rate of 0.1 L/s/ha.

Valley Slopes

The original intent to assess wet weather flows on the valley slopes was to utilize the flow monitoring program to identify rainfall events and the additional flow introduced into the system during these rain events. Using this data, the model could be calibrated to the observed storm event, to project the effects of the system during a 1:50 year storm event.

However, across all the flow monitor and lift station locations that were used to assess flow on the valley slopes, there was minimal rainfall response observed in the collection system. Because of this, the rainfall response was not significant enough to derive calibration parameters for storm events.

The primary rainfall event was between June 13, 2022 and June 14, 2022. The following figure shows the flow recorded at FM 3 and the rainfall intensity. Overall, approximately 43 mm of rain fell in that time period. This would typically induce a noticeable response to flows in the system. Flow Monitor 3 also has the largest catchment area in the system

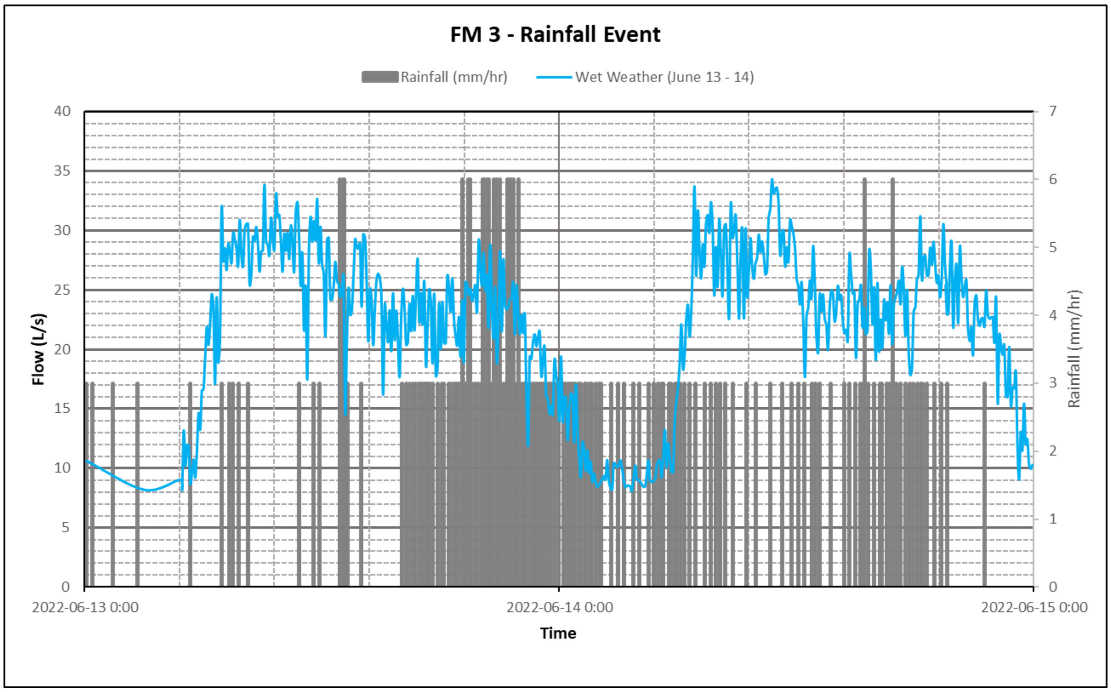


Figure 4-2 Flow Monitor 3 Rainfall Event

These two days were on a Monday and a Tuesday. As a comparison, the flows on this day were compared against the next Monday and Tuesday, June 20 – June 21, which had no notable rainfall. The period of time with the highest rainfall intensity shows almost no difference in flows from the dry weather comparison.

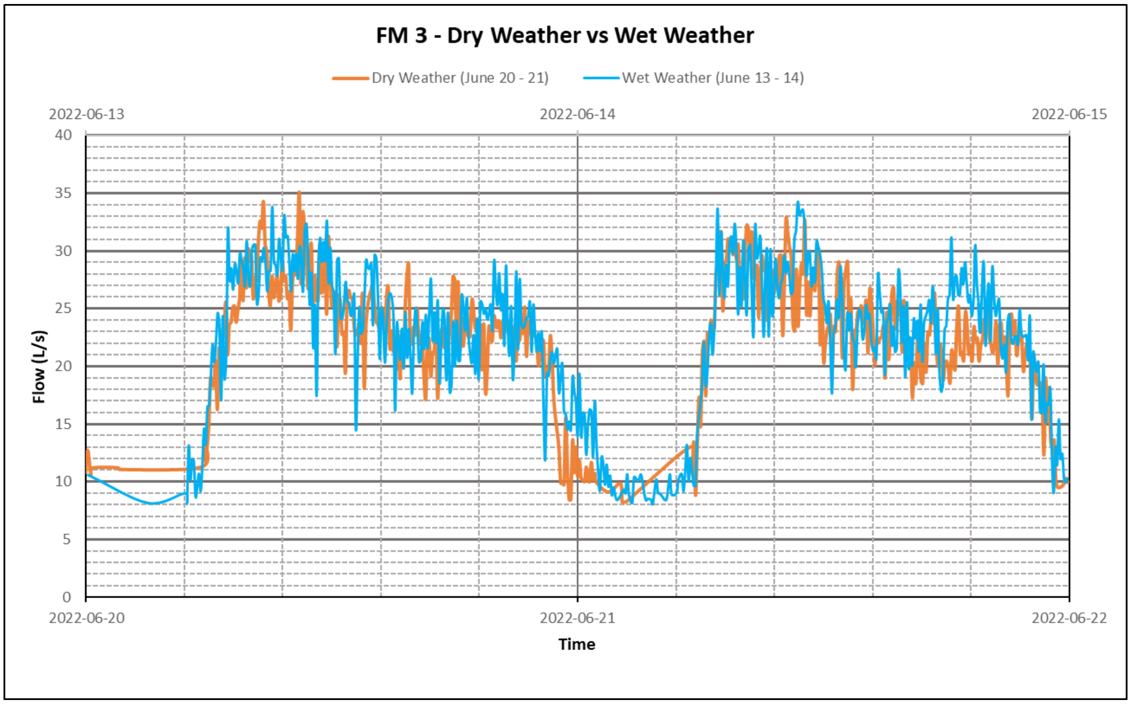


Figure 4-3 Flow Monitor 3 Dry Weather vs Wet Weather

This leads to the conclusion that the valley slopes have minimal responses to rainfall events, for the intensity of storms that were observed during the monitoring period.

