WATER STREET ENGINEERING

Water Master Plan

Village of Harrison Hot Springs

04 Dec 2025

Document Information

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Authors	Jade Sangha, EIT, Neal Whiteside, MASc, PEng		
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EXECUTIVE SUMMARY

Water Street Engineering Ltd. (Water Street) was retained by the Village of Harrison Hot Springs (the Village) to update the Village's Water Master Plan. The objectives of the plan are to:

- Identify existing and future deficiencies in the water system, and
- Develop a plan of upgrades to address deficiencies.

The previous Village-wide water master plan was completed in 2015 by CTQ (CTQ Consultants, 2015). As part of the Master Plan, a Village-wide water model was created. Since the 2015 study, key upgrades include new and upsized distribution piping and upsizing of the Harrison Reservoir feeder and supply mains.

Existing demands were developed using source flow, population, and meter data. The Village's Official Community Plan (OCP) was used to develop a population and water demand assessment and forecast. For detailed information on demand development, refer to the Population, Base Sanitary Flows, and Base Water Demands Memorandum (Water Street Engineering, 2025a).

A model calibration was completed using results from hydrant testing. For information on the test results, refer to the Hydrant Flow Testing Results Memorandum (Water Street Engineering, 2025b).

Two water system conditions were evaluated:

- The **Existing Condition** reflects the existing water distribution network with existing demands.
- The **OCP Condition** reflects the existing water distribution network with OCP demands.

Each system condition was evaluated under two scenarios:

1. **Peak hour demand** (PHD) at 7 AM, to assess for system pressures and velocities.
2. **Maximum day demand with fire flow** (MDD + FF), to assess for available fire flows.

Following modelling and deficiency analysis, nine (9) projects were identified, which generally include:

- Addressing insufficient fire protection,
- Improving water quality,
- Adding utility connections,
- Demand management, and
- Operational improvements.

From the nine identified projects, two were classified as high priority. High priority projects are those that addresses an existing significant deficiency or system need with broad impacts . These include the Cedar Ave Water Main Looping (Project 1) and Lillooet and Echo Ave Water Main Looping (Project 2),

Five medium priority projects were identified, which address significant deficiencies or system need with localized impact. These include the Naismith Ave and Mount St Water Main Looping (Project 3), Water Hydrants (Project 4), McCombs Dr Water Main Looping (Project 5), Universal Metering Study (Project 6), and GIS System Update (Project 7).

Two low priority projects were identified, the Lillooet and Bear Ave Water Main Looping (Project 8) and Echo Ave and Eagle St Water main Looping (Project 9). Both projects are to provide sufficient fire flows for growth, to protect future (OCP) developments.

From the nine identified projects, three have been noted to be currently planned: Cedar Ave Water Main Looping (Project 1, High Priority), Lillooet and Echo Ave Water Main Looping (Project 2, High Priority), and McComb Water Main Looping (Project 5, Medium Priority).

High-level cost estimates were prepared for each recommended project. The total costs of projects summarised by priority is as follows:

- High priority (2 projects): $1,273,000
- Medium priority (5 projects): $2,712,000
- Low priority (2 projects): $84,000

Other, non-capital, recommendations have also been identified, including:

- Fire protection reviews,
- Water quality monitoring and flushing,
- Demand management,
- Operational changes, and
- Further investigations.

1 INTRODUCTION

1.1 PURPOSE

Water Street Engineering Ltd. (Water Street) was retained by the Village of Harrison Hot Springs (the Village) to provide engineering services for the development of the Village's Water Master Plan.

1.2 SCOPE

The scope of the Water Master Plan includes:

- Review of relevant background reports
- Hydrant flow testing and model calibration
- Existing and future demand development and required fire flow assignment
- Updated assessment of water infrastructure deficiencies based on updated modelling of existing condition
- Updated assessment of future condition water infrastructure requirements
- Recommendations for demand management
- Recommendations for infrastructure improvements to meet existing and future demands
- Class D cost estimates for recommended improvements
- Prioritized recommendations for infrastructure improvements based on risk and asset management

1.3 PREVIOUS WORK

A Village-wide Water Master Plan was created in 2015 by CTQ (CTQ Consultants, 2015). As part of the Master Plan, a Village-wide water model was created in WaterGEMS.

1.4 LIMITATIONS

The following data limitations affect the accuracy of the model and calculated results:

- Potential inaccuracies and/or missing information from the GIS shapefiles and record drawings provided to update the model
- Inherent uncertainty in OCP forecasts (i.e. dwelling unit counts and population loading forecasts for residential and ICI lots)
- Fire flow requirements based on the Village's design criteria
- Variation in head loss characteristics in the piping in the model
- Status of isolation valves (e.g. missing closed valves in the model)
- Boundary conditions
- Limitations on forecasting of expected / design water use rates

The project scope does not include evaluation of the Village's Water Treatment Plant or raw water supply. At the time this report was developed, a Water Treatment Plant (WTP) Master Plan was being completed by McElhanney (McElhanney, 2025). The WTP Master Plan provides capital projects for the lake intake and VFD, reservoir, and raw water intake.

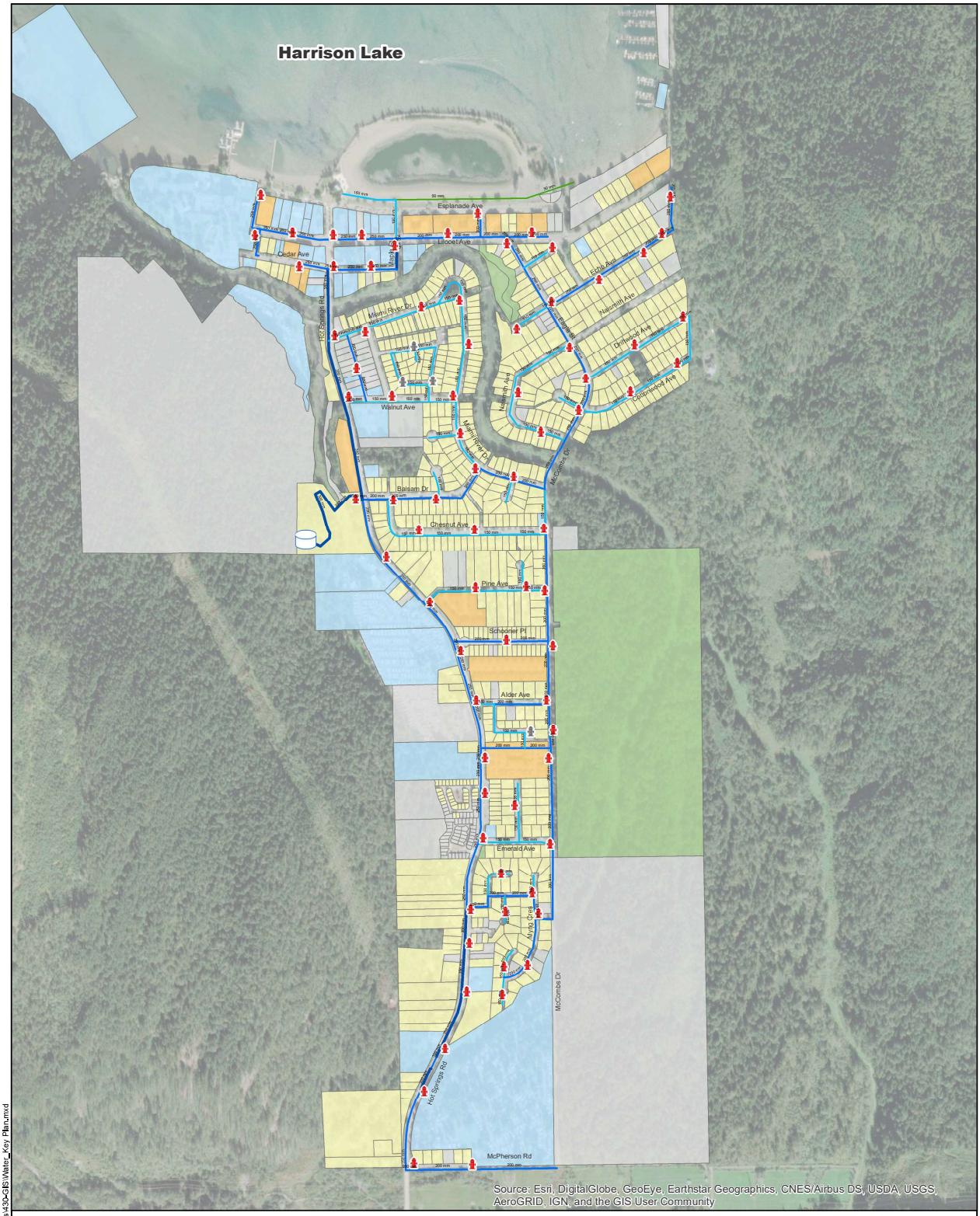
1.5 ACKNOWLEDGEMENTS

The project development, leadership, and review of interim deliverables was accomplished with the assistance of the following individuals.

- Village of Harrison Hot Springs
  - Director of Operations
  - Utilities Supervisor
  - Public Works Supervisor
- SFE Global (flow monitoring program)
  - Glenn Cumyn

    - Nicole Moen
    - Sam Cumyn
- Wedler Engineering
    - Jonathan Funk, PEng; Principal

In addition to the authors, the Water Street Engineering team included: Neal Whiteside, PEng, Laura Christensen, PEng; and Jade Sangha, EIT.



Legend

- Reservoir
- Hydrant
- Hydrant - Private

Water Main Diameter (mm)

- 50
- 100 - 150
- 200 - 250
- 300 - 350

Existing Land Use

- Park
- Single-family Residential
- Multi-family Residential
- ICI
- Vacant

N

0 150 300 450 m

1:10,000

Water Master Plan

PREPARED FOR

Village of Harrison Hot Springs

PROJECT NO. 456.1

DATE 04 Dec 2025

REVISION 0

Key Plan

Figure 1-1

WATER STREET ENGINEERING

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2 EXISTING SYSTEM BACKGROUND

2.1 EXISTING INFRASTRUCTURE

The Village's existing water system consists of 15 km of distribution pipes ranging from 50 mm to 350 mm diameter in a single, gravity fed, pressure zone. The pipe material is primarily PVC with some small portions of ductile iron.

WATER SUPPLY

The system is supplied from Harrison Lake via a 350 mm intake line extending one kilometer north into the lake. The Beach Pumps (three 40 HP pumps, VFD-controlled) convey raw water to the treatment plant, which uses membrane ultrafiltration and chlorination. The treated water is pumped from the treatment plant with two 40 HP pumps lift to the reservoir. Review of the raw water pumps and the treatment plant is outside the scope of this Master Plan but is included in the Water Treatment Plant (WTP) Master Plan, which is currently being developed by McElhanney (McElhanney, 2025).

RESERVOIR

The water storage reservoir is 2,778 m^3 in volume[1]. The steel tank was constructed in 2009 to replace a concrete reservoir. The top water level is 74.7 m with an invert elevation of 64.81 m. Currently the reservoir is operated between 95 to 99% full (normal operating range, pump start / stop setpoints).

A Rockfall Hazard Mitigation report was completed by GeoWest Engineering in 2023 (GeoWest Engineering, 2023) and provided geotechnical recommendations for mitigation of rockfall hazards at the reservoir site. This project has not yet been completed. Capital works to address the rockfall hazards are included in the separate WTP Master Plan.

The 2021 Reservoir Inspection Report recommended a maintenance and action plan for the reservoir (Greatario Services, 2021). Considerations of these items and general reservoir condition are included in the separate WTP Master Plan.

Resiliency is also a concern; the existing reservoir is the only treated water reservoir in the community. If it were out of service, the WTP would need to provide treated water continuously on-demand (rather than current batch operation). As well without the reservoir, the fire storage volume and fire flows would be compromised. Potential mitigation measures include a second reservoir, additional WTP capacity (pumping capacity, chlorine dosing) to provide emergency fire flows, and/or emergency operating measures. These are also discussed in the WTP Master Plan.

2.2 EXISTING DEMANDS

Existing demands were analyzed, and the results are summarized in a technical memorandum, "Population, Base Sanitary Flows and Base Water Demands" by Water Street Engineering, dated 29 Sep 2025, provided in Appendix 1. The existing village-wide BD is 704 m^3/day (8.1 L/s) and MDD is 2494 m^3/day (28.9 L/s). The existing demands are further broken down in Section 3.4.

The Village's water demands are unique and increase significantly during the summer months due to seasonal residents and tourists. There is high uncertainty in the population projections; population growth has not followed that of the surrounding Fraser Valley area.

Most water users are billed at a flat rate. While water meters are being installed on all new residential properties, only a small number of multifamily and commercial customers are billed at a volumetric rate. The lack of water use data limits the determination of effective demand management strategies to decrease water use.

[1] Reservoir IFC drawings indicate 2,678 m^3 capacity (Dayton & Knight, 2009), while the 2021 Reservoir Inspection Report shows a name plate capacity of 2,778.5 m^3, or 234,000 gal (Greatario Services, 2021).

2.3 2025 WATER SYSTEM EMERGENCY RESPONSE PLAN

The Village has an Emergency Response Plan in place for their water system (Village of Harrison Hot Springs, 2025), which outlines response plans in the event of:

- Contamination of water source
- Loss of water source (reservoir, supply line)
- Broken water main
- Power failure
- Pump failure
- Chlorination system failure
- Backflow or back siphonage
- Coliform bacteria in distribution system
- Alternative bulk water supply usage
- Water treatment membrane bypass
- Flood conditions

2.4 2015 CAPITAL PLAN AND DEFICIENCIES

The 2015 Water Master Plan (WMP) (CTQ Consultants, 2015) identified several deficiencies and capital projects, summarised in Table 2-1.

Table 2-1: Projects and Deficiencies from 2015 Capital Plan

Project	Purpose / Description	Status
Above Ground Supply/Distribution	Repair/replace above ground piping section	Complete
Hot Springs Road 'A'	Provide fire flow for existing development. Upgrade 375 m of watermain to meet commercial fire flow requirements	Complete
Hot Springs Road 'B'	Provide fire flow for future development. Upgrade 125 m of watermain to meet commercial fire flow requirements	Complete; 33m of pipe under Miami River has not yet been upgraded (upgrade of this section is not required, sufficient fire flows available)
Village Center Loop	Provide service and hydrant protection to properties on wells. Add 250 mm of watermain to Lillooet/Cedar.	Incomplete; upgrade has been partially constructed but looping not yet completed.
Lakeshore Residential	Provide service and hydrant protection to properties on wells. Add 605 m of watermain to Lillooet (east) and Bear.	Incomplete; upgrade has been partially constructed but looping not yet completed.
Naismith and Mount	Provide service and hydrant protection to properties on wells. Add 595 m of watermain to Naismith and Mount.	Incomplete
Emerald and Diamond	Provide service and hydrant protection to properties on wells. Add 350 m of watermain to Emerald and Diamond.	Complete
Angus Estates	Provide service and hydrant protection to properties on wells. Add 875 m of watermain to Angus Estates subdivision.	Complete
Pine and Lakberg	Provide service and hydrant protection to properties on wells. Add 490 m of watermain to Pine and Lakberg.	Complete

Project	Purpose / Description	Status
Marine Tourism 'A' and 'B'	Provide service and hydrant protection to properties on well, fire flow for future development. Add 610 m of watermain to Rockwell.	Incomplete; it is assumed this area will remain unserviced.
Water Services	Connect all existing fronted properties. Add 57 service connections.	Incomplete; 31 fronted residential properties remain on wells/unserviced.
Water Hydrants	Add hydrants to existing fronted properties. Add 5 hydrants.	Incomplete; 5 identified hydrants have not yet been added to the system.
Tee Replacement	Replace damaged tee at Cedar & Hot Springs	Incomplete
Water Treatment Capacity Increase	Add Capacity to WTP as demand increases	Complete
Universal Metering	Meter all existing (2014) serviced properties	Incomplete; majority of single-family residential properties remain unmetered.
System Flushing	Clean debris from system. Improve system performance by flushing and/or pigging 15 km of pipe.	Complete; village currently flushes twice a year.
Sampling Pedestals	Construct compliant sampling locations. Install 6-10 Heath Canada compliant sampling locations.	Complete; yard hydrants added instead.

3 WATER MODEL UPDATE

3.1 MODEL IMPORT

The Village provided the village-wide model in Oct 2024 in an EPANET format, which was exported from the model from the 2015 Water Master Plan. Modelling for the 2025 Water Master Plan was completed in Bentley's WaterCAD version 24.00.03.22.

3.2 GENERAL UPDATES

New piping installed since 2015 was added to the model (total 3.1 km in length), where record drawings were provided by the Village, including:

- New water main installation on Pine Ave and Lakberg Cres.
- New water main installation on Emerald Ave and Diamond St.
- New water main installation on Myng Cres, Ramona Pl, Hadaway Dr, Angus Pl, and Hope Pl.
- New water main installation on Schooner Place.
- New water main installation on St Alice St N and St Alice St S.
- New water main installation on Bear Ave.
- New water main installation on Lillooet Ave, between Eagle St and Bear Ave.
- Water main upgrade on Hot Springs Ave, from Ramona Pl to south of the Miami River.
- Water main upgrade to main feeding out of the Harrison Reservoir. Note the Harrison Reservoir supply line has also been upgraded, but this is not reflected in the model (as the reservoir is modelled as the boundary condition, see the following section).

The elevations of all nodes within the model were updated based on 2016 DEM obtained from LidarBC.

3.3 BOUNDARY CONDITIONS

The modelled boundary is the Village's water storage reservoir (2678 m^3 steel reservoir, located at 590 Hot Springs Rd). The Harrison Lake intake, raw water pump station, and forcemain are not modelled.

Table 3-1: Boundary Conditions

Source	HGL	Notes
Harrison Reservoir	73.71 m	Assumed 90% full (record drawings indicate 64.81 m tank invert elevation, 74.7 m TWL).