To account for some level of rainfall derived inflow and infiltration, an assumed I&I rate of 0.1 L/s/ha was applied to the valley slopes to simulate an extreme wet weather event.

The following table shows the I&I for the valley slopes catchment areas with the assumed 0.1 L/s/ha rate applied.

Table 4-15 Valley Slopes I&I Rates

Catchment Area	Area (ha)	I&I Rate (L/s)
LS 2A	48	5
FM 3	160	16
FM 4	58	6
LS 4	107	11
LS 6	50	5
LS 8	175	18

4.4.3 Future Flow Generation

The future wastewater demands are determined in the same way as the water network, by applying the unit rates to the projected growth, in units, for each land use. The units were distributed as shown in the Growth Projections and Design Basis Memo. There are three growth horizons, 5 years, 15 years, and 25 years, and two separate growth scenarios.

Dead Man's Flats was projected as linear growth, where the 25 Year Horizon maxes out the current Memorandum of Agreement for wastewater flow, which is 7.5 L/s ADWF and 37.2 L/s PWWF. Using these flow maximums, a peaking factor of 5x was assumed, and accounts for I&I. Current PWWF is approximately 5 L/s.

As per the design criteria, each land use has its own peaking factor for Peak Dry Weather Flow. I&I rates were assigned to the system using the estimated gross developable area of each growth area, determined by the unit densities discussed in Section 1.2.

Growth Scenario 1

The following are the system wide wastewater flows for each growth horizon in Growth Scenario 1, which represents the full projected growth across 25 years. They do not include the existing demands.

The gross developable areas are shown in the following table.

Table 4-16 Wastewater Gross Developable Areas

Land Use	5 Year	15 Year	25 Year
	Area (ha)	Area (ha)	Area (ha)
Commercial	8.5	15.4	25.1
Hotels	10.1	21.3	32.5
Residential - Low Density	13.1	33.7	54.2
Residential - Medium / High Density	24.5	57.7	90.9
Total	**53.4**	**128.1**	**202.7**

The following table shows the system wide demands for the 5 Year Horizon.

Table 4-17 5 Year Horizon Wastewater Flows

Land Use	ADWF	PF	PDWF	I&I	PWWF
	L/s		L/s	L/s	L/s
Commercial	2.0	3.5	6.9	2.4	9.3
Hotels	9.1	4.0	36.3	2.8	39.1
Residential - Low Density	1.3	3.1	4.2	3.7	7.9
Residential - Medium / High Density	7.7	3.1	23.9	6.9	30.7
Dead Mans Flats	1.3	5.0	6.7	-	6.7
Total	**20.1**	**-**	**71.3**	**15.7**	**87.0**

The following table shows the system wide demands for the 15 Year Horizon.

Table 4-18 15 Year Horizon Wastewater Flows

Land Use	ADWF	PF	PDWF	I&I	PWWF
	L/s		L/s	L/s	L/s
Commercial	5.4	3.5	18.9	4.3	23.2
Hotels	19.1	4.0	76.4	6.0	82.4
Residential – Low Density	3.5	2.8	9.5	9.4	18.9
Residential – Medium / High Density	18.1	2.8	49.7	16.2	65.9
Dead Mans Flats	4.0	5.0	20.1	-	20.1
Total	**50.0**	**-**	**174.6**	**35.9**	**210.5**

The following table shows the system wide demands for the 25 Year Horizon.

Table 4-19 25 Year Horizon Wastewater Flows

Land Use	ADWF	PF	PDWF	I&I	PWWF
	L/s	L/s	L/s	L/s	L/s
Commercial	8.8	3.5	30.8	7.0	37.8
Hotels	29.1	4.0	116.5	9.1	125.6
Residential - Low Density	5.6	2.6	14.2	15.2	29.4
Residential - Medium / High Density	28.5	2.6	72.8	25.5	98.3
Dead Mans Flats	6.7	5.0	33.5	-	33.5
Total	**72.0**	**-**	**234.4**	**56.8**	**291.2**

4.5 Hydraulic Model Development

4.5.1 Existing System Implementation

A wastewater hydraulic model of the Town's wastewater system was developed for the 2016 UMP, however due to it being six years old, and the intent to move to a time-based model, the decision was made to remake the model utilizing Bentley SewerGEMS.

Schematic linework, manhole locations, and asset attributes such as pipe diameter, material, and invert elevations were established from the Town's most recent GIS data. All assets were associated to the GIS IDs from the Town's asset management system, which will result in easily updating and removing assets as the GIS information is updated. All new assets as of March 2022 were included in the model.

The inputs, particularly the invert elevations at pipes and manholes, were reviewed for completeness and to ensure all pipes in the network had their inverts oriented in the proper direction.

Lift station pump curves and operating points were retained from the previous UMP inputs, and were reviewed for accuracy and updated where necessary as per information provided from EPCOR. Lift Station 2 was notably updated since the previous UMP, and had its new wet well location, orientation and inputs updated, in addition to updated lift station pump curves.

Any missing ground level or manhole rim inputs were updated as per the most recent LiDAR information provided by the Town.

Wastewater flows were implemented into the model utilizing the customer water meter data, as discussed in Section 4.4.1. Each catchment area was divided into smaller sub catchments for each manhole in the system using Thiessen geometry. All water meters that fell into a particular manhole's sub catchment had their demands assigned to that manhole. The sum of demands in each of these sub catchments equals the Average Dry Weather Flow for each catchment area.

4.5.2 Extended Period Simulation

The model was developed as a time-based model, also known as an extended period simulation. This form of model simulates the daily demands and operational information such as pump cycles in real time, and is a more accurate way of representing the flow patterns and characteristics in the system. The flows and hydraulic grade lines of the system can be charted over time to see when and how long particular events affect the system.

As discussed in Section 4.4, diurnal patterns were developed for each of the flow monitor and lift station catchment areas. These diurnal patterns act as peaking factors or multipliers for the demands, creating the peak and low flows throughout the day.

4.6 Existing System Evaluation

4.6.1 Collection System Analysis

Flow Capacity

The existing collection system was reviewed under the Peak Wet Weather flow scenario, with particular focus on the peak flows during the day. The simulation results during the peak flows, showing pipe flows and any surcharging pipes can be found in Figure S4 (Appendix D).

Overall, there were only two pipe sections that did not meet the design criteria for pipe capacity, hydraulic gradeline, or velocity.

+ SNG1263 – Located on Bow Valley Trail in front of the Canmore Rocky Mountain Inn, this pipe segment has a flow that is 109% of the pipe's capacity. As it is a short pipe segment with a lower slope than downstream, no surcharging is observed during or after the peak flows. No action will need to be taken for the existing system, however this pipe should be monitored during future scenarios, as it will act as a bottleneck if additional flows are introduced.
+ SNG0800 – Located on Hospital Place and is the connection for TeePee town into Bow Valley Trail. This pipe segment has a flow that is 100% of the pipe's capacity. No surcharging is observed during or after the peak flows. No action will need to be taken for the existing system, however this pipe should be monitored during future scenarios, as it will act as a bottleneck if additional flows are introduced.

Pipe Lifecycle

The Town of Canmore's wastewater collection system contains aging infrastructure, particularly in the Downtown area. The service life of wastewater mains as per Canmore's asset management standards is 75 years.

Currently there are pipes dating back to 1965, making the oldest pipes in the system approximately 58 years old. Figure S5 (Appendix D) shows the pipes according to age.

Currently no pipes in the system are approaching the end of their lifecycle, however replacement programs should be considered in the future when pipe lifecycle is approaching its end.

4.6.2 Lift Station Analysis

The existing lift stations were reviewed under the Peak Wet Weather flow scenario. All lift stations had a firm pumping capacity greater than the peak flows, and meet the design criteria.

Table 4-20 Existing Lift Station Analysis

Lift Station	PWWF (L/s)	Firm Pumping Capacity (L/s)
LS 1	57.3	200+
LS 2	88.6	130
LS 2A	21.3	51
LS 3	1.2	Unknown
LS 4	32.2	85
LS 5	9.3	40
LS 6	26.4	30
LS 7	10.9	120
LS 8	28.9	72
LS 9	2.1	7
LS 10	26.4	80
LS 11	4.0	15
LS 12	0.5	4

From a lifecycle and operational standpoint, Lift Station 3 is in severely deteriorated condition and does not operate reliably. The lift station should be replaced when practical for the Town.

4.7 Future System Evaluation

4.7.1 Collection System Analysis

The existing collection system was reviewed under the Peak Wet Weather flow scenario, with particular focus on the peak flows during the day. The results during the peak flows, showing pipe flows and any surcharging pipes can be found in Figures S6 – S11.

5 Year Horizon

The 5-year horizon saw significantly increased flows along the Bow Valley Trail area, as the growth projections accelerated all projected development in Bow Valley Trail and TeePee town to the 5-year horizon. These increased flows result in surcharging along Bow Valley Trail. The following figure shows the hydraulic grade line between Hospital Place and 17th Street. Figure S6 shows the hydraulic model results fo this scenario.

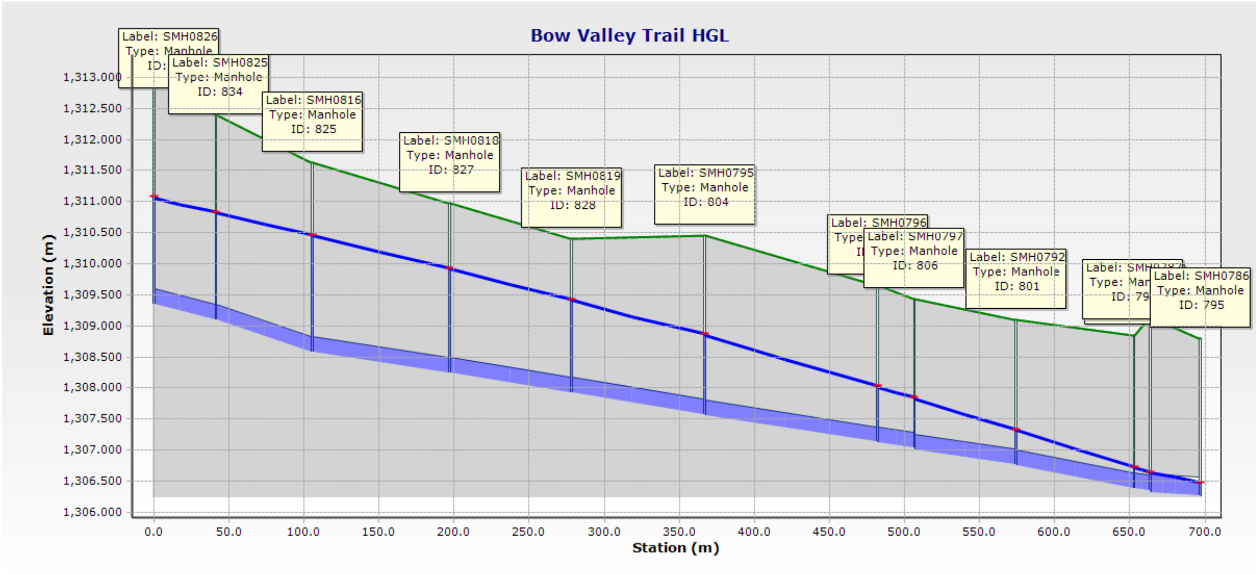


Figure 4-4 BVT Hydraulic Grade Line

The flow through these pipes is significantly higher than the pipe capacity and act as a bottleneck for upstream flows, resulting in surcharging. The surcharging under these conditions carries on to the upstream end of the Bow Valley Trail collection system.