3.4 DEMANDS

Existing demands were developed using source flow, population, and meter data. Unit rates derived from the existing demands were used together with the Village-wide Official Community Plan (OCP) to develop a population and water demand assessment and forecast for the Village. Future demands were calculated using an OCP growth estimate. For detailed information on demand development, refer to the Population, Base Sanitary Flows, and Base Water Demands Memorandum (Water Street Engineering, 2025a) provided as Appendix 1. OCP land uses are shown in Figure 3-1.

The resulting demands used for the master plan are shown in Table 3-2. This considers an existing serviced residential population of 2032 ca and an OCP serviced residential population of 2551 ca. Note the projected OCP demands assessed assume the Harrison Hot Springs Resort and Spa will not be connected to the system at OCP.

Table 3-2: Existing and Future Demands Summary

Use	Demand (m^3/day)	
	Existing	OCP
Base Demand (BD)		
ICI	117	162
Residential	439	605
Unaccounted for Water (UFW)	147	237
Total Base Demand (BD)	704	1004
Seasonal Demand (SD, in addition to BD)		
ICI	166	216
Residential	1625	1941
Total Addl. Seasonal Demand (SD)	1791	2157
Maximum Day Demand (MDD) (BD + SD)	**2494**	**3161**

The methodology for demand assignment in the model was as follows:

1. Demands were calculated per lot according to the methodology above / in Appendix 1
2. Each lot was assigned a model junction in close proximity. Junctions lying on supply mains were excluded from this process.
3. Demands are summed per demand category on assigned nodes.

The demand categories used to allocate demands in the model are shown in Table 3-3.

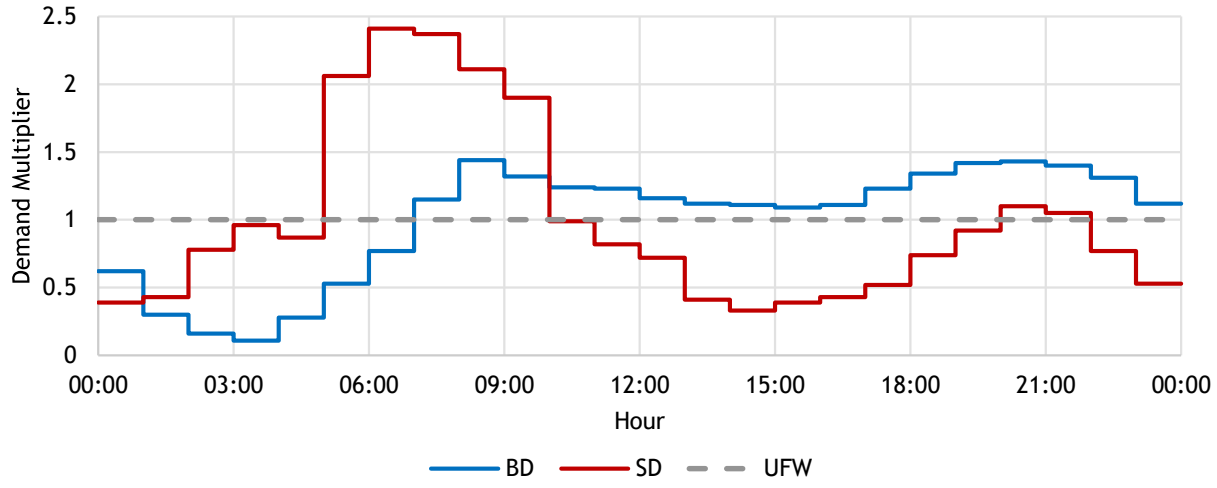
Table 3-3: Water Demand Categories

Model Scenario	Demand Pattern in Model	Description
Existing	BD-ICI	Base demand, ICI
	BD-RES-MF-M	Base demand, residential multi-family, metered
	BD-RES-MF-UM	Base demand, residential multi-family. un-metered
	BD-RES-SF	Base demand, residential single-family
	UFW	Unaccounted-for-water
	SD-ICI	Seasonal demand, ICI
	SD-RES-MF-M	Seasonal demand, residential multi-family, metered
	SD-RES-MF-UM-I	Seasonal demand, residential multi-family, un-metered, indoor
	SD-RES-MF-UM-O	Seasonal demand, residential multi-family, un-metered, outdoor
	SD-RES-SF-I	Seasonal demand, residential single-family, indoor
	SD-RES-SF-O	Seasonal demand, residential single-family, outdoor
OCP	OCP-BD-ICI	Base demand, ICI
	OCP-BD-ICI-N	Base demand, ICI, new properties

Model Scenario	Demand Pattern in Model	Description
	OCP-BD-RES	Base demand, residential
	OCP-UFW	Unaccounted-for-water
	OCP-SD-ICI	Seasonal demand, ICI
	OCP-SD-ICI-N	Seasonal demand, ICI, new properties
	OCP-SD-RES-I	Seasonal demand, residential, indoor
	OCP-SD-RES-O	Seasonal demand, residential, outdoor

The following diurnal pattern was input into the model; however, all analyses were completed using steady state analysis.

Table 3-4: Diurnal Demand Patterns



3.5 REQUIRED FIRE FLOWS

The required fire flows are assignment based on each parcel's OCP designation and the Village's Subdivision and Development Servicing Bylaw No. 1779 (Village of Harrison Hot Springs, 2022), which sets fire flow requirements according to various building types. The minimum required fire flows are as listed in Table 3-5.

The maximum required fire flow considered is 150 L/s, used for lots with multi-family and ICI OCP designations. A detailed Fire Underwriter's Survey (FUS) assessment was not in the scope of this study. The Village may choose to further review fire flow requirements for current buildings (using FUS guide as a standard) to review the adequacy of the 150 L/s requirement.

Table 3-5: Required Fire Flow by OCP Designation

Abbr.	OCP Designation	Required Fire Flow (L/s)	Notes
LB	Lakeshore Beach	n/a	No hydrants
LDR	Low Density Residential	60	Residential; single-family, duplex
LR	Lakeshore Residential	150	Residential; townhomes, row homes

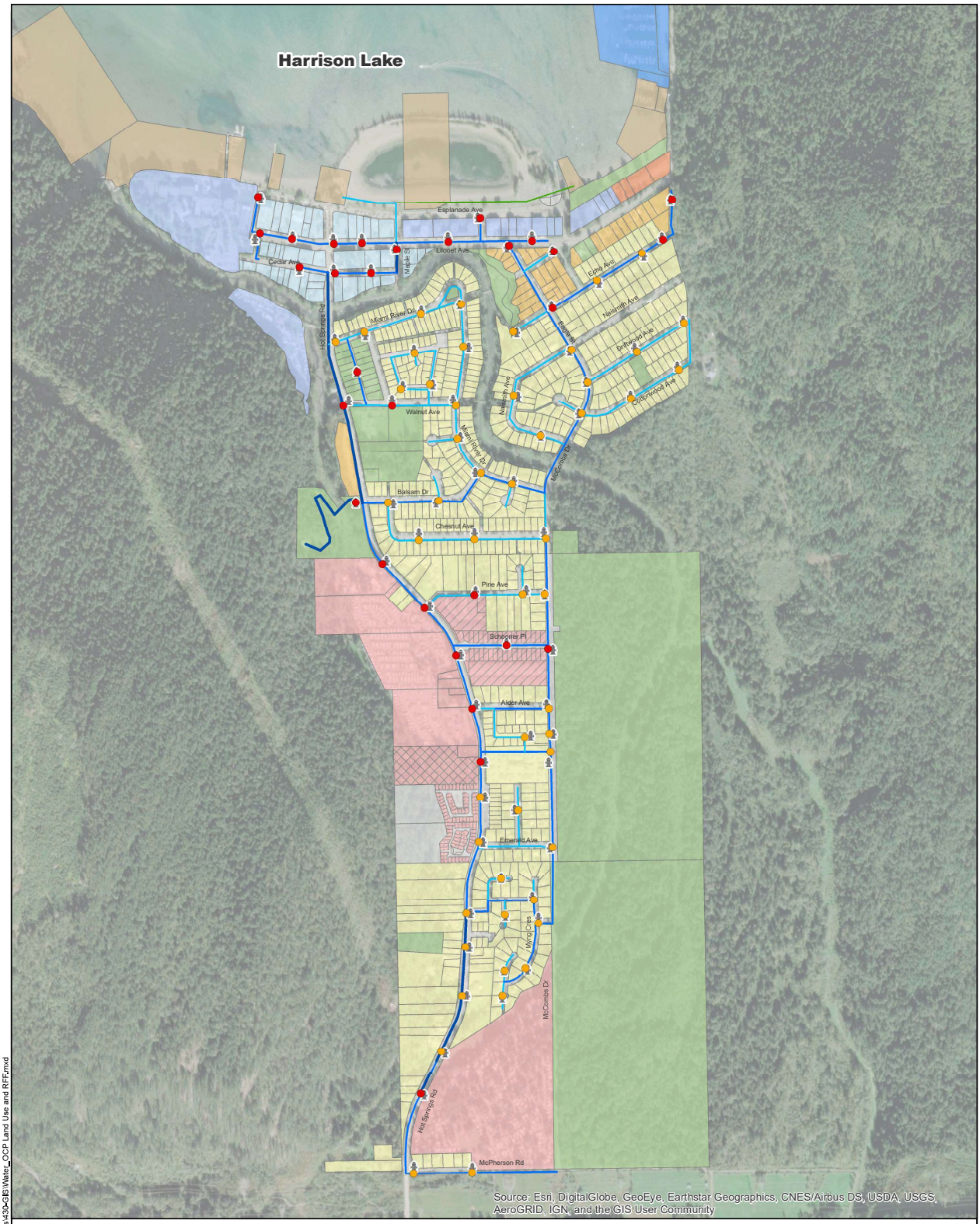
Abbr.	OCP Designation	Required Fire Flow (L/s)	Notes
MDR	Medium Density Residential	150	Residential; townhomes, row homes
MTC	Marine Tourist Commercial	n/a	Unserviced ICI
PU	Public Use	150	ICI or park. No fire flow requirement considered for parks without buildings/structures.
TC	Tourist Commercial	150	ICI
VC	Village Centre	150	Mixed use; apartments, commercial
WC	Waterfront Commercial	150	Mixed use; apartments, commercial
TC-HDR[1,2]	Tourist Commercial - High Density Residential	150	Residential; apartments
TC-MDR[1,3]	Tourist Commercial - Medium Density Residential	150	Residential; townhomes, row homes
TC-SLR[1,4]	Tourist Commercial - Small Lot Residential	60	Residential; resort (small lot) residential

Notes:
1. New categories created for residential properties with the Tourist Commercial (TC) OCP designation.
2. Singular property at 740 Hot Springs Rd (planned apartment development).
3. 628 McCombs Dr, 386 & 388 Pine Ave, and all properties on Schooner Pl.
4. 750 & 798 Hot Springs Rd.

The methodology for required fire flows was as follows:

1. Required fire flows were calculated per lot according to Table 3-5.
2. Required fire flow are assigned to each model junction with a connected hydrant, equal to the maximum required fire flow of all adjacent lots.

The required fire flows by junction are shown in Figure 3-1.



Legend

Hydrants

Required Fire Flow (L/s)

- 60
- 150

Water Main Diameter (mm)

- 50
- 100 - 150
- 200 - 250
- 300 - 350

OCP Land Use

- Lakeshore Beach
- Public Use
- Low Density Residential
- Medium Density Residential
- Lakeshore Residential
- Village Commercial
- Waterfront Commercial
- Marine Tourist Commercial
- Town Centre
- Town Centre - High Density Residential
- Town Centre - Medium Density Residential
- Town Centre -Small Lot Residential
- Vacant

N

0 150 300 450 m

1:10,000

WATER STREET ENGINEERING

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Water Master Plan

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Village of Harrison Hot Springs

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DATE 04 Dec 2025

REVISION 0

OCP Land Use and Required Fire Flows

Figure 3-1

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4 MODEL CALIBRATION

Hydrant testing was completed by SFE Global, with direction from Water Street and assistance from the City (for valve operation and recording of information from City SCADA). The test results are detailed in the Hydrant Flow Testing Results Memorandum (Water Street Engineering, 2025b), provided as Appendix 2.

Two types of hydrant testing were completed within the Village.

1. Three system flow tests were performed, used to verify system operation.
2. Three C-factor tests were performed, used to calibrate the C-factors for the model pipes.

For the three C-factor tests, Hazen-Williams C-factors were calculated, which are in the range of 142-166 for PVC pipes. Note that the previous water model from the 2015 Water Master Plan used a C-factor of 130. To better approximate both the system flow test results and the calculated C-factors, all PVC pipes in the model have been adjusted to a C-factor of 140. The modelled C-factors are shown in Table 4-1.

Table 4-1: Modelled C-Factors

Pipe Material	Modelled Hazen-Williams C-Factor
PVC	140
Ductile Iron	130

5 DESIGN CRITERIA

The design criteria used to review the system at peak hour demand (PHD) and at maximum day demand with fire flow (MDD+FF) are described under this section, based on the Village's Subdivision and Development Servicing Bylaw No. 1779 (Village of Harrison Hot Springs, 2022) and the MMCD Design Guidelines (MMCD, 2022).

5.1 PRESSURE

From the Village's Servicing Bylaw:

- Maximum static pressure: 830 kPa (120 psi)
- Minimum static pressure: 275 kPa (40 psi)
- Minimum pressure at PHD: 275 kPa (40 psi)
- Minimum pressure at MDD+FF: 140 kPa (20 psi)

5.2 VELOCITY

From the Village's Servicing Bylaw:

- Maximum velocity for pump supply, reservoirs, and trunk mains: 2.0 m/s (note this is not considered for the MDD+FF analysis)
- Maximum velocity for distribution lines at PHD: 2.0 m/s
- Maximum velocity for distribution lines at MDD+FF: 4.0 m/s

5.3 PIPE SIZING

From the Village's Servicing Bylaw (used for sizing of new mains only):

- Distribution mains: minimum 200 mm
- Fire hydrant connections: minimum 150 mm
- Service connections: minimum 19 mm
- Looped distribution mains in residential subdivisions: minimum 150 mm (providing fire flow and all other hydraulic requirements can be met)

5.4 RESERVOIR STORAGE

From the MMCD Design Guidelines:

- A: Fire Storage (from Fire Underwriters Survey Guide)
- B: Equalization Storage (25% of MDD)
- C: Emergency Storage (25% of A+B)

The storage volume required is the sum of A, B, and C.

6 EXISTING CONDITIONS HYDRAULIC ANALYSIS

6.1 PRESSURES, VELOCITIES, AND FIRE FLOWS

The following scenarios were developed to assess existing hydraulic deficiencies in the water system:

1. Existing peak hour demand (at 7 AM)
2. Existing MDD + FF

There were no deficiencies identified in the peak hour demand scenario (Figure 6-1). Pressures in the system range from 82.7 psi to 87.9 psi. This is expected as the system is relatively flat with a single pressure zone. The modelled pressures are within the acceptable design criteria range. All PHD modelled velocities are below the required 2.0 m/s requirement.

Existing MDD+FF was modelled, and the results are presented in Figure 6-2. The available fire flow was compared to the required fire flow under OCP, as existing required fire flows were not set. The following deficiencies were noted and/or dismissed.

Table 6-1: Existing Fire Flow Deficiencies

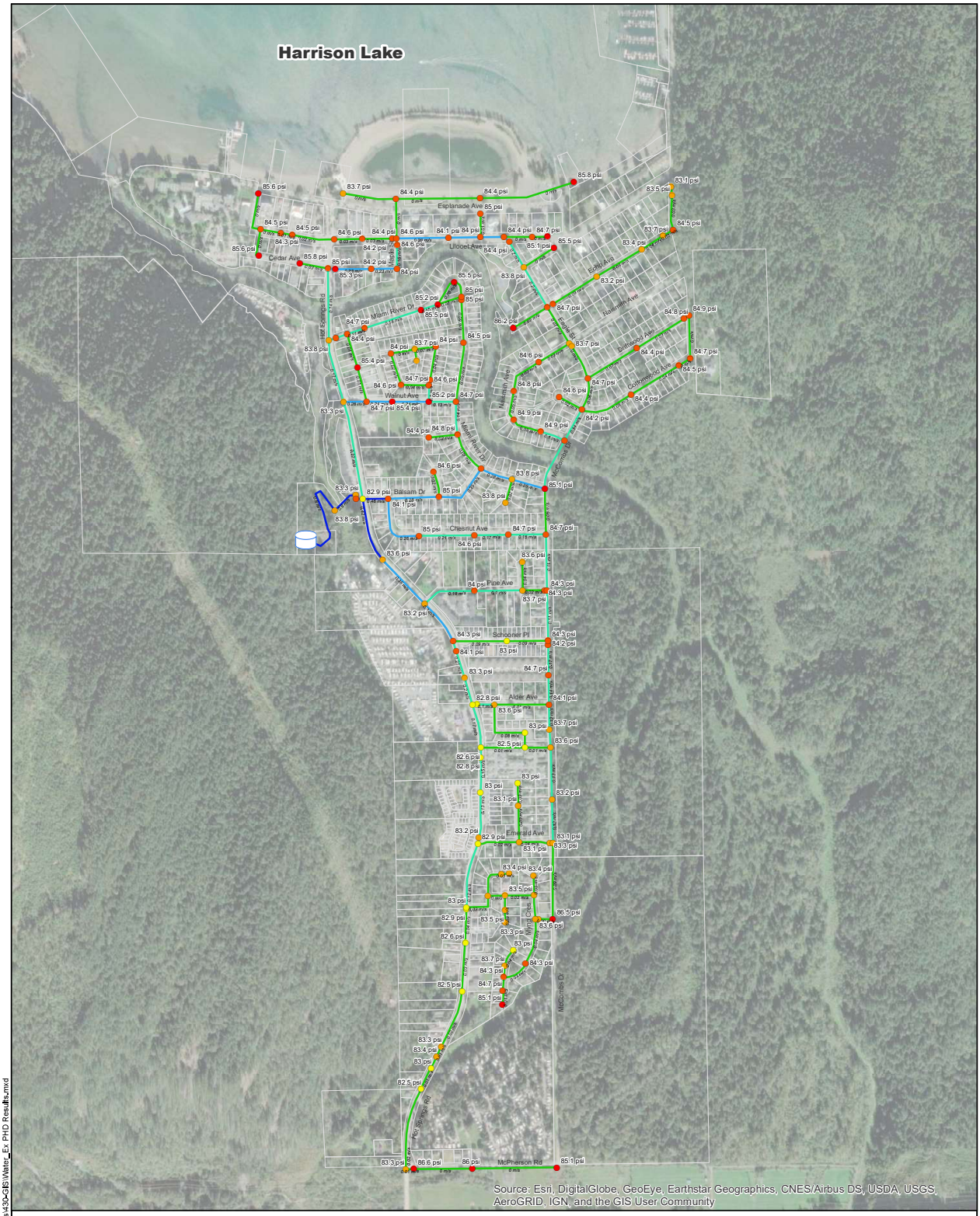
Location	Notes	Action
Lillooet Ave, west of Maple St, and St Alice St	125 L/s AFF calculated, which does not meet the 150 L/s RFF, driven by the existing multi-family and commercial developments in the area.	Looping and/or upsizing required
Lillooet Ave, east of Eagle St	126 L/s AFF calculated, which does not meet the 150 L/s RFF, driven by the existing multi-family developments (450 and 470 Esplanade Ave).	Looping and/or upsizing required
Chehalis St	126 L/s AFF calculated, which does not meet the 150 L/s RFF driven by the existing multi-family developments (378 and 410 Lillooet Ave). These lots may also be serviced by the hydrants on Lillooet Ave (>150 L/s AFF).	Review fire protection for noted properties
Bear Ave	71 L/s AFF calculated, which is sufficient for the existing single-family homes on Bear Ave (60 L/s RFF). However, this hydrant may also be used to service the church at 514 Lillooet Ave (150 L/s RFF).	Review fire protection for noted properties
Echo Ave	69 L/s AFF calculated, which is sufficient for the existing single-family homes on Echo Ave (60 L/s RFF). However, the hydrant at the end of Echo Ave, near Lillooet Ave and Rockwell Dr, could be used to service the multi-family developments on Lillooet Ave (i.e. 595 Lillooet Ave, 150 L/s RFF).	Review fire protection for noted properties
Walnut Ave at Poplar St	109 L/s AFF calculated, which does not meet the 150 L/s RFF driven by the elementary school. This lot may also be serviced by hydrants on the west side of the school on Hot Spring Rd (>150 L/s AFF).	Review fire protection for noted properties
Pine Ave	129 L/s AFF calculated, which does not meet the 150 L/s RFF driven by the existing multifamily development at 386 Pine Ave. This lot may also be serviced by hydrants on the west side of the development on Hot Spring Rd (>150 L/s AFF).	Review fire protection for noted properties

6.2 RESERVOIR STORAGE

The reservoir has adequate capacity with existing demands, as shown in the table below.

Table 6-2: Existing Reservoir Storage

Description	Value	Units	Notes
A: Fire Storage			
Required Fire Flow	150	L/s	Per Section 3.5
Duration	2	hours	Per FUS
Fire Storage	1080	m^3	Required Fire Flow × Duration
B: Balancing Storage			
MDD	2494	m^3/day	Per Section 3.4
Balancing Storage	624	m^3	25% of MDD
C: Emergency Storage			
Emergency Storage	426	m^3	25% of A + B
Total Volume Required	2129	m^3	
Existing Reservoir Capacity	2778	m^3	
Reservoir Spare Capacity	+649	m^3	



Legend

- Reservoir
- Parcels

Peak Hour Demand Pressure (psi)	Peak Hour Demand Velocity (m/s)
<83	<0.10
83-84	0.10 - 0.22
84-85	0.23 - 0.40
>85	>0.41

N

0 150 300 450 m

1:10,000

WATER STREET ENGINEERING

EGBC Permit to Practice #1000830

Water Master Plan

PREPARED FOR

Village of Harrison Hot Springs

PROJECT NO. 456.1

DATE 04 Dec 2025

REVISION 0

Existing Peak Hour Demand Results

Figure 6-1

Document Path: D:\WSE Dropbox\001-Projects\456-Harrison Hot Springs Master Plans\430-GIS\Water_Ex PHD Results.mxd

Legend

- Parcels
- Reservoir
- Fire Flow Deficiency (Available Fire Flow < Required Fire Flow)

Water Main Diameter(mm)

- 50
- 100 - 150
- 200 - 250
- 300 - 350

Available Fire Flow (L/s)

- < 70
- 70 - 100
- 100 - 150
- 150 - 200
- > 200

Note: Lables show Avaliable Fire Flow / Required Fire Flow

N

0 150 300 450 m

1:10,000

Water Master Plan

PREPARED FOR

Village of Harrison Hot Springs

PROJECT NO. 456.1

DATE 04 Dec 2025

REVISION 0

Existing MDD + FF Results

Figure 6-2

WATER STREET ENGINEERING

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Document Path: D:\WSE Dropbox\001-Projects\456-Harrison Hot Springs Master Plans\430-GIS\Water_Ex. MDD+FF Results.mxd

7 OCP CONDITION HYDRAULIC ANALYSIS

7.1 PRESSURES, VELOCITIES, AND FIRE FLOWS

The following scenarios were developed to assess existing hydraulic deficiencies in the water system:

1. Future peak hour demand (at 7 AM)
2. Future MDD + FF

Future demands were developed as described in Section 3.4.

The peak hour pressures and available fire flows are presented in Figure 7-1 and Figure 7-2, respectively. Similar to the existing system, there were no deficiencies identified in the peak hour demand scenario. Pressures in the system range from 82 psi to 87.6 psi, which are within the acceptable design criteria range. All PHD modelled velocities are below the required 2.0 m/s requirement.

The available fire flow was compared to the required fire flow under OCP land use. The following deficiencies were noted.

Table 7-1: OCP Fire Flow Deficiencies

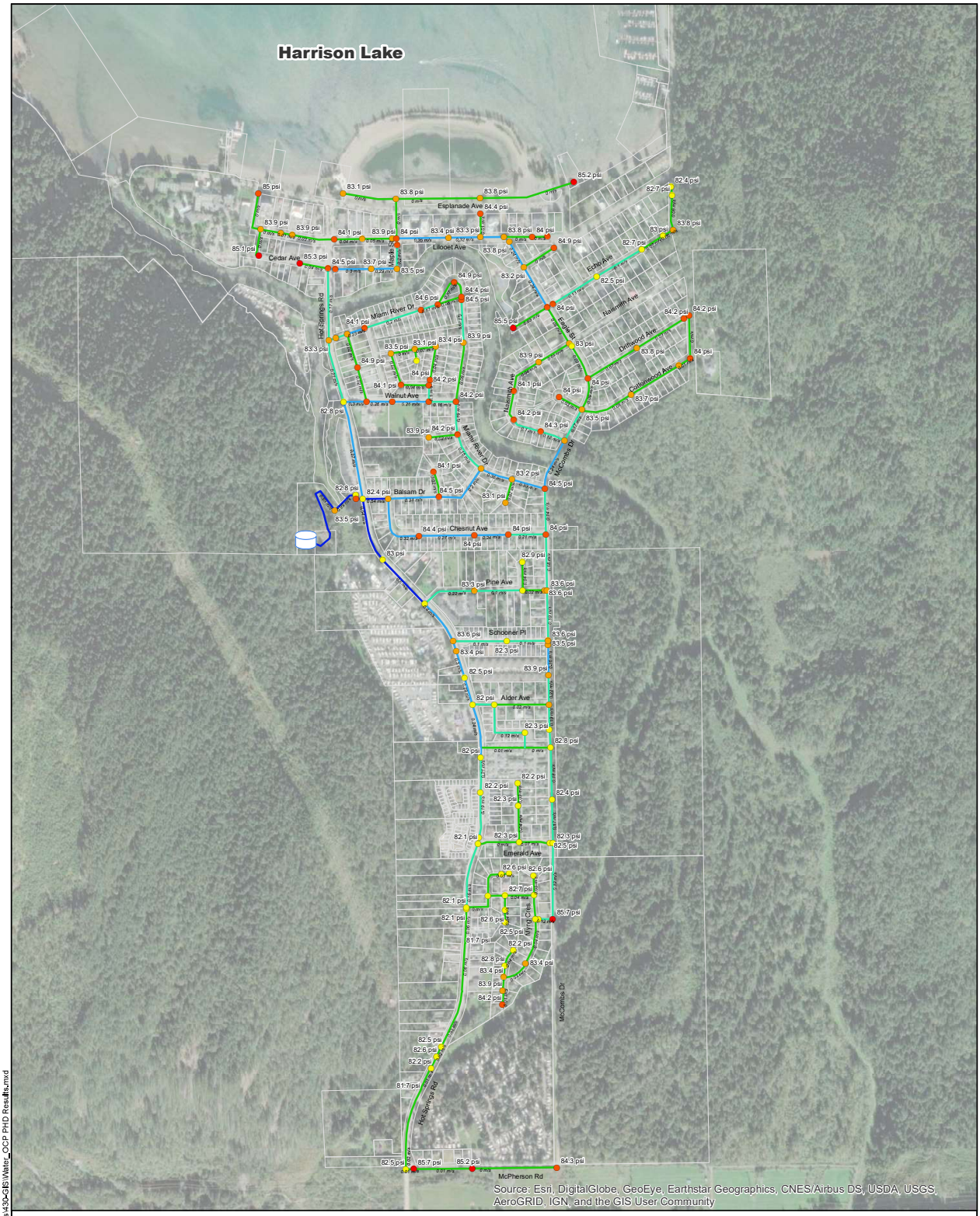
Location	Description	Action
Lillooet Ave, west of Maple St, and St Alice St	124 L/s AFF calculated, which does not meet the 150 L/s RFF. This is an existing deficiency.	Looping and/or upsizing required
Lillooet Ave, east of Eagle St	126 L/s AFF calculated, which does not meet the 150 L/s RFF. This is an existing deficiency.	Looping and/or upsizing required
Chehalis St	126 L/s AFF calculated, which does not meet the 150 L/s RFF driven by the existing multi-family developments (378 and 410 Lillooet Ave). These lots may also be serviced by the hydrants on Lillooet Ave (>150 L/s AFF).	Review fire protection for noted properties
Bear Ave	71 L/s AFF calculated, which does not meet the 150 L/s RFF for lots on Bear Ave with multi-family OCP designations.	Looping and/or upsizing required
Echo Ave	68 L/s AFF calculated, which does not meet the 150 L/s RFF for lots on Echo Ave with multi-family OCP designations.	Looping and/or upsizing required
Walnut Ave at Poplar St	109 L/s AFF calculated, which does not meet the 150 L/s RFF driven by the existing elementary school. This lot may also be serviced by hydrants on the west side of the school on Hot Spring Rd (>150 L/s AFF).	Review fire protection for noted properties
Pine Ave	129 L/s AFF calculated, which does not meet the 150 L/s RFF driven by the existing multifamily development at 386 Pine Ave. This lot may also be serviced by hydrants on the west side of the development on Hot Spring Rd (>150 L/s AFF).	Review fire protection for noted properties

7.2 RESERVOIR STORAGE

The reservoir has adequate capacity with OCP demands, as shown in the table below.

Table 7-2: OCP Reservoir Storage

Description	Value	Units	Notes
A: Fire Storage			
Required Fire Flow	150	L/s	Per Section 3.5
Duration	2	hours	Per FUS
Fire Storage	1080	m^3	Required Fire Flow × Duration
B: Balancing Storage			
MDD	3161	m^3/day	Per Section 3.4
Balancing Storage	790	m^3	25% of MDD
C: Emergency Storage			
Emergency Storage	468	m^3	25% of A + B
Total Volume Required	2338	m^3	
Existing Reservoir Capacity	2778	m^3	
Reservoir Spare Capacity	+440	m^3	



Legend

- Reservoir
- Parcels

Peak Hour Demand Pressure (psi)

- <83
- 83-84
- 84-85
- >85

Peak Hour Demand Velocity (m/s)

- <0.10
- 0.10 - 0.22
- 0.23 - 0.40
- >0.41

N

0 150 300 450 m

1:10,000

WATER STREET ENGINEERING

EGBC Permit to Practice #1000830

Water Master Plan

PREPARED FOR

Village of Harrison Hot Springs

PROJECT NO. 456.1

DATE 04 Dec 2025

REVISION 0

OCP Peak Hour Demand Results

Figure 7-1

Document Path: D:\WSE Dropbox\001-Projects\456-Harrison Hot Springs Master Plans\430-GIS\Water_OCP PHD Results.mxd

Legend

- Parcels
- Reservoir
- Fire Flow Deficiency (Available Fire Flow < Required Fire Flow)

Available Fire Flow (L/s)

- < 70
- 70 - 100
- 100 - 150
- 150 - 200
- > 200

Water Main Diameter(mm)

- 50
- 100 - 150
- 200 - 250
- 300 - 350

Note: Lables show Avaliable Fire Flow / Required Fire Flow

N

0 150 300 450 m

1:10,000

WATER STREET ENGINEERING

EGBC Permit to Practice #1000830

Water Master Plan

PREPARED FOR

Village of Harrison Hot Springs

PROJECT NO. 456.1

DATE 04 Dec 2025

REVISION 0

OCP MDD + FF Results

Figure 7-2

Document Path: D:\WSE Dropbox\001-Projects\456-Harrison Hot Springs Master Plans\430-GIS\Water_OCP MDD+FF Results.mxd

8 WATER QUALITY CONSIDERATIONS

System dead-ends (un-looped water mains) pose a risk of low chlorine residuals. Noted dead-ends in the system include:

- Echo Ave: This has been identified as a fire flow deficiency.
- Lillooet Ave, east of Maple St: This has also been identified as a fire flow deficiency.
- McPherson Rd: This is one of the farthest points from the reservoir and has minimal demand. Looping along McCombs Dr would improve water quality.

Water quality monitoring and regular flushing, if required, should be undertaken until these projects are completed.

The Village has indicated, and has been confirmed by SCADA, that the reservoir is currently operated between 95% and 99% full. Increasing the reservoir cycle volume is recommended to improve mixing of the reservoir for water quality. The Village should consider modifying the reservoir operation to increase cycling and turnover for water quality. The reservoir should maintain a minimum storage of 2,129 m^3 for balancing, fire, and emergency storage (80% of the total storage volume of 2678 m^3 per Table 6-2). Based on this the tank fill (pump start) setpoint should be lowered to 80%, to provide 20% storage. Reservoir cycle volumes should be fine tuned based on operational experience and monitored chlorine residuals.

9 DEMAND MANAGEMENT

As population in the Village increases, the impact on the water system can be reduced by implementing demand management practices. The Village adopted a Municipal Water Conservation Plan in 2018 (Village of Harrison Hot Springs, 2018) that includes the following measurements:

- Public education & awareness
- Water use restrictions from June 1 to September 30
- Requirement to install water meters on all new residential construction or new connections to the water system
    - Residential properties, either metered or unmetered, are billed on a flat rate
    - Commercial properties are currently already metered and billed on a volumetric basis

In addition to the existing water conservation plan, the following projects or initiatives should be considered:

- Complete a study to assess the costs and benefits of universal metering through proactive installation of water meters on existing residential properties. Grant funding may be accessed for the cost of the study and subsequent capital costs of implementation.
- Offer residential customers the opportunity to switch to volumetric billing. A rate review would be required to set a rate that would incentivise switching to volumetric billing but maintain sufficient cost recovery.
- Recent SCADA upgrades have improved the data collection at various points in the water system. These upgrades should be leveraged through improved data analysis, such as monitoring for leakage.
- Additional water use restrictions from June 1 to September 30. This may include further restricting days residents can irrigate to one or two weekdays per week (current restriction allow irrigation one weekday and one weekend day).

10 PROJECT IDENTIFICATION AND PRIORITIZATION

The proposed project list is presented in Table 10-1 with locations shown on Figure 10-1. Individual project definition sheets are included in Appendix 3. The projects generally include:

- Addressing insufficient fire protection,
- Improving water quality,
- Adding utility connections,
- Demand management, and
- Operational improvements.

The proposed projects are further discussed below.

10.1 FIRE FLOW IMPROVEMENTS - EXISTING

The hydrants on Lillooet Ave, west of Maple St, and St Alice St do not provide sufficient fire flow for the existing multi-family and commercial developments. Looping along Cedar Ave (Project 1) is recommended to both increase available fire flows at these hydrants and provide servicing and hydrant protection to the residential properties on Cedar Ave that currently lack them. There are plans to complete this project at the same time as sewer improvements on Cedar Ave (Sewer Project 4 in the Sanitary Sewer Master Plan).

Similarly, the hydrants on Lillooet Ave, east of Eagle St, do not provide sufficient fire flow for the existing multi-family developments here. Properties on Lillooet Ave, east of Spruce St, are also currently unserviced and without hydrant protection. Looping along Lillooet Ave, connecting with the Echo Ave water main (Project 2), is recommended to address both deficiencies. This project is currently planned, to be completed when a new multi-family development is constructed adjacent to Rendal Park (at Lillooet Ave and Spruce St).

The single-family homes on Naismith Ave are currently unserviced and without hydrant protection. Looping along Naismith Ave and Mount St (Project 3) is recommended to provide servicing and hydrant protection to these properties.