The pipes between Hospital Place and 17th Street will need to be upgraded to at least 300 mm diameter to increase pipe capacity and eliminate surcharging. Figure S7 shows the model results after upgrading Bow Valley Trail.

The following figure shows the hydraulic grade line of the same pipes, when upgraded to 300 mm.

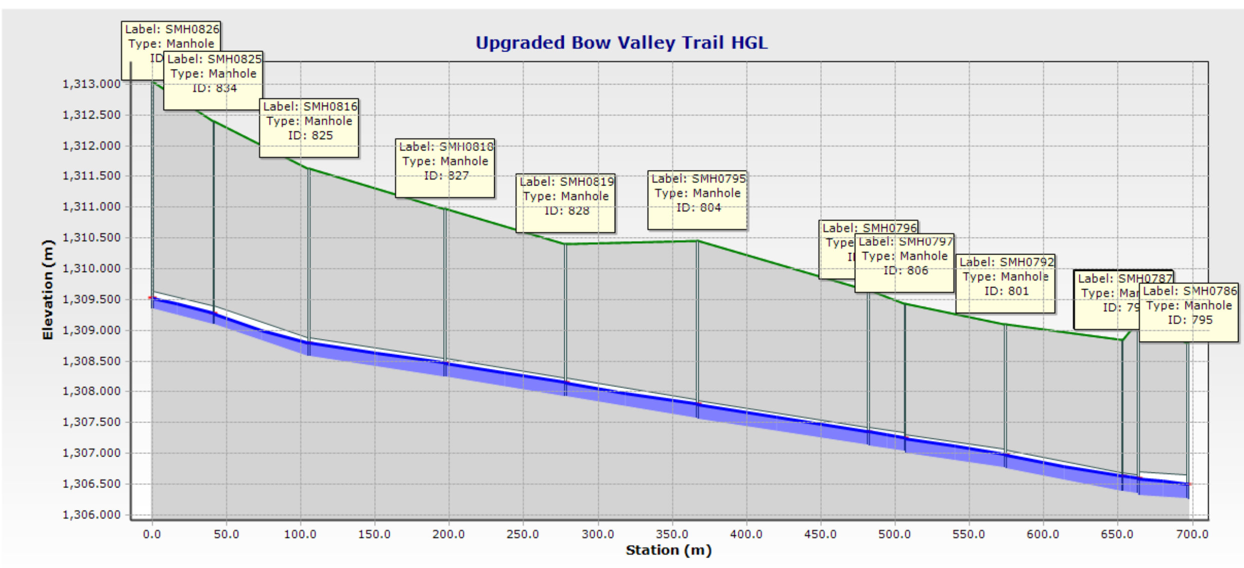


Figure 4-5 Upgraded BVT Hydraulic Grade Line

Outside of the noted surcharging, there are five other pipe segments which do not meet the design criteria for flow capacity. All of these pipe segments are part of the Bow Valley Trail collection system, and do not result in any surcharging. These sections should be monitored if development beyond what has been projected for the Bow Valley Trail area occurs.

- SNG0810
- SNG0273
- SNG0657
- SNG1649
- SNG1263

15 Year Horizon

Figure S8 shows the hydraulic model results for the 15 Year Horizon. Surcharging is seen upstream of Lift Station 11, as it over capacity in this horizon, as per Section 4.7.2. Figure S9 shows the hydraulic model results after the proposed lift station upgrade, which resolves the noted surcharging.

25 Year Horizon

Figure S10 shows the hydraulic model results for the 15 Year Horizon. In the 25-year horizon, there are two additional pipe segments that are above their design capacity. Both are on the trunk line down stream from Stewart Creek and Lift Station 10, just before it ties into Three Sisters Parkway. No surcharging occurs in either pipe, and no action needs to be taken.

- SNG1327
- SNG11325

Surcharging is seen upstream of Lift Stations 8, 10 and 11. Figure S11 shows the hydraulic model results after the proposed lift station upgrades, which resolves the noted surcharging

Pipe Lifecycle

A replacement program should be developed for pipes installed between 1965 and 1972, to be executed starting from the end of the 15-year horizon and replacing sections of pipe each year. This would ensure that there are no assets older than the 75-year lifecycle by the end of the 25 year horizon, and are represented by pipes that are currently older than 50 years.

There are approximately 10 km of wastewater lines older than 50 years. They are primarily located in the Downtown area, Railway Ave, Bow Valley Trail / TeePee town, and Rundle Drive.

The replacement program will be broken out into five separate areas, for the purposes of project time lines and cost estimates. These are the same areas as the water distribution system, and the replacement programs should be done in tandem. They are as follows:

- South Canmore (6th Street to 3rd Street) – 2 km
- Downtown (6th Street to 10th Street) – 3.5 km
- 7th Avenue (10th St to Industrial Place) – 1.5 km
- Rundle (Bridge Road to Three Sisters Drive) – 0.75 km
- Teepee Town / Railway Ave – 2.5 km

Cured in Place Pipe (CIPP) lining is a possible alternative to outright replacement for aging sewer infrastructure, it can effectively extend the lifespan of gravity collection systems, even if they are severely deteriorated.

Typically, CIPP lining is significantly more cost effective than open cut replacement, however these cost savings would be less significant than replacing just the sewer, as the intention of the replacement program is to perform it in tandem with water replacement where possible. With that in mind, CIPP lining should still be investigated, as it may still be more cost effective and result in less consumer and environmental impact than direct replacement.

To be conservative, costs for replacement will be used to estimate the project costs, however an allowance for CCTV which can determine the viability of CIPP lining will be included.

4.7.2 Lift Station Analysis

In order to consider the impacts of Dead Man's Flats to available lift station capacity, timing of upgrades, and extent of upgrades, along with consideration for existing infrastructure agreements, Lift Station 8 and Lift Station 10 were additionally reviewed with no contribution from Dead Man's Flats.

5 Year Horizon

The lift stations were assessed under the 5-year scenario during peak flow conditions. All lift stations are within their firm pumping capacity, with the exception of Lift Station 11, which has peak flows slightly above its firm pumping capacity. No surcharging occurs during the peak flows, however the lift station should be upgraded to accommodate the 15 year flows prior to additional development.

The peak flow into Lift Station 11 at the end of the 15-year horizon is approximately 40 L/s.

Table 4-21 5 Year Horizon Lift Station Analysis

Lift Station	PWWF (L/s)	Firm Pumping Capacity (L/s)
LS 1	65.0	200+
LS 2	112.6	130
LS 2A	24.5	51.0
LS 3	1.2	Unknown
LS 4	32.5	85.0
LS 5	9.3	40.0
LS 6	26.6	30.0
LS 7	27.4	120.0
LS 8	59.5	72.0
LS 9	2.1	7.0
LS 10	50.7	80.0
LS 11	15.5	15.0
LS 12	0.5	4.0

The existing Lift Station 11 was designed as an interim lift station, with future phases planned for higher flows. The future phases include a new building, process piping, and other appurtenances. This upgrade should trigger the first phases of the ultimate lift station design.

5 Year Horizon – No DMF

Under the 5 year horizon with no future DMF flow, Lift Station 8 and Lift Station 10 are within their firm pumping capacity.

Table 4-22 5 Year Horizon – No DMF Lift Station Analysis

Lift Station	PWWF (L/s)	Firm Pumping Capacity (L/s)
LS 8 – No DMF	47.1	72
LS 10 – No DMF	43.2	80

15 Year Horizon

The lift stations were assessed under the 15-year scenario during peak flow conditions. Lift station 11 was upgraded to 40 L/s pumping capacity as recommended in the 5-year horizon in this assessment.

Lift Stations 8 and 10 both have peak flows higher than their firm pumping capacities with Dead Man's Flats online. Surcharging can occur upstream of these lift stations at their peak flow rates.

Table 4-23 15 Year Horizon Lift Station Analysis

Lift Station	PWWF (L/s)	Firm Pumping Capacity (L/s)
LS 1	64.7	200+
LS 2	118.2	130
LS 2A	31.2	51.0
LS 3	1.2	Unknown
LS 4	33.0	85.0
LS 5	9.3	40.0
LS 6	27.7	30.0
LS 7	62.3	120.0
LS 8	93.1	72.0
LS 9	2.1	7.0
LS 10	91.1	80.0
LS 11	38.9	40
LS 12	0.5	4.0

Lift Station 8 currently operates two pumps and was designed to be easily upgraded to three pumps. Adding the third pump will increase the firm pumping capacity to approximately 150 L/s, which will be sufficient to satisfy the 15 year and 25-year horizons.

Lift Station 10 currently operates three pumps and will require pump replacements in order to upgrade its pumping capacity. Due to the relatively small increase in pumping capacity required to satisfy the design criteria for the 15-year horizon, it is recommended that the lift station be upgraded for the 25 year horizon, for a total pumping capacity of approximately 125 L/s.

15 Year Horizon – No DMF

Under the 15 year horizon with no future DMF flows, Lift Station 8 would still be over it's firm pumping capacity, and require the recommended upgrade to three pumps. Lift Station 10 would still be below it's firm pumping capacity, and an upgrade would not be triggered under this horizon.

Lift Station 8 had an existing incoming PWWF of 28.6 L/s. As such, the TSMV developments could contribute 43.4 L/s to the lift station prior to an upgrade being required.

Table 4-24 15 Year Horizon – No DMF Lift Station Analysis

Lift Station	PWWF (L/s)	Firm Pumping Capacity (L/s)
LS 8 – No DMF	76.2	72
LS 10 – No DMF	69.2	80

25 Year Horizon

The lift stations were assessed under the 25-year scenario during peak flow conditions. Lift station 8 was upgraded to 150 L/s pumping capacity and Lift Station 10 was upgraded to 125 L/s pumping capacity, as recommended in the 15-year horizon in this assessment.

All lift stations are within their firm pumping capacity, with the exception of Lift Station 11, which has peak flows of approximately 65 L/s, compared to the previously upgraded capacity of 40 L/s. A final upgrade up to 65 L/s will satisfy the design criteria for the 25-year horizon.

Table 4-25 25 Year Horizon Lift Station Analysis

Lift Station	PWWF (L/s)	Firm Pumping Capacity (L/s)
LS 1	67.1	200+
LS 2	118.7	130
LS 2A	36.7	51.0
LS 3	1.2	Unknown
LS 4	33.0	85.0
LS 5	9.3	40.0
LS 6	26.6	30.0
LS 7	98.0	120.0
LS 8	127	150.0
LS 9	2.1	7.0
LS 10	125.0	125.0
LS 11	62.8	40.0
LS 12	0.5	4.0

25 Year Horizon – No DMF

Under the 25 year horizon with no future DMF flows, Lift Station 10 would be over its firm pumping capacity and would require an upgrade. Lift Station 8 would be withing its firm pumping capacity, when upgraded to 150 L/s.

Lift Station 10 had an existing incoming PWWF of 26.4 L/s. As such, the TSMV developments could contribute 53.6 L/s to the lift station prior to an upgrade being required.

Table 4-26 25 Year Horizon – No DMF Lift Station Analysis

Lift Station	PWWF (L/s)	Firm Pumping Capacity (L/s)
LS 8 – No DMF	93.6	150
LS 10 – No DMF	92.2	80

Lift Station 8 and Lift Station 10 Contributing Flows Summary

In total, TSMV contributes 65 L/s to Lift Station 8. The lift station had 43.4 L/s of remaining capacity, resulting in 21.6 L/s contributing to the upgrade if the existing capacity were assigned to TSMV. DMF contributes 33.5 L/s to the lift station upgrade.

In total, TSMV contributes 65 L/s to Lift Station 10. The lift station had 53.6 L/s of remaining capacity, resulting in 12.2 L/s contributing to the upgrade if the existing capacity were assigned to TSMV. DMF contributes 33.5 L/s to the lift station upgrade.

4.8 Wastewater Projects

4.8.1 EX S1 – Lift Station 3 Replacement

New

Project Description

Replace the existing Lift Station 3 with a new wet well, pumps, electrical and building structure.