The 2015 WMP noted that the existing hydrant distribution does not meet FUS linear spacing and coverage guidelines. Five additional hydrants are recommended on the existing system (Project 4).

10.2 FIRE FLOW IMPROVEMENTS - GROWTH

The Lillooet and Bear Ave water main looping (Project 8) is proposed to increase available fire flows on the eastern end of Bear Ave, should multi-family developments be constructed in the future. Similarly, the Echo Ave and Eagle St water main upgrade (Project 9) is proposed to increase available fire flows at this intersection, should multi-family developments be constructed here.

10.3 WATER QUALITY IMPROVEMENTS

Potential water quality concerns for the dead-ends at Lillooet Ave, east of Maple St, and at Echo Ave are addressed by fire protection Project 1 and Project 2, respectively.

Other potential water quality issues are noted on McPherson Rd, a dead-end and one of the farther points from the reservoir. Looping of the watermain along McCombs Dr (Project 5), between McPherson Rd and Hadway Dr, is recommended to improve water quality for this section of water main. This project is currently planned.

10.4 DEMAND MANAGEMENT

The 2015 WMP recommended that the Village implements universal metering. It is noted that the majority of multi-family and ICI properties within the Village are now metered, however most single-

family homes currently remain un-metered. It is recommended that the Village completes a study to assess the costs and benefits of implementing universal metering (Project 6).

10.5 OPERATIONAL

Inaccuracies and/or missing data are noted in the Village's GIS system. An update of the GIS system data (Project 7) is recommended, which may involve the collection and review of record drawings, and surveying where required.

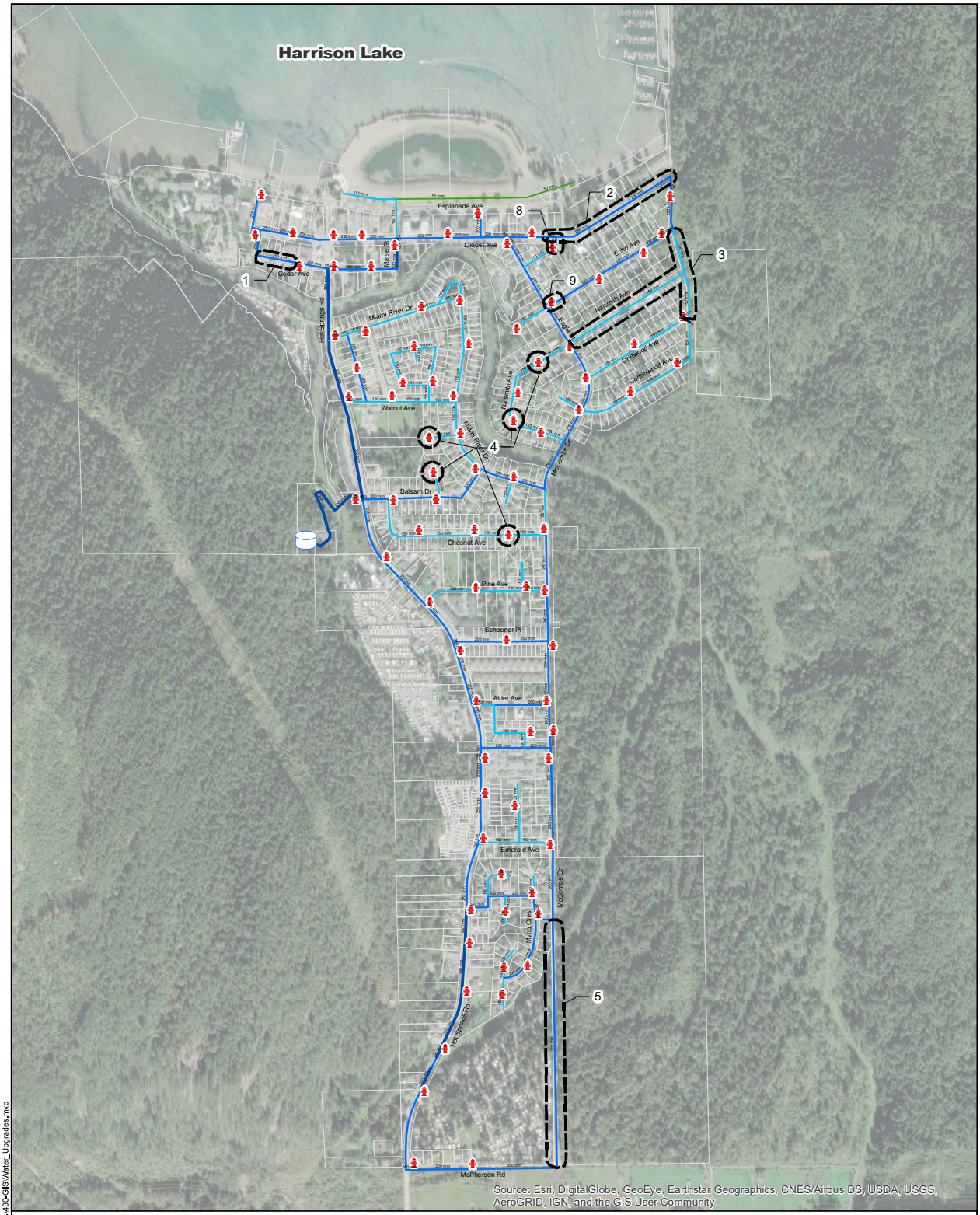
10.6 PROJECT PRIORITIES

Projects are rates as either High, Medium, Low or Conditional. These designations are defined as follows:

- **High**: Project addresses an existing significant deficiency or system need with broad impacts. Projects that address significant fire protection deficiencies are also included in this category. Typical timeline is completion within 5 years.
- **Medium**: Project addresses significant deficiency or system need with localized impact or addresses information gaps to identify deficiencies that could have localized impacts. Generic timeline is completion within 5 to 10 years but subject to project specifics.
- **Low**: Project addresses minor deficiency or system need with localized impact. Projects related to growth are also included in this category. Generic timeline is completion within 10 to 20 years but subject to project specifics.

Table 10-1: Capital Projects - Prioritization

Project Number	Description	Deficiency	Action	Primary Justification Category	Timeline	Priority
1	Cedar Ave Water Main Looping	Unserviced properties without hydrant protection, inadequate fire flows to protect existing developments, and water quality concerns due to dead-end	Construct 127 m of 250 mm diameter water main	Fire protection	Existing	High (Planned)
2	Lillooet and Echo Ave Water Main Looping	Unserviced properties without hydrant protection, inadequate fire flows to protect existing developments, and water quality concerns due to dead-end	Construct 445 m of 200 mm diameter water main	Fire protection	Existing	High (Planned)
3	Naismith Ave and Mount St Water Main Looping	Unserviced properties without hydrant protection	Construct 590 m of 150 mm diameter water main	Fire protection	Existing	Medium
4	Water Hydrants	Properties with water main frontage that have insufficient hydrant protection	Install 5 new hydrants	Fire protection	Existing	Medium
5	McCombs Dr Water Main Looping	Water quality concerns due to dead-end	Construct 650 m of 200 mm diameter water main	Water quality	Existing	Medium (Planned)
6	Universal Metering Study	Unmetered properties	Complete a study to assess costs/benefits of universal metering	Demand management	Existing	Medium
7	GIS System Data Update	Inaccuracies and/or missing data in Village GIS system	Update data in the Village's GIS system	Operational	Existing	Medium
8	Lillooet and Bear Ave Water Main Looping	Inadequate fire flows to protect future (OCP) developments	Construct 38 m of 200 mm diameter water main	Fire protection	Growth	Low
9	Echo Ave and Eagle St Water Main Upgrade	Inadequate fire flows to protect future (OCP) developments	Upgrade 20 m of the 150 mm diameter water main to 200 mm	Fire protection	Growth	Low



Legend

- Reservoir
- Parcels
- Hydrant
- Water Project

Water Main Diameter (mm)

- 50
- 100 - 150
- 200 - 250
- 300 - 350

N

0 150 300 450 m

1:10,000

Water Master Plan

PREPARED FOR

Village of Harrison Hot Springs

PROJECT NO. 456.1

DATE 04 Dec 2025

REVISION 0

Capital Projects

Figure 10-1

WATER STREET ENGINEERING

EGBC Permit to Practice #1000830

Document Path: D:\WSE Dropbox\001-Projects\456-Harrison Hot Springs Master Plans\430-GIS\Water_Upgrades.mxd

11 CAPITAL WORKS PLAN

Based on the identified deficiencies and project prioritization outlined in Section 10, a capital works plan has been developed. All proposed projects are based on capacity improvements to meet future development conditions and are summarised in the table below.

Table 11-1: Capital Projects

Project Number	Description	Deficiency	Priority	DCC Eligible?	Capital Cost
1	Cedar Ave Water Main Looping [1]	Unserviced properties without hydrant protection, inadequate fire flows to protect existing developments, and water quality concerns due to dead-end	High (Planned)	Partial	$283,000
2	Lillooet and Echo Ave Water Main Looping	Unserviced properties without hydrant protection, inadequate fire flows to protect existing developments, and water quality concerns due to dead-end	High (Planned)	Partial	$990,000
3	Naismith Ave and Mount St Water Main Looping	Unserviced properties without hydrant protection	Medium	No	$1,272,000
4	Water Hydrants	Properties with water main frontage that have insufficient hydrant protection	Medium	No	$120,000
5	McCombs Dr Water Main Looping	Water quality concerns due to dead-end	Medium (Planned)	No	$1,260,000
6	Universal Metering Study	Unmetered properties	Medium	No	$36,000
7	GIS System Data Update	Inaccuracies and/or missing data in Village GIS system	Medium	No	$24,000
8	Lillooet and Bear Ave Water Main Looping	Inadequate fire flows to protect future (OCP) developments	Low	Yes	$52,000
9	Echo Ave and Eagle St Water Main Upgrade	Inadequate fire flows to protect future (OCP) developments	Low	Yes	$32,000

Notes:
1. Cedar Ave Water Main Looping (Project 1) to be completed in conjunction with sewer improvements on Cedar Ave (Sewer Project 4 in the Sanitary Sewer Master Plan)

Capital costs for construction projects include 10% for design, 10% for construction administration / project management, and 30% contingency. No provisions were made for site specific costing. Projects without construction scopes include a 20% contingency.

Unit costs used in preparing the capital works plan are based on Water Street's experience with similar projects in other municipalities.

Water main unit costs include supply, install, road restoration, and isolation valves (if applicable) but do not include services or hydrants. It is assumed that new residential water services will have water meters installed, as per the Municipal Water Conservation Plan (Village of Harrison Hot Springs, 2018).

The unit cost used are as follows (excl. design, construction administration / project management, and contingency):

- Water Main, 150 mm: $960 per lin.m
- Water Main, 200 mm: $1,115 per lin.m
- Water Main, 250 mm: $1,308 per lin.m
- Water Hydrant: $16,025 ea
- Service Connection incl. Meter: $9,585 ea

For new water mains, the following allowance is assumed for hydrants and services:

- Hydrant spacing of 150 m for single-family areas, 90 m for multi-family and ICI areas.
- New service connections installed for all existing residential properties (one per lot).

For individual projects, see the project definition sheets are included in Appendix 3. Also listed in this appendix are potential external funding (grant) opportunities (where applicable).

12 CONCLUSIONS AND RECOMMENDATIONS

12.1 SUMMARY

The background review, demand development, and water system modelling revealed the following deficiencies:

- Insufficient fire flows to protect existing and/or future properties.
- Properties with insufficient hydrant protection.
- Properties without water service connections (unserviced an/or on private well systems).
- Water quality concerns due to dead-end at McPherson Rd.
- Unmetered properties.
- Inaccuracies and/or missing data in the Village GIS system.

12.2 RECOMMENDATIONS - CAPITAL PROJECTS

Nine capital projects are recommended. These projects have been given a project priority and high-level capital cost estimate. The total costs of the recommended projects are summarised by project priority in Table 12-1. There are two projects that are high priority, related to providing sufficient fire protection to existing properties:

- Project 1: Cedar Ave Water Main Looping
- Project 2: Lillooet and Echo Ave Water Main Looping

Additionally, three projects are noted to be currently planned:

- Project 1: Cedar Ave Water Main Looping –High Priority
- Project 2: Lillooet and Echo Ave Water Main Looping –High Priority
- Project 5: McComb Water Main Looping – Medium Priority

Table 12-1: Project Summary by Priority

Project Priority	Number of Projects	Total Capital Costs
High	2	$1,273,000
Medium	5	$2,712,000
Low	2	$84,000
Total	9	$4,069,000

12.3 RECOMMENDATIONS - OTHER

Other, non-capital, recommendations are as follows:

1. Review fire protection for 378 Lillooet Ave, 410 Lillooet Ave, 514 Lillooet Ave, 595 Lillooet Ave, 501 Hot Springs Rd (elementary school), and 386 Pine Ave.
2. Complete water quality monitoring (if required) and continue with regular flushing (twice per year) until water quality improvements are completed (Projects 1, 2, 5).
3. Modify reservoir operating levels to increase reservoir cycling volume and improve mixing of the reservoir for water quality.
4. Offer water main connection to residential properties that are currently unserviced and/or on private well systems, with water main frontage. It is noted that there are 31 such residential properties.

5. Offer residential customers with existing meters the opportunity to switch to volumetric billing. A rate review would be required to set a rate that would incentivise switching to volumetric billing but maintain sufficient cost recovery.
6. Recent SCADA upgrades have improved the data collection at various points in the water system. These upgrades should be leveraged through improved data analysis, such as monitoring for leakage.
7. Consider additional water use restrictions from June 1 to September 30. This may include further restricting days residents can irrigate to one or two weekdays per week (current restriction allow irrigation one weekday and one weekend day).
8. The 2015 WMP included the replacement of a damaged tee at Cedar and Hot Springs Rd. It is recommended that the Village further investigates this issue using flow monitoring data. The recent SCADA upgrades can be utilised here.
9. The capacity of the raw water pumps, treatment system, and treated water pumps should be reviewed in light of the future demands calculated in this Master Plan.
10. Further review fire flow requirements for current buildings (using FUS guide as a standard) to review adequacy of the 150 L/s requirement assumed.

13 CLOSURE

We trust this report meets your present requirements. Please contact the undersigned with any questions or comments.

WATER STREET ENGINEERING LTD.

Jade Sangha, EIT
Modelling Engineer

Neal Whiteside, MASc, PEng
Principal, Senior Municipal Engineer

EGBC permit number 1000830

14 REFERENCES

CTQ Consultants. (2015). *Village of Harrison Hot Springs Water Master Plan*.

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Water Street Engineering. (2025b). *Village of Harrison Hot Springs Water Master Plan - Hydrant Flow Testing Results*.

ABBREVIATIONS

AFF	Available Fire Flow (amount available from modelling or testing of the system)
BD	Base Demand
DCC	Development Cost Charges
DEM	Digital Elevation Model
FF	Fire Flow
FUS	Fire Underwriter's Survey
GIS	Geographic Information System
ICI	Industrial, Commercial, Institutional
MDD	Maximum Day Demand
OCP	Official Community Plan
PHD	Peak Hour Demand
PVC	Polyvinyl Chloride
RFF	Required Fire Flow (amount required to meet design criteria)
SD	Seasonal Demand
TWL	Top Water Level
UFW	Unaccounted for Water
WMP	Water Master Plan
WTP	Water Treatment Plant

APPENDIX 1: POPULATION, BASE SANITARY FLOWS, AND BASE WATER DEMANDS MEMORANDUM

Bound separately

APPENDIX 2: HYDRANT FLOW TESTING RESULTS MEMORANDUM

Bound separately

APPENDIX 3: PROJECT DEFINITION SHEETS

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 1
Cedar Ave Water Main Looping
Priority: High

Project Description: Construct 127 m of 250 mm diameter water main

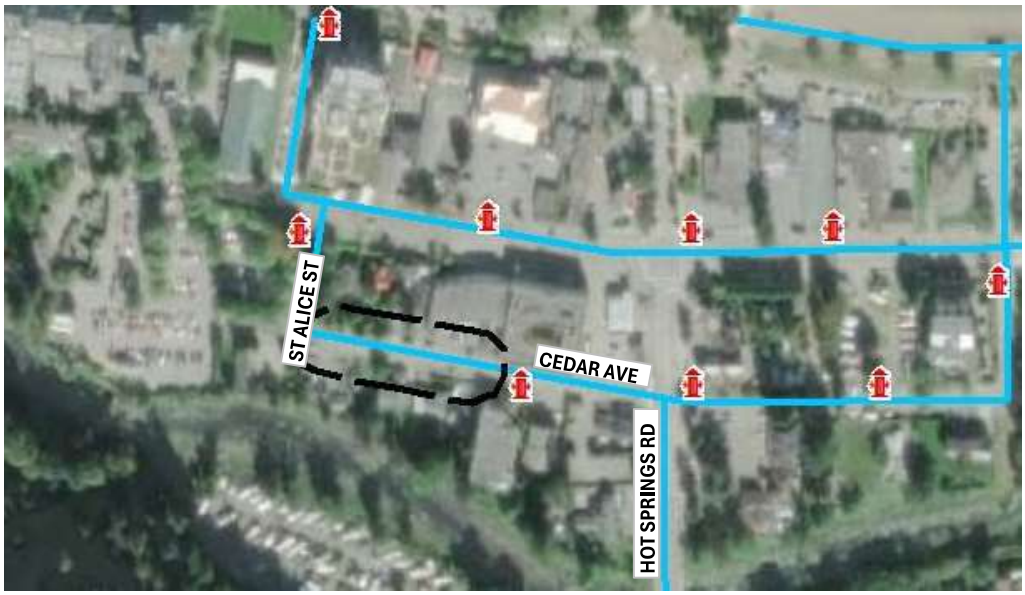
Deficiency: Unserviced properties without hydrant protection, inadequate fire flows to protect existing

Primary Justification: Fire protection

DCC Eligible: Partial

Grant Opportunities: Canada Community Building Fund, British Columbia Growing Communties Fund

Additional Notes: Planned project, to be completed in conjunction with sewer improvements on Cedar Ave (Sewer Project 4 in the Sanitary Sewer Master Plan). Increases available fire flows at hydrants on Lillooet Ave, west of Maple St, and provides servicing and hydrant protection to unserviced properties on Cedar Ave.