Project Rationale

Lift Station 3 is in poor condition and is eligible for a life cycle replacement. Regrading the collection system to connect to downstream lift stations by gravity is not feasible. New developments in the immediate area may increase risks associated with the lift station's failure.

Project Details

- New wet well
- New pumps and electrical
- New building

Project Trigger

- This project should be completed in the next 5 years
- 100% attributed to lifecycle

Project Cost

Engineering	$	110,000.00
Implementation	$	750,000.00
Contingency	$	240,000.00
Allowance for care of water	$	400,000.00
Total	**$**	**1,500,000.00**

4.8.2 S1 – Bow Valley Trail Sewer Upgrade

Formerly UMP2016 – Project S6

Project Description

Upgrade approximately 430 m of existing wastewater line from 250 mm to 300 mm along Bow Valley Trail between approximately 13th St and 17th St.

This project was assumed to be coordinated with a roadworks program, and only captured deep utility installation costs.

Project Rationale

Significant growth is projected in the northwestern portion of Bow Valley Trail, and was captured in the 5 Year development horizon. Due to this growth, Peak Wet Weather Flows will exceed current pipe capacity and could cause pipe surcharging.

Project Details

- 430 m of 250 mm to 300 mm wastewater pipe upgrade

Project Trigger

- This project should be completed prior to further development along Bow Valley Trail, and before any roadworks programs
- Triggered by growth, OSL Zone 6

Project Cost

Engineering	$	180,000.00
Implementation	$	1,205,000.00
Contingency	$	415,000.00
Total	**$**	**1,800,000.00**

Project Cost Sharing

This project is necessary for growth-related conditions.

Deep utility assets have a prescribed life cycle of 75 years. The recorded installation date for the sewer lines is 1990, resulting in a remaining lifecycle of 43 years.

As per the cost allocation methodology, the formula is as follows:

$$UpgradeCost - \left(1 - \frac{ServiceLifeRemaining}{LifeSpan}\right) * Basecost = DeveloperCost$$

Where:

+ Base Cost = $1,780,000
+ Upgrade Cost = $1,800,000
+ Service Life Remaining = 43 Years
+ Life Span = 75 Years
+ $\$1{,}800{,}000 - (1 - \frac{43}{75}) * \$1{,}780{,}000 = \$1{,}040{,}000$ developer cost

Using the cost sharing methodology, 57% of the total cost should be borne by development, and 43% of the cost should be borne by the Town of Canmore.

4.8.3 S2 – Lift Station 11 Upgrade Phase 1

New

Project Description

Upgrade Lift Station 11 to a pumping capacity of 40 L/s. The existing lift station is an interim phase, this upgrade would include the first phases of the ultimate design for the lift station.

Project Rationale

Growth in Stewart Creek and Smith Creek both discharge flow into Lift Station 11. The lift station needs to be upgraded to support the initial flows. This upgrade will trigger the planned future phases of the lift station.

Project Details

+ New process piping
+ 40 L/s pumping capacity
+ Electrical and mechanical equipment
+ New standby generator
+ Lift Station Building

Project Trigger

+ Development of the following number of units in OSL 14:
  - 30 ICI Units
  - 150 Low Density Residential Units
  - 130 Medium / High Density Residential Units
+ Peak Wet Weather Flow of 15 L/s into lift station
+ Triggered by growth, OSL Zone 14

Project Cost

Engineering	$	230,000.00
Implementation	$	1,530,000.00
Contingency	$	530,000.00
Total	**$**	**2,290,000.00**

Project Cost Sharing

This is a planned future phase to support development. Cost is 100% attributable to development

4.8.4 S3 – Lift Station 8 Upgrade

Project Description

Add a third pump in Lift Station 8, upgrading the pumping capacity to approximately 150 L/s

Project Rationale

Growth in the Stewart Creek, Smith Creek and Deadman's flats all contribute flows to Lift Station 8. Once the Peak Wet Weather Flow is greater than the firm pumping capacity an upgrade is required. Lift Station 8 was designed to install a third pump, effectively doubling the firm pumping capacity.

The upgrade will satisfy pumping requirements past the 25 year horizon.

Project Details

- Install third pump
- Install new VFD and update electrical system and programming

Project Trigger

- Development of the following number of units in OSL 14:
  - 60 ICI Units
  - 310 Low Density Residential Units
  - 280Medium / High Density Residential Units
- In approximately 10 years of development
- PWWF of 72 L/s into Lift Station 8
- Triggered by growth, OSL Zone 14 and 15
- Recommended Project Year: 2032-2033

Project Cost

Engineering	$	60,000.00
Implementation	$	400,000.00
Contingency	$	140,000.00
Total	**$**	**600,000.00**

Project Cost Sharing

This is new infrastructure installed in existing infrastructure designed for the upgrade, and the costs are 100% attributable to development. If available capacity were assigned to TSMV, then TSMV would contribute 21.6 L/s to the upgrade, and DMF would contribute 33.5 L/s to the upgrade, resulting in the following cost allocation:

- 39% of the project cost should be borne by TSMV ($ 235,000)
- 61% of the project cost should be borne by DMF ($ 365,000)

4.8.5 S4 – Lift Station 10 Upgrade

Project Description

Replace the existing pumps in Lift Station 10 for a peak wet weather flow of approximately 125 L/s, along with possibly existing electrical equipment and backup generator

Project Rationale

Growth in the Stewart Creek, Smith Creek and Deadman's flats all contribute flows to Lift Station 10. Once the Peak Wet Weather Flow is greater than the firm pumping capacity an upgrade is required. Lift Station 10 will have to be upgraded to reach the required flows, including the pumps, some electrical equipment, and potentially the backup generator. VFDs would also be beneficial to install.

The upgrade will satisfy pumping requirements past the 25 year horizon.