Assumptions: 90 m hydrant spacing for multi-family and ICI areas. New service connections and meters installed for all existing residential properties that are currently unserviced (one per lot).

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price	Estimated Amount
1	250 mm Dia. Water Main	m	110	$ 1,308.00	$ 143,880
2	Water Hydrant	ea.	1	$ 16,025.00	$ 16,025
3	Water Service and Meter	ea.	3	$ 9,585.00	$ 28,755
			Subtotal:		**$ 188,660**
	Design / Construction Management / Contingency (%)			**50%**	**$ 94,330**
			Total Estimated Cost:		**$ 282,990**
			Rounded Total Estimated Cost:		**$ 283,000**

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 2
Lillooet and Echo Ave Water Main Looping
Priority: High

Project Description: Construct 445 m of 200 mm diameter water main

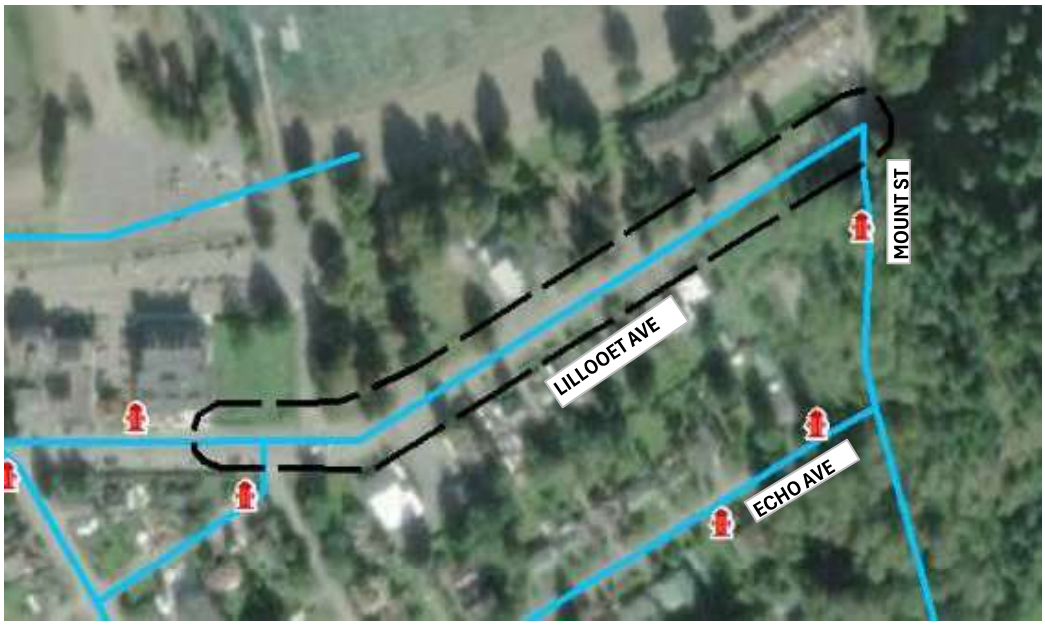
Deficiency: Unserviced properties without hydrant protection, inadequate fire flows to protect existing

Primary Justification: Fire protection

DCC Eligible: Partial

Grant Opportunities: Canada Community Building Fund, British Columbia Growing Communties Fund

Additional Notes: Planned project, to be completed during construction of multi-family development adjacent to Rendal Park. Increases available fire flows at hydrants on Lillooet Ave, east of Eagle St, and provides servicing and hydrant protection to unserviced properties on Lillooet Ave, east of Spruce St.



Assumptions: 90 m hydrant spacing for multi-family and ICI areas. New service connections and meters installed for all existing residential properties that are currently unserviced (one per lot).

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price	Estimated Amount
1	200 mm Dia. Water Main	m	397	$ 1,115.00	$ 442,655
2	Water Hydrant	ea.	4	$ 16,025.00	$ 64,100
3	Water Service and Meter	ea.	16	$ 9,585.00	$ 153,360
			Subtotal:		**$ 660,115**
	Design / Construction Management / Contingency (%)			**50%**	**$ 330,058**
			Total Estimated Cost:		**$ 990,173**
			Rounded Total Estimated Cost:		**$ 990,000**

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 3
Naismith Ave and Mount St Water Main Looping
Priority: Medium

Project Description: Construct 590 m of 150 mm diameter water main
Deficiency: Unserviced properties without hydrant protection
Primary Justification: Fire protection
DCC Eligible: No
Grant Opportunities: Canada Community Building Fund
Additional Notes: Provide servicing and hydrant protection to unserviced properties on Naismith Ave.

Assumptions: 150 m hydrant spacing for single-family areas. New service connections and meters installed for all existing residential properties that are currently unserviced (one per lot).

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price	Estimated Amount
1	150 mm Dia. Water Main	m	587	$ 960.00	$ 563,520
2	Water Hydrant	ea.	4	$ 16,025.00	$ 64,100
3	Water Service and Meter	ea.	23	$ 9,585.00	$ 220,455
			Subtotal:		**$ 848,075**
	Design / Construction Management / Contingency (%)			**50%**	**$ 424,038**
			Total Estimated Cost:		**$ 1,272,113**
			Rounded Total Estimated Cost:		**$ 1,272,000**

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 4
Water Hydrants
Priority: Medium

Project Description: Install 5 new hydrants

Deficiency: Properties with water main frontage that have insufficient hydrant protection

Primary Justification: Fire protection

DCC Eligible: No

Grant Opportunities: Canada Community Building Fund

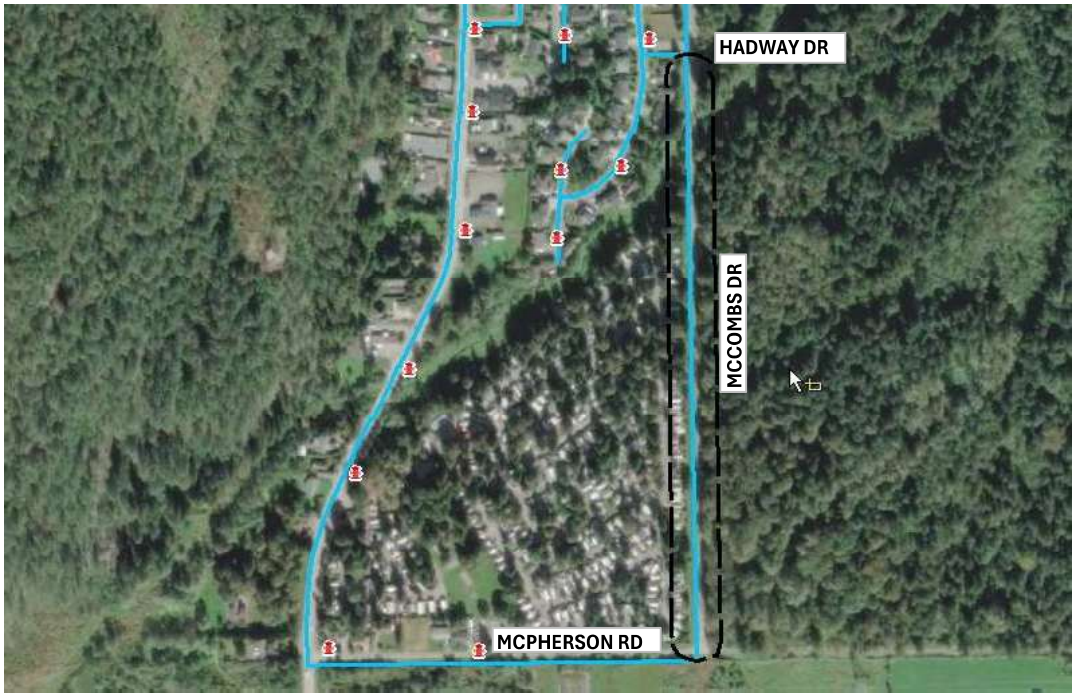
Additional Notes: Provides hydrant protection where FUS linear spacing and coverage guidelines are not met. Recommendation per the 2015 Water Master Plan.

Assumptions: n/a

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price	Estimated Amount
1	Water Hydrant	ea.	5	$ 16,025.00	$ 80,125
			Subtotal:		**$ 80,125**
	Design / Construction Management / Contingency (%)			**50%**	**$ 40,063**
			Total Estimated Cost:		**$ 120,188**
			Rounded Total Estimated Cost:		**$ 120,000**

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 5
McCombs Dr Water Main Looping
Priority: Medium

Project Description: Construct 650 m of 200 mm diameter water main
Deficiency: Water quality concerns due to dead-end
Primary Justification: Water quality
DCC Eligible: No
Grant Opportunities: Canada Community Building Fund
Additional Notes: Planned project. Addresses potential water quality concern on McPherson Rd.



Assumptions: 90 m hydrant spacing for multi-family and ICI areas. New service connections and meters installed for all existing residential properties that are currently unserviced (one per lot).

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price	Estimated Amount
1	200 mm Dia. Water Main	m	653	$ 1,115.00	$ 728,095
2	Water Hydrant	ea.	7	$ 16,025.00	$ 112,175
				Subtotal:	**$ 840,270**
				Design / Construction Management / Contingency (%) **50%**	**$ 420,135**
				Total Estimated Cost:	**$ 1,260,405**
				Rounded Total Estimated Cost:	**$ 1,260,000**

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 6
Universal Metering Study
Priority: Medium

Project Description: Complete a study to assess costs/benefits of universal metering
Deficiency: Unmetered properties
Primary Justification: Demand management
DCC Eligible: No
Grant Opportunities: British Columbia Infrastructure Planning Grant Program, Canada Community Building Fund
Additional Notes: Assess the costs and benefits of implementing universal metering.

Assumptions: Allowance only

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price		Estimated Amount
1	Project Allowance	ea.	n/a	n/a	$	30,000
				Subtotal:	**$**	**30,000**
				Contingency (%)	**20% $**	**6,000**
				Total Estimated Cost:	**$**	**36,000**
				Rounded Total Estimated Cost:	**$**	**36,000**

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 7
GIS System Data Update
Priority: Medium

Project Description: Update data in the Village's GIS system

Deficiency: Inaccuracies and/or missing data in Village GIS system

Primary Justification: Operational

DCC Eligible: No

Grant Opportunities: Union of BC Municipalities Asset Management Planning Program, Canada Community Building Fund

Additional Notes: Inaccuracies and/or missing data have been noted in the Village's GIS System. Collection and review of record drawings, and surverying where required, is recommended.

Assumptions: Allowance only

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price		Estimated Amount
1	Project Allowance	ea.	n/a	n/a	$	20,000
				Subtotal:	**$**	**20,000**
				Contingency (%)	**20%** **$**	**4,000**
				Total Estimated Cost:	**$**	**24,000**
				Rounded Total Estimated Cost:	**$**	**24,000**

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 8
Lillooet and Bear Ave Water Main Looping
Priority: Low

Project Description: Construct 38 m of 200 mm diameter water main

Deficiency: Inadequate fire flows to protect future (OCP) developments

Primary Justification: Fire protection

DCC Eligible: Yes

Grant Opportunities: n/a

Additional Notes: Contingent on future development. Increases available fire flows at the hydrant on the eastern end of Bear Ave.

Assumptions: 90 m hydrant spacing for multi-family and ICI areas.

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price	Estimated Amount
1	200 mm Dia. Water Main	m	31	$ 1,115.00	$ 34,565
				Subtotal:	**$ 34,565**
			Design / Construction Management / Contingency (%)	**50%**	**$ 17,283**
				Total Estimated Cost:	**$ 51,848**
				Rounded Total Estimated Cost:	**$ 52,000**

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 9
Echo Ave and Eagle St Water Main Upgrade
Priority: Low

Project Description: Upgrade 20 m of the 150 mm diameter water main to 200 mm
Deficiency: Inadequate fire flows to protect future (OCP) developments
Primary Justification: Fire protection
DCC Eligible: Yes
Grant Opportunities: n/a
Additional Notes: Contingent on future development. Increases available fire flows at the hydrant at Echo Ave and Eagle St.

Assumptions: n/a

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price	Estimated Amount
1	200 mm Dia. Water Main	m	19	$ 1,115.00	$ 21,185
			Subtotal:		**$ 21,185**
			Design / Construction Management / Contingency (%)	**50%**	**$ 10,593**
			Total Estimated Cost:		**$ 31,778**
			Rounded Total Estimated Cost:		**$ 32,000**

WATER STREET ENGINEERING

TECHNICAL MEMORANDUM			
Subject	Population, Base Sanitary Flows and Base Water Demands		
Project	Village of Harrison Hot Springs Sanitary Sewer and Water Master Plans		
To	Jace Hodgson Village of Harrison Hot Springs	**From**	Jade Sangha, EIT and Neal Whiteside, MASc, PEng
Date	29 Sep 2025	**File ref**	Water Street File # 456.300
Version	C	**Status**	Final

1. INTRODUCTION

1.1. PURPOSE

The Village of Harrison Hot Springs (the Village) has retained Water Street Engineering (Water Street) to complete village-wide sanitary sewer, storm, and water master plans.

This technical memorandum evaluates populations, base sanitary flows and base water demands for use in the sanitary sewer and water master plans. Specifically, this memorandum aims to:

1. Identify current and future village-wide residential populations based on BC Stats and Fraser Valley Regional District (FVRD) data.
2. Assess current and future Industrial, Commercial, and Institutional (ICI) population equivalents, to develop the current and future design population equivalents (sum of residential population and ICI population equivalent).
3. Estimate the (winter base and summer peak) residential populations and ICI population equivalents. connected to the sanitary sewer and water systems.
4. Develop estimated current sanitary sewer base sanitary flow (total and per capita rate), and groundwater infiltration (GWI) based on 2025 flow monitoring.
5. Develop estimates of current water demands (BD, SD, UFW), based on 2023 data.

1.2. BACKGROUND

The VHHS is experiencing population growth and redevelopment, which necessitates a long-term improvement plan to ensure the water and sanitary sewer systems can meet the increasing demands / loads and fire protection requirements.

As noted in the 2015 Water Master Plan, the growth in the village is unique and has not been consistent with the surrounding municipalities. The Village has a developed tourism industry and a significant number of seasonal residents. Estimating the seasonal residents and seasonal commercial population equivalents is important for planning and evaluation of the Village sanitary sewer and water systems.

1.3. PREVIOUS WORK

2016 LIQUID WASTE MANAGEMENT PLAN (CTQ, 2016)

The 2016 Liquid Water Management Plan (LWMP) noted a 2011 Census population of 1,468 ca and an average growth rate (1996 -2011) of 4.2%. A yr-2036 population forecast range of 2,367 to 2,733 ca was developed based

on growth rates. A "full-capacity" population of 4,447 ca was also developed based on current (at the time) land use zoning.

1.4. LIMITATIONS

This technical memorandum must be read with the Statement of Limitations at the end of this document.

2. BASE (WINTER) POPULATION

The BC Stats Population Estimates & Projections for British Columbia (BC Stats, 2024a) and the FVRD regional growth strategy (Fraser Valley Regional District, 2024) were used to assess current and future base (winter) village-wide populations. BC Stats uses the Component/Cohort-Survival method to project populations, which grows the population from the latest base year estimate by forecasting births, deaths and migration. Similarly, the BC Stats Household Estimates & Projections for British Columbia (BC Stats, 2024b) is used to assess current and future dwelling units and per-capita dwelling unit densities. Note that households include occupied dwellings only. The FVRD regional growth strategies presents populations and number of households for 2021 and projections for 2030, 2040 and 2050.

The historical estimates and future projections of populations and household within the Village are shown in Figure 1. Note the future projections provided by BC Stats only include up to the year 2046. The FVRD projections for populations and population per housing unit differ slightly from corresponding BC Stats projections.

For the Master Planning work, 2023 population data from BC Stats was selected to represent existing conditions, as this is consistent with the data available. The Village has selected the 2050 FVRD projections as their preferred option for future growth estimates. These are presented in Table 1.

Figure 1: BC Stats population and household estimates / projections

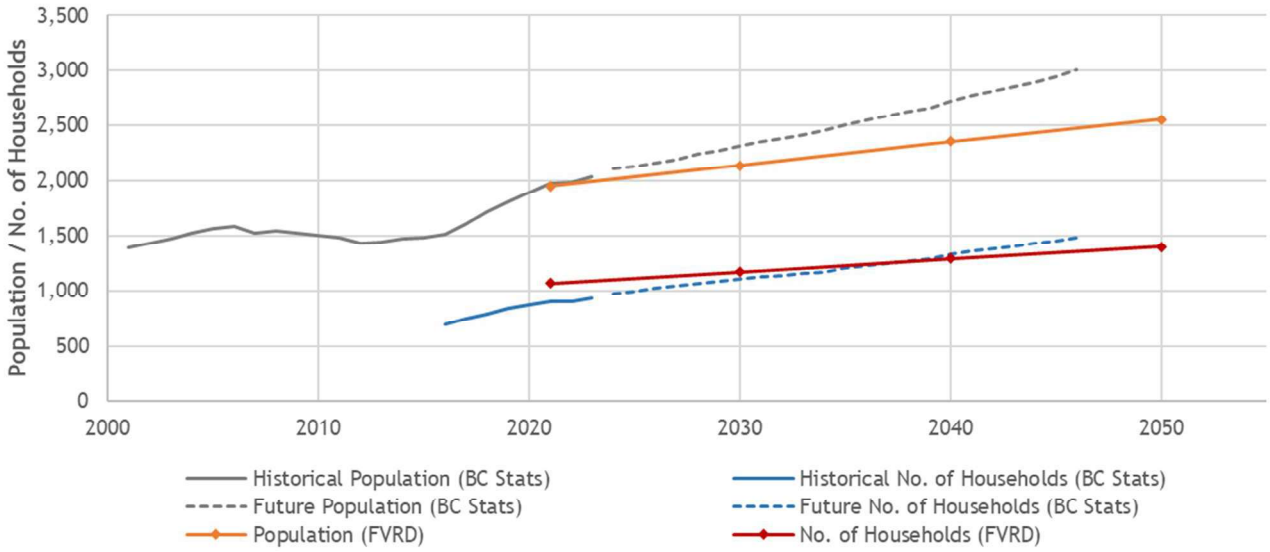


Table 1: Village-wide base (winter) populations

Master Plan Scenario	BC Stats		FVRD	
	Population	No. of Households	Population	No. of Housing Units
2021 for reference*	1,979	897	1,951	1,070
Existing (2023)	2,032	932	-	-
2046 BC Stats*	3,004	1,488	-	-
Future (2050)	-	-	2,553	1,400
* Not considered in master plan modelling, provided for reference only.				

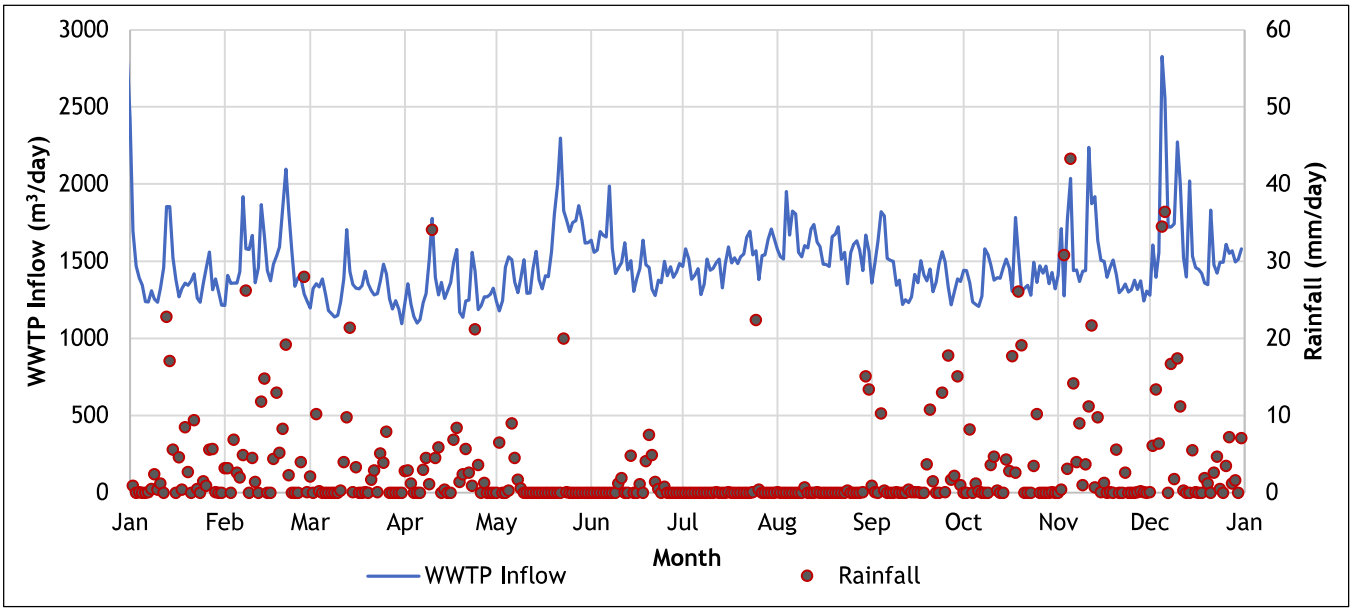
The 2023 BC Stats population projection is used for the existing master plan scenarios; the 2050 FVRD population projection is used for the future master plan scenarios.

3. WWTP & WTP FLOWS

3.1. WWTP EFFLUENT FLOWS

The daily recorded effluent discharge from 2023 is shown in Figure 2. The wastewater treatment plant (WWTP) effluent flows were used to assist in determining base sanitary flows (winter and seasonal component) and in turn establishing the seasonal population.

Figure 2: 2023 WWTP effluent flow



Implicitly included in the WWTP effluent flows would be:

- Some daily fluctuation compared to inflows to the WWTP (due to changes in levels in the WWTP aeration basins),
- Rainfall derived inflow and infiltration (RDII), and
- Sanitary ground water inflows (GWI)

The first two factors were minimized by averaging flows over a number of dry days in the summer and winter periods. It was assumed that the GWI would not vary considerably from summer to winter.

Table 2: 2023 WWTP effluent flow summary

Period	Flow		Dates
	m³/day	L/s	
Average (for reference incl. wet periods)	1479	17.1	1 Jan - 31 Dec
Winter Dry Weather	1185	13.7	5-10, 27-31 Mar, 4-6 Apr
Summer Dry Weather	1617	18.7	26 Jul - 29 Aug
Seasonal Component of DWF	432	5.00	Summer less Winter dry weather flow

Data for 2021 was checked and showed a similar increase in summer dry weather WWTP flows.

3.2. WTP FLOWS

Source flows to the Village are metered at the water treatment plant (WTP), which flows to the Village's tank before supplying the Village. The flows are manually recorded daily, and do not include peak hour consumption. The data for the village is shown in Figure 3 and Table 3.

Figure 3: 2023 WTP discharge

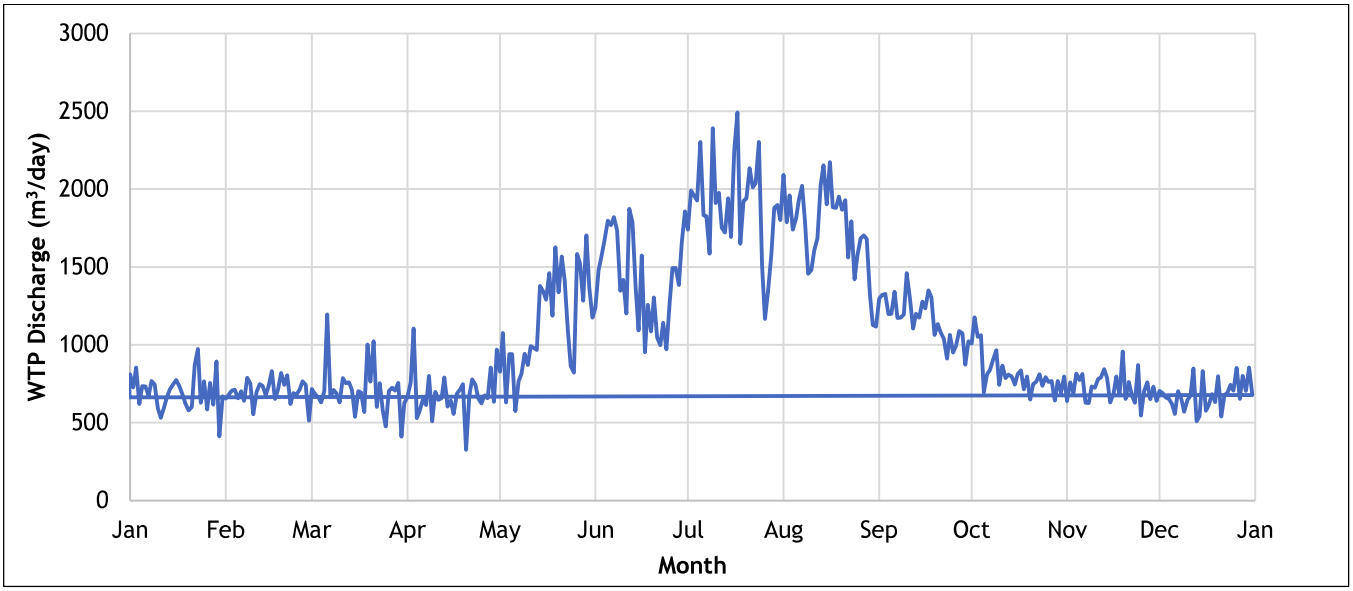


Table 3: 2023 WTP discharge summary

Demand Type	Demand		Dates
	m³/day	L/s	
Average Day (ADD)	1034	12.0	1 Jan - 31 Dec
Base (BD)	703	8.14	1 Jan - 31 Mar (Q1)
Maximum Day (MDD)	2492	28.8	17 Jul
Seasonal (SD)	1789	20.7	Maximum Day less Base demand

It is noted that due to the location of the WTP water meter, there can be significant fluctuations in the daily flow recordings (due to tank level fluctuations). As such, the above measured peak day flow (28.8 L/s) may be higher than the actual system MDD.

3.3. 2025 SANITARY SEWER FLOW MONITORING

Flow monitoring was completed between Jan and Jun 2025 as described in a separate technical memorandum (Water Street Engineering, 2025).

4. SERVICED & METERED PROPERTIES

4.1. SERVICED WATER AND SEWER LOTS

Not all of the Village is serviced by the respective water and sanitary sewer systems. A list of properties connected to the water and sanitary systems was provided by the Village, and mapped to GIS data to determine whether a property is serviced with water and/or sewer, or neither, and number of service connections. BCAA actual use codes were used to assign usage type and dwelling unit counts.

- Un-serviced lots: 175 GIS parcels were identified as un-serviced. These parcels include several large lots and the total area of unserviced parcels is 211.2 ha (63% of total lot area of parcels within Village).
- Lots serviced by **both water and sewer**: 659 lots, 78.4 ha, accounting for 1098 dwelling units, including 622 single-family dwelling units and 13 multi-family units (with a total of 475 water service connections noted). It is noted that many of the multi-family units are understood to be unoccupied in the winter.
- Lots serviced by **sanitary sewer only**: 82 lots, 47.3 ha, accounting for 97 dwelling units. A review of the lots serviced by sanitary but not water indicates that these generally have their own groundwater source (i.e. well(s)).
- Lots serviced by **water only**: 2 lots both indicated as vacant by BCAA actual use code.

Notable properties / exceptions are as follows:

- **Springs RV Resort (SRVR, 640 & 670 Hot Springs Rd.):** The SRVR is connected to both the Village water and sewer systems. HHP is set-up for seasonal RV use. The water system is metered. It is understood that the facility is open year-round.
    - Serviced area (for calculation of sanitary GWI and RDII): 47,464 m^2 / 4.75 ha
    - Metered water use: Winter 15 m^3/day (Q1 2023) and Summer 115 m^3/day (Q3 2023)
    - Outdoor water use allowance (summer typical only, not included in BSF): 9 m^3/day (assumed based on 3,000 m^2 irrigated area at 3 mm/day irrigation rate)
    - Winter and summer BSF water: Assumed equal to metered water consumption less outdoor usage. 15 m^3/day winter, 106 m^3/day summer total.
    - Typical winter and summer occupancy: 12% winter (back calculated from Q1 2023 meter data) and 90% summer (assumed)
    - Total number of RV pads: 288 sites plus additional 82 RV sites being added in 2025 (Phase 3).
    - Occupancy per occupied pad (based on indoor water consumption at 200 L/ca/day): 2.04 ca/site
- **Harrison Holiday Park (HHP, 973 Hot Springs Rd.):** The HHP has its own water supply system (groundwater wells). The sanitary system discharges to MH14 on McCombs Rd. HHP is set-up for seasonal RV use. It is understood that the facility is empty in the winter (except for caretaker occupancy), and open April - October.
    - BSF rate: 388 L/occupied site/ day; 2.04 ca/site at 190 L/ca/day (matching Springs RV rates)
    - Total number of RV pads: 400
    - Typical winter and summer occupancy: 32 % winter (126 sites) and 90% summer (360 sites)
    - Note winter occupancy derived from April calibration data
    - Serviced area (for calculation of sanitary GWI and RDII): 129,447 m^2 / 12.9 ha
    - Winter discharge BSF: 49 m^3/day
    - Summer BSF: 140 m^3/day

- **Harrison Hot Springs Resort (HHSR, 100 Esplanade Ave):** The HHSR has its own water supply but is connected to the sanitary sewer system. The sanitary sewer system is metered but volume measured is only the discharge from the onsite pools.[1] Key information on the HHSR:
    - Serviced area (for calculation of sanitary GWI and RDII): 60,347 m^2 / 6.03 ha
    - Total number of rooms: 342
    - Typical winter and summer occupancy: 30 % winter and 90 % summer (note this is arbitrary)
    - BSF rate: 460 L/occupied room/day; 2 BU x 230 L/BU/day (Province of BC (MFNRO), 2012)
    - Metered discharge (emptying of pools): 15.2 m^3/day (average from 2020 - 2023 meter data)
    - Winter discharge BSF estimate: 47 m^3/day (indoor), 62 m^3/day (total incl. pool) – pre-calibration
    - Summer BSF estimate: 142 m^3/day (indoor), 157 m^3/day (total incl. pool) – pre-calibration
    - Observed April 2025 average dry weather flow (ADWF) of 12.1 L/s (1,045 m^3/day) including 7.3 L/s GWI and 4.8 L/s BSF (see flow monitoring TM)Revised existing summer BSF estimate to match Apr 2025 data.

- **Harrison Hot Springs Public Mineral Pool (HHSMP, 101 Hot Springs Rd):** The HHSMP is not supplied from the Village water system but is connected to the sanitary sewer system. The HHSMP's discharge is metered.
    - Metered discharge (emptying of pools): 103 m^3/day (average from 2022 - 2023 meter data)
    - Assume other uses are not significant.
    - Winter and Summer BSF = 103 m^3/day

- **Harrison RV Country Club (398 Hot Springs Rd):** This site is also not supplied from the Village water system but is connected to the sanitary sewer system. No metering.
    - Estimated 70 RV sites (year-round occupancy assumed)
    - Assumed 2.04 ca/site and 160 L/ca/day, to arrive at 23 m^3/day
    - No future growth assumed.

4.2. WATER SERVICE METER DATA

The Village meters all ICI users and all new multi-family (MF) residential lots connected to the water system. Single-family and older multi-family residential lots are not metered. Meters are read quarterly, and the metered consumption customer data was provided by the Village. Note the exact dates of meter read were not provided (hence the length of billing periods is estimated as 365 /4 days for each period).

Meter data was matched to GIS parcel data, to determine existing metered consumption for each metered lot and assign metered consumption to a use type (ICI or MF residential).

The data provided included 30 active water meters including:

- 21 on ICI (industrial, commercial, institutional) properties
- 9 residential (multi-family) properties (incl. 3 mixed use properties with commercial uses as well)
- A total of 369 dwelling units (most of the estimated 506 MF dwelling units in the Village).

Metered consumption data was used to estimate water demands as follows:

- Base demand (BD): Q1 demand (excluding missing readings).
- Maximum day demand (MDD): Assume metered usage is same as Q3 consumption

[1] 27 Nov 2024 email from VHHS (Tyler Simmonds).

Table 4: 2023 ICI and multi-family metered consumption (L/s)

Use	Quarter				ADD	Winter BD	MDD
	Q1	Q2	Q3	Q4			
ICI	1.36	2.05	3.28	1.62	1.99	1.36	3.28
Residential (Multi-family)	0.54	0.85	1.22	0.59	0.79	0.54	1.22
Total	1.90	2.90	4.50	2.21	2.78	1.90	4.50

In 2023, metered consumption made up 23% of total water delivered by the WTP.

5. EXISTING WATER BALANCE

5.1. WATER BASE DEMANDS

Winter base and summer MDD water demands were derived from the data as follows.

Table 5: 2023 existing water demands

Use	Use Code	Demand (m^3/day)	Source / Unit Rates
Base Demand			
ICI	BD-ICI-M	117	From meter data
Residential MF Metered [1,2]	BD-RES-MF-M	46	From meter data. 280 DU, 232 ca
Residential MF Unmetered[1,2]	BD-RES-MF-UM	29	197 DUo x 0.63 ca/DU x 237 L/ca/day
Residential SF [1,2]	BD-RES-SF	363	622 DU x 2.47 ca/DU x 237 L/ca/day
Unaccounted for Water[3]	BD-UFW	147	125 L/service/day x 1176
Total Base Demand		704	
Seasonal Component (in addition to BD)			
ICI	SD-ICI-M	166	From meter data
Residential MF Metered	SD-RES-MF-M	58	From meter data
Residential MF Unmetered Addl. Indoor Use	SD-RES-MF-UM-I	7	Assume addl. 22 % occupancy
Residential MF Unmetered Outdoor Use	SD-RES-MF-UM-O	91	Same rate as SF lots
Residential SF Addl. Indoor Use[4]	SD-RES-SF-I	80	Assume addl. 22 % occupancy
Residential SF Outdoor Use[5]	SD-RES-SF-O	1390	4.78 L/m^2/day on irrigable area of 50% of lot area up to maximum of 2000 m^2/DU
Total Addl. Seasonal Demand		1791	
Maximum Day Demand		2494	

Notes:
1. 237 L/ca/day represents typical indoor water use rate observed in lower mainland with current mix of indoor water fixture (excl. unusual leakage)
2. Total population of 2032 ca for Harrison; distributed first to SF DU at 2.47 ca/DU; then remainder to MF DU. Note the low population density is expected to be primarily due to seasonal occupancy.
3. UFW estimated from water balance; i.e. total delivered water from source flow data less metered consumption and unmetered estimate.
4. Additional seasonal occupancy allowance of 22% (note 2021 census data indicates 18% of DU are not occupied normally).
5. Outdoor water use rate of 4.78 L/m^2/day is back-calculated from observed seasonal demand after accounting for an allowance for addl. occupancy.

5.2. SANITARY DRY WEATHER FLOWS

Sanitary dry weather flows were developed from the data as follows.