Project Details

+ Replace 3 pumps for a firm pumping capacity of 125 L/s
+ Upgrade electrical equipment
+ Replace backup generator if required
+ Add VFDs

Project Trigger

+ Development of the following number of units in OSL 14:
    - 75 ICI Units
    - 400 Low Density Residential Units
    - 360 Medium / High Density Residential Units
+ 18 L/s from Dead Man's Flats
+ In approximately 13 years of development
+ PWWF of 80 L/s into Lift Station 10
+ Triggered by growth, OSL Zone 14 and 15
+ Recommended Project Year: 2035-2036

Project Cost

Engineering	$	230,000.00
Implementation	$	1,530,000.00
Contingency	$	530,000.00
Total	**$**	**2,290,000.00**

Project Cost Sharing

This project is necessary for both growth-related conditions.

Facilities have an estimated life cycle of 50 years. The recorded installation date for Lift Station 10 is 2001, resulting in a remaining lifecycle of 30 years. As per the cost allocation methodology, the formula is as follows:

$$UpgradeCost - \left(1 - \frac{ServiceLifeRemaining}{LifeSpan}\right) * Basecost = DeveloperCost$$

Where:

+ Base Cost = $1,950,000
+ Upgrade Cost = $2,290,000
+ Service Life Remaining = 30 Years
+ Life Span = 50 Years
+ $\$2{,}290{,}000 - (1 - \frac{30}{50}) * \$1{,}950{,}000 = \$1{,}510{,}000$ developer cost

Using the cost sharing methodology, 66% of the total cost should be borne by development, and 34% of the cost should be borne by the Town of Canmore.

If available capacity were assigned to TSMV, then TSMV would contribute 21.6 L/s to the upgrade, and DMF would contribute 33.5 L/s to the upgrade, resulting in the following cost allocation:

+ 39% of developer cost (26% of project cost) should be borne by TSMV ($ 590,000)
+ 61% of developer cost (40% of project cost) should be borne by DMF ($ 920,000)

4.8.6 S5 – Lift Station 11 Upgrade Phase 2

Project Description

Upgrade Lift Station 11 to a pumping capacity of 60 L/s.

Project Rationale

Growth in Stewart Creek and Smith Creek both largely end up discharging flows into Lift Station 11. The lift station needs to be upgraded to support the initial flows. This upgrade will trigger the planned future phases of the lift station.

Project Details

+ 60 L/s pumping capacity

Project Trigger

+ Development of the following number of units in OSL 14:
  - 80 ICI Units
  - 440 Low Density Residential Units
  - 400Medium / High Density Residential Units
+ Peak Wet Weather Flow of 40 L/s into lift station
+ Triggered by growth, OSL Zone 14

Project Cost

Engineering	$	60,000.00
Implementation	$	380,000.00
Contingency	$	130,000.00
Total	**$**	**570,000.00**

Project Cost Sharing

This is a planned future phase to support development. Cost is 100% attributable to development

4.8.7 S6 – South Canmore Sewer Line Replacement

Project Description

Replace aging wastewater infrastructure in the South Canmore area, between 3rd Street and 6th Street.

Project Rationale

Wastewater lines in the older areas of Canmore are nearing their lifecycle, and the Town should begin a program to replace the infrastructure that is nearing its lifecycle. The oldest pipes in Canmore were installed in 1966, and will reach their 75 year lifecycle by 2041, approximately 19 years after this study.

CIPP lining can be investigated instead of replacement, with CCTV performed to determine viability

For the best use of resources, the utility replacement program should be paired with a roadworks program and the water replacement program.

Project Details

+ 2,000 m of 200 mm wastewater line replacement

Project Trigger

+ Recommended Project Year: 2037-2038

Project Cost

Engineering	$	390,000.00
Implementation	$	1,560,000.00
Contingency	$	780,000.00
Total	**$**	**2,730,000.00**

Project Cost Sharing

This is existing infrastructure replacement that is 100% attributable to the Town of Canmore.

4.8.8 S7 – Downtown Canmore Sewer Line Replacement

Project Description

Replace aging wastewater infrastructure in the Downtown area, between 6th Street and 10th Street.

Project Rationale

Wastewater lines in the older areas of Canmore are nearing their lifecycle, and the Town should begin a program to replace the infrastructure that is nearing its lifecycle. The oldest pipes in Canmore were installed in 1966, and will reach their 75 year lifecycle by 2041, approximately 19 years after this study.

CIPP lining can be investigated instead of replacement, with CCTV performed to determine viability

For the best use of resources, the utility replacement program should be paired with a roadworks program and the water replacement program.

Project Details

+ 3,500 m of 200 mm wastewater line replacement
+ 3,000 m^2 road replacement

Project Trigger

+ Recommended Project Year: 2038-2039

Project Cost

Engineering	$	760,000.00
Implementation	$	3,030,000.00
Contingency	$	1,520,000.00
Total	**$**	**5,310,000.00**

Project Cost Sharing

This is existing infrastructure replacement that is 100% attributable to the Town of Canmore.

4.8.9 S8 – 7th Avenue Sewer Line Replacement

Project Description

Replace aging wastewater infrastructure in the 7th Avenue area, 10th Street and Industrial Place.

Project Rationale

Wastewater lines in the older areas of Canmore are nearing their lifecycle, and the Town should begin a program to replace the infrastructure that is nearing its lifecycle. The oldest pipes in Canmore were installed in 1966, and will reach their 75 year lifecycle by 2041, approximately 19 years after this study.

CIPP lining can be investigated instead of replacement, with CCTV performed to determine viability

For the best use of resources, the utility replacement program should be paired with a roadworks program and the water replacement program.

Project Details

- 3,000 m of 200 mm wastewater line replacement
- 3,000 m^2 road replacement

Project Trigger

- Recommended Project Year: 2039-2040

Project Cost

Engineering	$	670,000.00
Implementation	$	2,690,000.00
Contingency	$	1,340,000.00
Total	**$**	**4,700,000.00**

Project Cost Sharing

This is existing infrastructure replacement that is 100% attributable to the Town of Canmore.

4.8.10 S9 – Rundle Sewer Line Replacement

Project Description

Replace aging wastewater infrastructure in the Rundle area, Rundle Drive, MacDonald Place and St. Barbara's Terrace.

Project Rationale

Wastewater lines in the older areas of Canmore are nearing their lifecycle, and the Town should begin a program to replace the infrastructure that is nearing its lifecycle. The oldest pipes in Canmore were installed in 1966, and will reach their 75 year lifecycle by 2041, approximately 19 years after this study.