Table 6: Existing sanitary dry weather flows

Use	Use Code	Load (m^3/day)	Source / Unit Rates
ADWF (Winter) – April 2025			
ICI with Water Connection	BSF-ICI	92	80% of ICI water BD
ICI without Water Connection	BSF-ICI-NW	175	Incl. HHP and HHSMP (see section 4)
Residential with Water Connection	BSF-RES	351	Equal to residential water BD
Residential without Water Connection [1]	BSF-RES-NW	45	97 DU x 2.47 ca/DU x 190 L/ca/day
BSF HHSR	BSF-ICI-HHSR	410	From calibration
Groundwater Infiltration (except HHSR)	GWI	211	2,000 L/ha/day (calibrated)
GWI (HHSR)	GWI-HHSR	631	From calibration
Total ADWF (Winter)		1916	

Notes:
1. Residential base sanitary flow rates are 80% of indoor water use rates per calibration.
2. HHSR loads from calibration

Note that the base sanitary flow cannot be directly compared to the water base demand, as there are several properties serviced by the sanitary system but not the water system (these lots have a separate private water supply).

A summer forecast is not produced as the design flow condition (high rainfall and RDII) occurs in the winter season.

5.3. EXISTING POPULATION AND SUMMER (SEASONAL) COMPONENT

Harrison Hot Springs has a significant seasonal population. From the water balance a 22% increase in serviced water population (1834 ca winter to 2237 ca summer) is estimated. Compared to the water system, the sanitary sewer system services an additional 186 ca in the winter (2020 ca total). The total residential sanitary sewer service population in the summer is estimated as 2464 ca.

The above values exclude the additional flows from the SRVR and HHP and additional occupancy at hotels including the HHR.

The above values are substantiated by the increased WTP and WWTP flows that were used in the water and sewer flow balances. The 2023 dry weather flow increase at the WWTP was 36% from 1185 m^3/day in the winter to 1617 m^3/day in the summer.

The existing serviced residential populations are estimated as shown in Table 7.

Table 7: 2023 serviced residential populations

Utility System Serviced	Winter Population (ca)	Summer Population Increase	Summer Population Increase (ca)	Summer Population (ca)
Sanitary	1834	+22%	+403	2237
Water	2020		+444	2464

6. OCP FORECAST

6.1. LAND USE DESIGNATIONS

The future residential population was based on the FVRD population projects (see Section 2). The projected distribution of residential population and ICI growth was developed based on the Village's Official Community Plan (OCP).

The various OCP designations considered are provided in the table below.

Table 8: OCP designations

Abbr.	OCP Designation	Subtype	Residential Uses	Lot Area (ha)
LB	Lakeshore Beach	Park		19
LDR	Low Density Residential	Residential	Single-family, duplex	60
LR	Lakeshore Residential	Residential	Townhomes, row homes	1
MDR	Medium Density Residential	Residential	Townhomes, row homes	4
MTC	Marine Tourist Commercial	ICI		10
PU	Public Use	ICI or Park		75
R	Resources	Vacant		90
TC	Tourist Commercial	ICI		24
VC	Village Centre	Mixed Use	Apartments	6
WC	Waterfront Commercial	Mixed Use	Apartments	25
TC-HDR[1,2]	Tourist Commercial - High Density Residential	Residential	Apartments	2
TC-MDR[1,3]	Tourist Commercial - Medium Density Residential	Residential	Townhomes, row homes	4
TC-SLR[1,4]	Tourist Commercial - Small Lot Residential	Residential	Resort (small lot) residential	1
Total				325

Notes:
1. New categories created for residential properties with the Tourist Commercial (TC) OCP designation.
2. Singular property at 740 Hot Springs Rd (planned apartment development).
3. 628 McCombs Dr, 386 & 388 Pine Ave, and all properties on Schooner Pl.
4. 750 & 798 Hot Springs Rd.

6.2. RESIDENTIAL POPULATION GROWTH

The FVRD projects a Village 2050 residential population of 2,553 ca with 1,400 occupied housing units. This translates to a population increase of +521 ca (or +26%). Assuming a seasonal occupancy of 78% of units being occupied year-round (based on current occupancy), a total of 1,804 total dwelling units in the village are projected (with 404 unoccupied). This translates to +603 new dwelling units.

To distribute these dwelling units spatially amongst the Village, future densities (DU/ha or DU/lot) were set based on a combination of current densities, typical densities in other municipalities, and judgement, such that the total resulted in a net +603 new dwelling units. The actual densities will depend on the ultimate development of the lot.

Residential dwelling units were assigned as either the current number of dwelling units or calculated using the estimated future density, whichever resulted in a greater number of dwelling units for a given property. Constraints to buildable areas were created for larger lots, particularly those fronting Hot Springs Rd, where steep topography to the west limits the total developable area.

Two OCP designations are classified as mixed-use: Village Centre (VC) and Waterfront Commercial (WC). For properties with these OCP designations, future residential usage was considered only for properties that currently have residential usage (including both multi- and single-family uses).

The residential densities and resulting dwelling units for each OCP designation are shown in the table below.

Table: OCP residential dwelling unit projections

Abbr.	Lot Area (ha)	Buildable Area (ha)	Dwelling Unit Density		Dwelling Units (DU)	Dwelling Unit Growth (DU)
			DU/ha	DU/lot		
LDR	60	55	13	-	798	189
LR	1	1	25	-	35	4
MDR	4	4	25	-	110	53
VC	2*	2*	150	-	242	124
WC	2*	2*	150	-	319	79
TC-HDR	2	1	150	-	105	105
TC-MDR	4	4	25	-	107	5
TC-SLR	1	1	-	1	87	52
Total	76	69	-	-	1803	611
Dwelling Unit Decrease on ICI Properties						-9
Net Dwelling Unit Growth						602
* Mixed-use OCP designations; this table only includes those properties identified as residential.						

The future residential population (2,553 ca as per FVRD projections) was distributed using estimated population densities. The population densities were set for each land use category generally based on current densities such that the total population was approximately equal to the FVRD projection of 2,553 ca. Note the population densities used for the future projections are less than existing population density estimates. This trend of declining population density is consistent with the BC Stats projections.

Table 9: OCP residential population projections

Abbr.	Dwelling Units (DU)	Population Density (ca/DU)		Population (ca)		Population Growth (ca)	
		Winter	Summer	Winter	Summer	Winter	Summer
LDR	798	2.16	2.64	1724	2103	296	361
LR	35	1.40	1.71	48	59	25	31
MDR	110	1.40	1.71	154	187	61	74
VC	242	0.53	0.65	128	157	36	44
WC	319	0.53	0.65	169	206	7	9
TC-HDR	105	0.53	0.65	56	68	56	68
TC-MDR	107	1.40	1.71	150	183	25	31
T-SLR	87	1.40	1.71	122	149	36	43
Total	1803	-	-	2553	3112	541	660
Population Decrease on ICI Properties						-22	-27
Net Population Growth						519	633

Note the above tables indicate a dwelling unit and population decrease for some ICI properties. These properties are currently used for single-family dwellings, however their OCP designations indicate they will be used for ICI or be vacant in the future.

6.3. ICI GROWTH

ICI growth is assumed to be consistent with residential growth (i.e. an overall ICI growth of +26% is assumed).

There are some properties which are currently residential but have ICI OCP designations. These properties are as follows:

- Town Centre (TC): 694, 674, 682, 690, and 728 Hot Springs Rd. Assumed to be commercial in the future. Assigned new water and sanitary demands.
- Public Use (PU): 590 Hot Springs Rd and 520 Lillooet Ave. Assumed to be vacant or used as parks in the future, with no water or sanitary demands.
- Resources (R): 480 and 980 Hot Springs Rd. Assumed to be vacant in the future, with no water or sanitary demands.

Additionally, there are some properties that are currently vacant ICI but are assumed to be developed at OCP:

- Town Centre (TC): 720 Hot Springs Rd. Assumed to be commercial in the future. Assigned new water and sanitary demands.
- Village Commercial (VC): 316 Hot Springs Rd, 260 Esplanade Ave, and 260 Cedar Ave. Assumed to be commercial in the future. Assigned new water and sanitary demands.
- Waterfront Commercial (WC): 490 Esplanade Ave, 498 Esplanade Ave, and 511 Lillooet Ave. Assumed to be commercial in the future. Assigned new water and sanitary demands.
- Public Use (PU): 22 lots throughout the Village. Assumed to remain vacant or used as parks in the future, with no water or sanitary demands.

It is assumed that properties with Marine Tourist Commercial (MTC) OCP designation will not be developed / not produce water or sanitary demands at OCP.

6.4. WATER BASE DEMANDS

Projected winter base and summer MDD water demands are summarized in Table 10.

It is assumed that all new residential and ICI properties will be connected to both the water and sanitary systems at OCP, and that currently un-serviced residential properties will become connected. Currently un-serviced ICI properties are assumed to remain un-serviced.

Table 10: OCP water demands

Use	Use Code	Demand (m^3/day)	Source / Unit Rates
Base Demand			
ICI New [1]	OCP-BD-ICI-N	34	2.01 L/m^2/day x 1700 m^2
ICI Existing [2]	OCP-BD-ICI	127	Assume 117% existing demand
Residential [3]	OCP-BD-RES	605	2551 ca x 237 L/ca/day
Unaccounted for Water [3,4]	OCP-BD-UFW	237	125 L/service/day x 1900 services
Total Base Demand		1004	Overall growth of +300 m^3/day (43%)
Seasonal Component (in addition to BD)			
ICI New [5]	OCP-SD-ICI-N	26	1.55 L/m^2/day x 1700 m^2
ICI Existing [2]	OCP-SD-ICI	190	Assume 117% existing demand
Residential Addl. Indoor Use [6]	OCP-SD-RES-I	133	Assume addl. 22 % occupancy

Residential Outdoor Use [3]	OCP-SD-RES-O	1808	4.78 L/m²/day on irrigable area of 50% of lot area up to maximum of 2000 m²/DU
Total Addl. Seasonal Demand		2157	Overall growth of +366 m³/day (20%)
Maximum Day Demand		3161	Overall growth of +657 m³/day (26%)

Notes:
1. New ICI BD rate of 2.01 L/m²/day selected based on existing ICI BD.
2. 117% selected to maintain an overall ICI winter BSF growth of 26%. See Table 11.
3. Unit-rate as per existing water balance. See Table 5.
4. Includes existing services plus new services, which consist of currently un-serviced residential properties and all new residential or ICI properties.
5. New ICI SD rate of 1.55 L/m²/day selected based on existing ICI SD.
6. Additional seasonal occupancy allowance of 22% as per existing water balance.

6.5. SANITARY DRY WEATHER FLOWS

Projected OCP sanitary dry weather flows were developed as follows

- Using unit rates for base sanitary loads (190 L/PE/day, 80% of water BD) and RDII (2000 L/ha/day)
- Note that the forecast assumes that the observed high BSF and GWI loads from HHSR are significantly reduced to design criteria values (460 L/room/day BSF and 2000 L/ha/day for GWI).
- HHP, Springs RV and Harrison RV Country Club full occupancy (as opposed to winter occupancy observed from flow monitoring)

Due to the large impact of the HHSR reduction, OCP flows (for ADWF) are similar to existing (i.e. the increase in loading from other areas can be offset by reductions in HHSR flows).

Table 11: OCP sanitary dry weather flows

Use	Use Code	Demand (m³/day)	Source / Unit Rates
ADWF (Winter)			
ICI New	OCP-BSF-ICI-N	27	80% of water BD
ICI Existing [1]	OCP-BSF-ICI	93	Assume 117% existing loads + HHSR
ICI Existing (no current water connection)	OCP-BSF-NW	360	HHP, Springs RV, HHMP, Harrison RV Country Club
Residential	OCP-BSF-RES	470	80% of water BD
Groundwater Infiltration	OCP-GWI	228	2,200 L/ha/day (calibrated)
HHSR BSF		157	
HHSR GWI		12	
Total ADWF (Winter)		1347	Overall growth of + m³/day (%)

Notes:
1. 117% selected to maintain an overall ICI winter BSF growth of 26%
2. HHSR loads reduced from existing observed.

7. CONCLUSIONS AND RECOMMENDATIONS

The recommended water demands for the water master plan are summarized in Table 12, and the sanitary dry weather flows recommended for the sanitary master plan are summarized in Table 13.

Table 12: Water demands summary

Use	Demand (m^3/day)	
	Existing	OCP
Base Demand		
ICI	117	162
Residential	439	605
Unaccounted for Water	147	237
Total Base Demand	704	1004
Seasonal Component (in addition to BD)		
ICI	166	216
Residential	1625	1941
Total Addl. Seasonal Demand	1791	2157
Maximum Day Demand	2494	3161

Table 13: Sanitary dry weather flows summary

Use	Demand (m^3/day)	
	Existing	OCP
ADWF (Winter)		
ICI BSF (water connected)	94	120
ICI BSF (no water connection)	175	360
HHSR BSF	410	157
Residential BSF	396	470
Groundwater Infiltration	211	227
HHSR GWI	631	12
Total ADWF (Winter)	1916	1347

WATER STREET ENGINEERING LTD. *(EGBC permit to practice # 1000830)*

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA W.N. WHITESIDE 29 Sep. 2025

Jade Sangha, EIT
Project Engineer

Neal Whiteside, MASc, PEng
Senior Municipal Engineer

REFERENCES

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ABBREVIATIONS

ADD	Average Day Demand (Water)
ADWF	Average Dry Weather Flow
BD	Base Demand (Water)
BSF	Base Sanitary Flow (Sanitary)
GWI	Ground water Infiltration (Sanitary)
HHP	Harrison Holiday Park
HHSMP	Harrison Hot Springs (Public) Mineral Pool
HHSR	Harrison Hot Springs Resort
FVRD	Fraser Valley Regional District
ICI	Industrial, Commercial, and Institutional
LWMP	Liquid Water Management Plan
MDD	Maximum Day Demand (Water)
MF	Multi-Family
RDII	Rainfall Derived Inflow and Infiltration (Sanitary)
SD	Seasonal (Outdoor) Demand
SF	Single-Family
SRVR	Springs RV Resort
UFW	Unaccounted for Water
Village	Village of Harrison Hot Springs
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

STATEMENT OF LIMITATIONS

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REVISION HISTORY

Version	Status	Date	Description of Revisions	Author
A	Draft	15 Apr 2025	For client review	JAS / NW
B	Draft	17 Jun 2025	Add OCP forecast, address comments	JAS / NW
C	Final	29 Sep 2025	Updated sanitary flows per flow monitoring	NW

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WATER STREET ENGINEERING

TECHNICAL MEMORANDUM			
Subject	Hydrant Flow Testing Results		
Project	Village of Harrison Hot Springs Water Master Plan		
To	Jace Hodgson Village of Harrison Hot Springs	**From**	Jade Sangha and Laura Christensen
Date	08 Sep 2025	**File ref**	Water Street File # 456.301
Version	0	**Status**	Final

1. INTRODUCTION

1.1. PURPOSE

The Village of Harrison Hot Springs (VHHS) has retained Water Street Engineering (Water Street) to complete a village-wide water master plan. This technical memorandum presents the results of the fire flow tests completed within the VHHS, for the purpose of calibrating the Village's water model.

1.2. BACKGROUND

The VHHS water system includes approximately 14 km of water mains. It is understood that these are primarily PVC pipe, but there are some areas of ductile iron (DI) pipe, although the locations are not fully clear. The size of water mains range from 100 mm (4") diameter to 350 mm (14") diameter. The installation year of the pipes range from 1984 to 2024, with approximately 27% of the total length installed in 1984.

2. TESTING PLAN

Hydrant testing was completed by SFE Global, with directions from Water Street and assistance from the City (for recording of information from City SCADA).

Two types of hydrant testing were completed within the Village.

1. Three system flow tests were performed, used to verify system operation.
2. Three C-factor tests were performed, used to calibrate the C-factors for the model pipes.

For each test, the pressures were monitored at static hydrant and the residual hydrant (if applicable). The flow hydrant was opened and allowed to flow for several minutes to allow pressures to stabilize. The flow from the flow hydrant was measured using a pitot tube flow meter.

For the system static tests, the pressure at the static hydrant, along with the flow rate, will be compared to modelled results to validate model operational assumptions.

For the C-factor tests, the C-factor of the pipe between the flow hydrant and static hydrant will be calculated by comparing the pressures before and after the test, along with the flow rate. For each C-factor test, two tests were completed: one with the valves closed and one without the valves closed. This resulted in a total of 6 completed C-factor tests.

Preliminary modelling was completed to identify hydrant flow test locations provided the maximum amount of information. Locations are summarized in Table 1 and fire flow test maps are shown attached showing valve closure and test hydrant locations for each test.

Other testing requirements were as follows:

- Time for work: Weekday from 09:00 to 15:00
- Flow condition: One or two 2.5" ports, with Hose Monster diffusers (2nd diffuser to be added if needed to meet desired pressure drop)
- Test duration: 5 minutes minimum or until pressures have stabilized
- Dechlorination: All chlorinated water will be neutralized upon discharge. Water to drain to existing gutter / storm drain system following dechlorination.
- Desired pressure drop: >10 psi
- Fire flow tests will be conducted as per NFPA 291. All flow rates along with static pressures and residual pressures (if applicable) will be recorded during each test.
- Reservoir levels to be recorded before, during, and after each test (from City SCADA system). The Reservoir should be in normal operation range prior to each test.