CIPP lining can be investigated instead of replacement, with CCTV performed to determine viability

For the best use of resources, the utility replacement program should be paired with a roadworks program and the water replacement program.

Project Details

+ 750 m of 200 mm wastewater line replacement

Project Trigger

+ Recommended Project Year: 2039-2040

Project Cost

Engineering	$	180,000.00
Implementation	$	710,000.00
Contingency	$	360,000.00
Total	**$**	**1,250,000.00**

Project Cost Sharing

This is existing infrastructure replacement that is 100% attributable to the Town of Canmore.

4.8.11 S10 - Railway Ave / Bow Valley Trail Sewer Line Replacement

Project Description

Replace aging wastewater infrastructure in the TeePee Town and Railway Ave area, from Gateway Street to Benchlands Trail along Railway Ave. This project also involves crossing Policeman's Creek along 8^{th} Street.

Project Rationale

Wastewater lines in the older areas of Canmore are nearing their lifecycle, and the Town should begin a program to replace the infrastructure that is nearing its lifecycle. The oldest pipes in Canmore were installed in 1966, and will reach their 75 year lifecycle by 2041, approximately 19 years after this study.

CIPP lining can be investigated instead of replacement, with CCTV performed to determine viability

For the best use of resources, the utility replacement program should be paired with a roadworks program and the water replacement program.

Project Details

- 3,000 m of 200 mm wastewater line replacement
- 9,000 m^2 road replacement

Project Trigger

- Recommended Project Year: 2041-2042

Project Cost

Engineering	$	540,000.00
Implementation	$	3,590,000.00
Contingency	$	1,240,000.00
Total	**$**	**6,290,000.00**

Project Cost Sharing

This is existing infrastructure replacement that is 100% attributable to the Town of Canmore.

5. Summary of Projects

Project	Name	Timeline	Trigger	Infrastructure	Cost	ToC Share	Dev Share	DMF Share
EX W1	Grassi Booster Station Capacity Upgrade (Phase 1)	2025	**Existing /Growth**	Facilities	$2,310,000.00	84.4%	12.3%	3.3%
EX W2	Pumphouse 2 Backwash Water Reuse	2035	**Existing**	Facilities	$1,500,000.00	100%	0%	-
EX W3	Pumphouse 1 Gas Chlorine to Liquid	TBD	**Existing**	Facilities	$1,000,000.00	100%	0%	-
W1	TeePee Town Waterline Replacement	2024	**Growth**	Linear	$900,000.00	72%	28%	-
W2	Smith Creek Reservoir and Booster Station	2027	**Growth**	Facilities	$12,780,000.00	0%	100%	-
W3	Canyon Ridge Booster Station Decommissioning	2027	**Existing**	Facilities	$1,200,000.00	100%	0%	-
W4	Silvertip Trail Looping	2028	**Growth**	Linear	$1,290,000.00	0%	100%	-
W5	Grassi Booster Station Waterline Twinning	2038	**Growth**	Linear	$2,980,000.00	73.1%	19.6%	7.3%
W6	Grassi Storage Reservoir Capacity Upgrade	2039	**Growth**	Facilities	$5,360,000.00	0%	75%	25%
W7	Grassi Booster Station Capacity Upgrade (Phase 2)	2038	**Growth**	Facilities	$750,000.00	0%	85%	15%
W8	Smith Creek Booster Station Upgrade (Phase 2)	2037	**Growth**	Facilities	$720,000.00	0%	100%	-
W9	South Canmore Waterline Replacement	2037	**Lifecycle**	Linear	$6,010,000.00	100%	0%	-
W10	Downtown Canmore Waterline Replacement	2038	**Lifecycle**	Linear	$8,830,000.00	100%	0%	-
W11	7th Avenue Waterline Replacement	2039	**Lifecycle**	Linear	$7,340,000.00	100%	0%	-
W12	Rundle Waterline Replacement	2040	**Lifecycle**	Linear	$6,010,000.00	100%	0%	-
W13	TeePee Town / Railway Ave Waterline Replacement	2041	**Lifecycle**	Linear	$4,560,000.00	100%	0%	-
W14	Water Treatment and Supply Study	2025	**Growth**	Facilities	$200,000.00	100%	0%	-
					$63,740,000.00	**$41,420,000.00**	**$20,570,000.00**	**$1,750,000.00**

Project	Name	Timeline	Trigger	Infrastructure	Cost	ToC Share	Dev Share	DMF Share
EX S1	Lift Station 3 Replacement	2027	**Lifecycle**	Facilities	$1,500,000.00	100%	0%	-
S1	Bow Valley Trail Sewer Upgrade	2024	**Growth**	Linear	$1,800,000.00	43%	57%	-
S2	Lift Station 11 Upgrade Phase 1	2027	**Growth**	Facilities	$2,290,000.00	0%	100%	-
S3	Lift Station 8 Upgrade	2032	**Growth**	Facilities	$600,000.00	0%	39%	61%
S4	Lift Station 10 Upgrade	2035	**Growth**	Facilities	$2,290,000.00	34%	26%	40%
S5	Lift Station 11 Upgrade Phase 2	2037	**Growth**	Facilities	$570,000.00	0%	100%	-
S6	South Canmore Sewer Line Replacement	2037	**Lifecycle**	Linear	$2,730,000.00	100%	0%	-
S7	Downtown Canmore Sewer Line Replacement	2038	**Lifecycle**	Linear	$5,310,000.00	100%	0%	-
S8	7th Avenue Sewer Line Replacement	2039	**Lifecycle**	Linear	$4,700,000.00	100%	0%	-
S9	Rundle Sewer Line Replacement	2040	**Lifecycle**	Linear	$1,250,000.00	100%	0%	-
S10	Railway Ave / Bow Valley Trail Sewer Line Replacement	2041	**Lifecycle**	Linear	$6,290,000.00	100%	0%	-
					$29,330,000.00	**$23,332,600.00**	**$4,715,400.00**	**$1,282,000.00**