Table 1: Hydrant Testing Plan

Test No.	Location	Test Main Dia Material	Closed Valves Refer to Figures	Flow Hydrant ID	Residual Hydrant ID	Static Hydrant ID
System Test						
1	Echo Dr, east of Eagle St	150 mm PVC	n/a	FH9	n/a	FH10
2	McCombs Dr, between Alder and Emerald Ave	200 mm PVC	n/a	FH52	n/a	FH65
3	Hot Springs Rd and McPherson Dr	200 – 350 mm PVC	n/a	FH59	n/a	FH63
C Factor Test						
4	Cottonwood & Driftwood Ave, east of Eagle St	150 mm PVC	Driftwood Ave & Eagle St (1 valve)	FH17	FH16	FH19
5	Miami River Dr, north of Walnut Ave	150 mm PVC	Walnut Ave & Miami River Dr (1 valve)	FH29	FH30	FH27
6	Hot Springs Rd, between Schooner Pl and Emerald Ave	250 mm PVC	Alder Ave & Hot Springs Rd (1 valve), Hot Springs Rd adjacent to 730 McCombs Dr (1 valve), Emerald Ave & Hot Springs Rd (2 valves)	FH55	FH56	FH46
Note: Pipe materials are as indicated in previous master planning reports and/or assumed based on information provided.						

. TESTING RESULTS

All hydrant flow testing was completed on 29 Jul 2025. The hydrant flow rate was measured using a Hose Monster 2 ½" diffuser and the observed pitot pressure reading was converted to flow using the Hose Monster table. For all tests, two hydrant ports were required, and the flow from each was combined. The pressure at the static and residual hydrants were visually observed using a dial pressure gauge and recorded via a pressure sensor with data logger. The water level within the reservoir supplying the water to the Village was also determined from SCADA data during the test period to support accurate calibration of the water model. Table 2 summarizes the measured flow rates and pressures during the fire flow testing.

Table 2: Measured Fire Flow Test Results

Location	Test No.	Test Type	Hydrant Flow (L/s)	Reservoir Level (Full)	Flow Condition	Static Hydrant HGL (m)	Residual Hydrant HGL (m)
Echo Dr, east of Eagle St	1.0	System	90.3	95.1	No Flow	58.7	-
					Flow	49.2	-
					ΔHGL	9.5	-
McCombs Dr, between Alder and Emerald Ave	2.0	System	98.5	94.6	No Flow	58.4	-
					Flow	50.6	-
					ΔHGL	7.7	-
Hot Springs Rd and McPherson Dr	3.0	System	89.5	95.2	No Flow	59.4	-
					Flow	49.6	-
					ΔHGL	9.8	-
Cottonwood & Driftwood Ave, east of Eagle St	4.0	C-factor - Valves Open	88.9	93.8	No Flow	59.1	59.1
					Flow	47.5	44.6
					ΔHGL	11.6	14.4
	4.1	C-factor - Valves Closed	65.7	94.2	No Flow	59.4	59.4
					Flow	43.9	23.6
					ΔHGL	15.5	35.9
Miami River Dr, north of Walnut Ave	5.0	C-factor - Valves Open	91.2	94	No Flow	59.8	59.4
					Flow	53.4	49.2
					ΔHGL	6.3	10.2
	5.1	C-factor - Valves Closed	80.6	94.7	No Flow	59.8	59.4
					Flow	51.0	31.6
					ΔHGL	8.8	27.8
Hot Springs Rd, between Schooner Pl and Emerald Ave	6.0	C-factor - Valves Open	96.3	94.7	No Flow	59.1	57.7
					Flow	52.4	49.2
					ΔHGL	6.7	8.4
	6.1	C-factor - Valves Closed	86.5	95.3	No Flow	59.1	57.7
					Flow	52.4	47.1
					ΔHGL	6.7	10.5

. CALCULATED C FACTORS

For the three C-factor tests (Test 4, 5 and 6), Hazen-Williams C-factors were calculated for the isolated portion of main during the closed valve tests. Table 3 summarizes the calculated C-factors, which are in the range of 142-166. Note that the previous water model from the 2015 Water Master Plan used a C-factor of 130. Further model calibration with result from all the hydrant flow tests will be completed.

Table 3: Calculated C-Factors from Fire Flow Test Results

Test No.	Location	Test Main Dia Material	Installation Year	Length of Piping	Calculated C Factor [1]
4	Cottonwood & Driftwood Ave, east of Eagle St	150 mm PVC	1984	311 m	151
5	Miami River Dr, north of Walnut Ave	150 mm PVC	1984	277 - 334 m [2]	166
6	Hot Springs Rd, between Schooner Pl and Emerald Ave	250 mm PVC	1995	382 m	142

Notes:
1. C-factors were manually calculated (without the benefit of the model). Model calibration may vary calculated C-factors slightly to account for different pipe materials and looping pipes. C-factors are relative to the nominal diameters (i.e. 150 mm or 250 mm).
2. A portion of the Test 5 main is looped. Equal headloss (and hence identical C-factors) is assumed for each branch.

WATER STREET ENGINEERING LTD. *(EGBC permit to practice # 1000830)*

Jade Sangha, EIT
Junior Civil Engineer

Laura Christensen, PEng
Senior Civil Engineer

ATTACHMENTS

Fire Flow Test Key Plan

Fire Flow Test 1: Echo Dr

Fire Flow Test 2: McComb Dr

Fire Flow Test 3: McPherson Dr

Fire Flow Test 4: Cottonwood & Driftwood Ave

Fire Flow Test 5: Miami River Dr

Fire Flow Test 6: Hot Springs Rd

STATEMENT OF LIMITATIONS

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This document represents Water Street Engineering Ltd.'s best professional judgement based on the information available at the time of its submission and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with the level and skill ordinarily exercised by members of the engineering profession currently practicing under similar conditions. No warranty, express or implied, is made.

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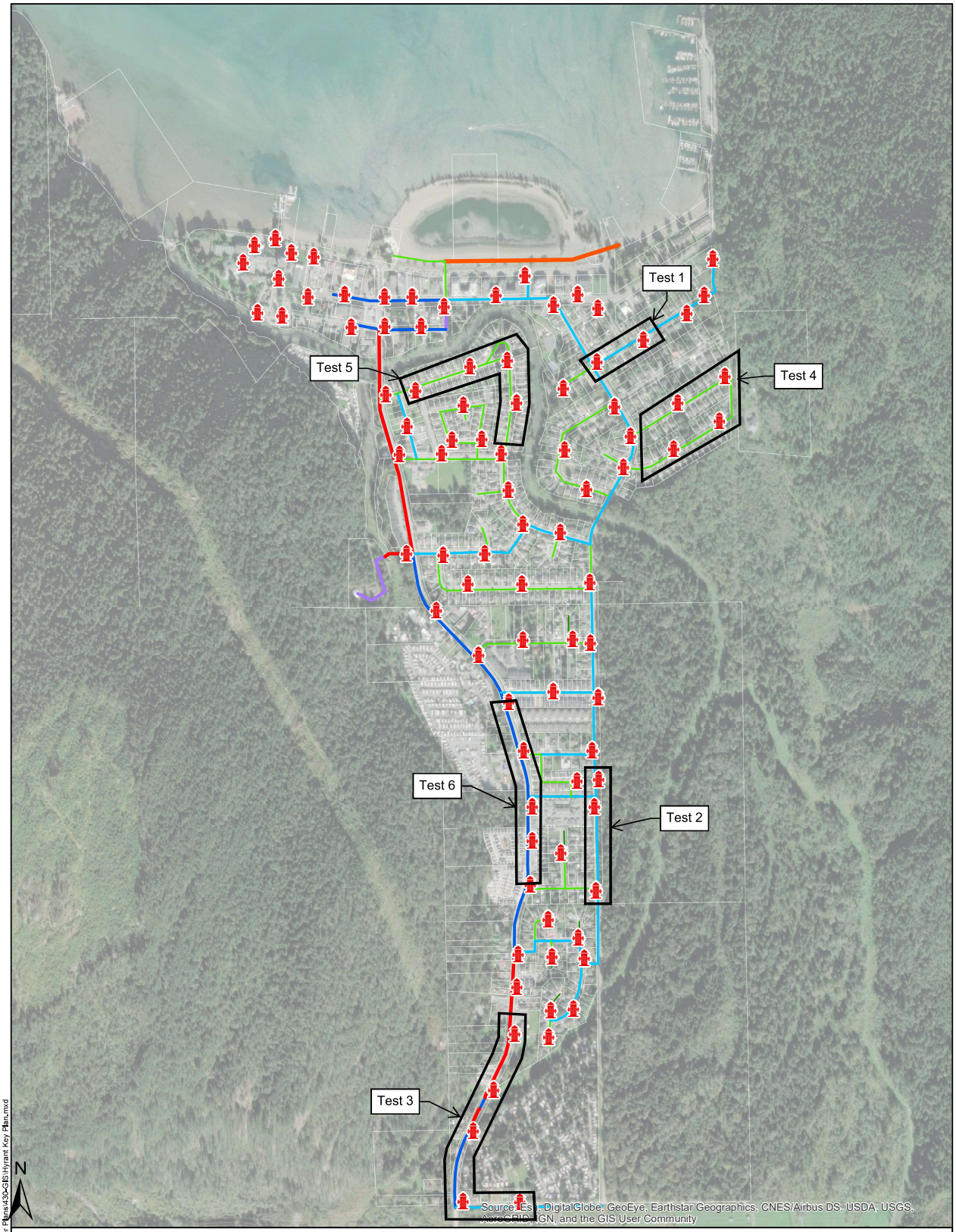
REVISION HISTORY

Version	Status	Date	Description of Revisions	Author
0	Final	08 Sep 2025	Original	JAS / LC

https://wopi.dropbox.com/wopi/files/oid_4011581495577261824/WOPIServiceId_TP_DROPBOX_PLUS/WOPIUserId_1519163251/Hydrant Testing Report.docx



Legend

Fire Hydrants

Watermain Diameter (mm)

- 50
- 100
- 150
- 200
- 250
- 300
- 350

0 100 200 300 m

1:10,000

WATER STREET ENGINEERING

EGBC Permit to Practice #1000830

Water Master Plan

PREPARED FOR

Village of Harrison Hot Springs

PROJECT NO. 456

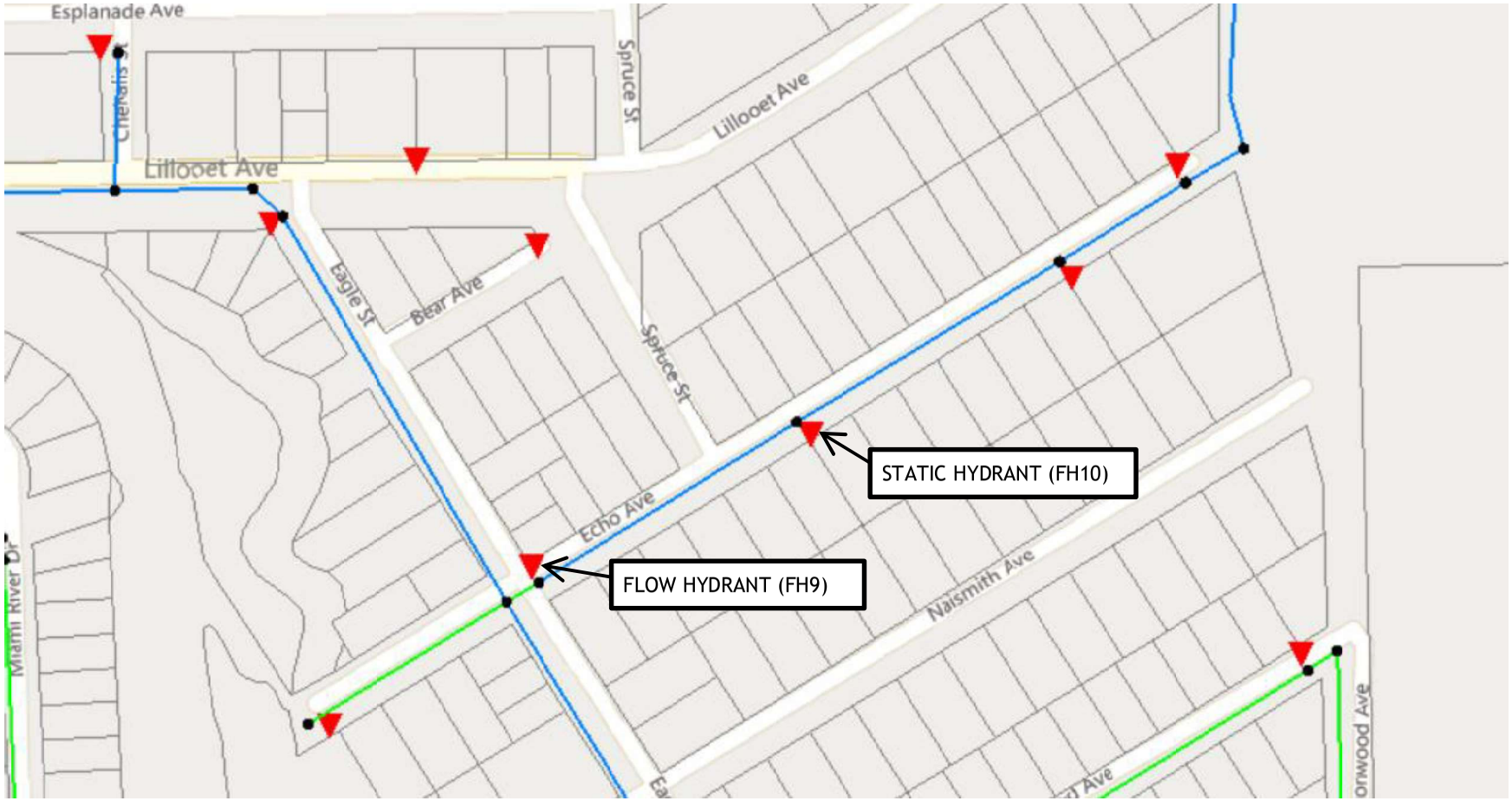
DATE 03 JUL 2025

REVISION 0

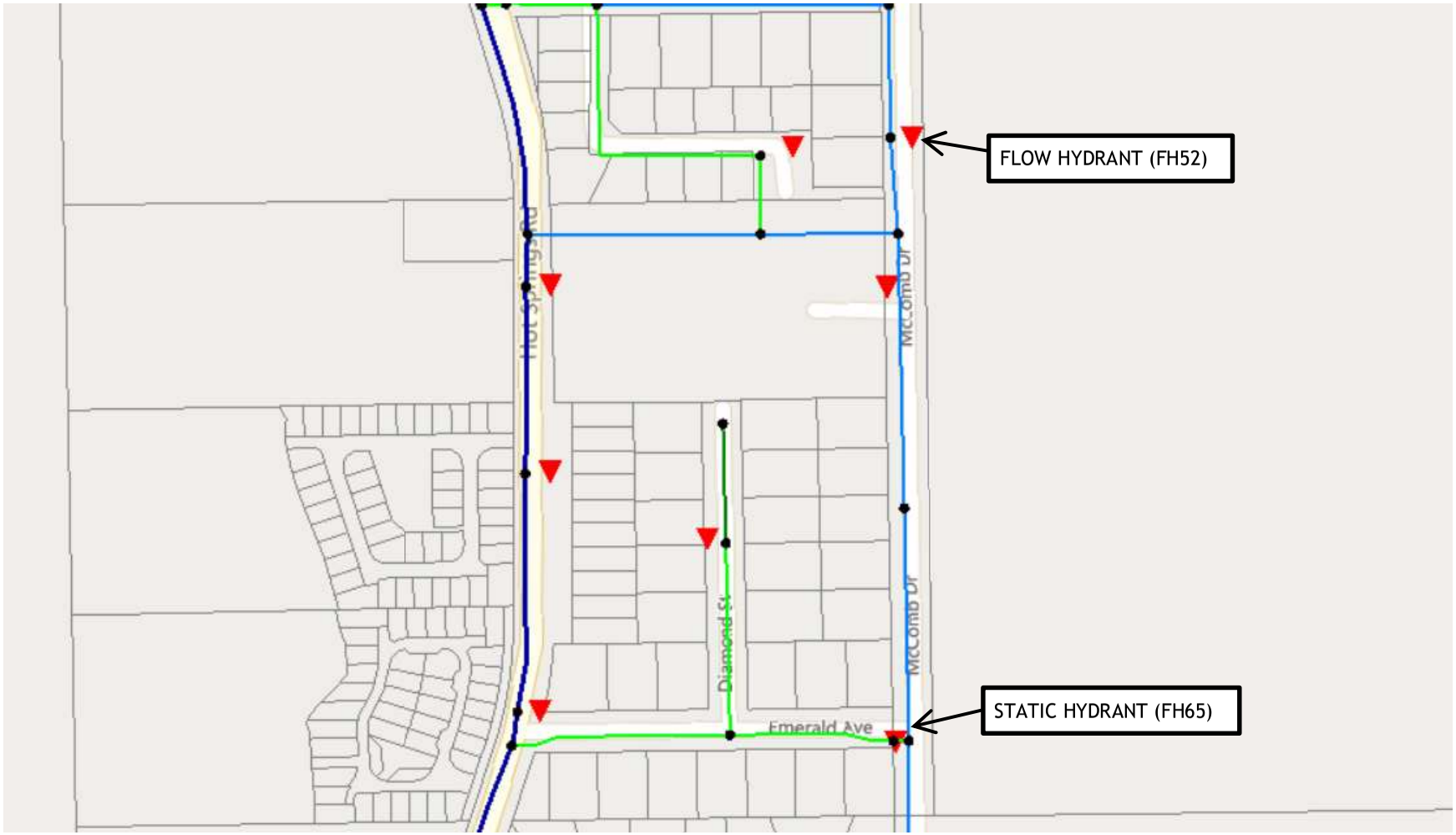
Fire Flow Test Key Plan

Document Path: D:\WSE Dropbox\001-Projects\456-Harrison Hot Springs Master Plans\430-GIS\Hyrant Key Plan.mxd

Fire Flow Test 1: Echo Dr



Fire Flow Test 2: McComb Dr



Pipe Diameter (mm)

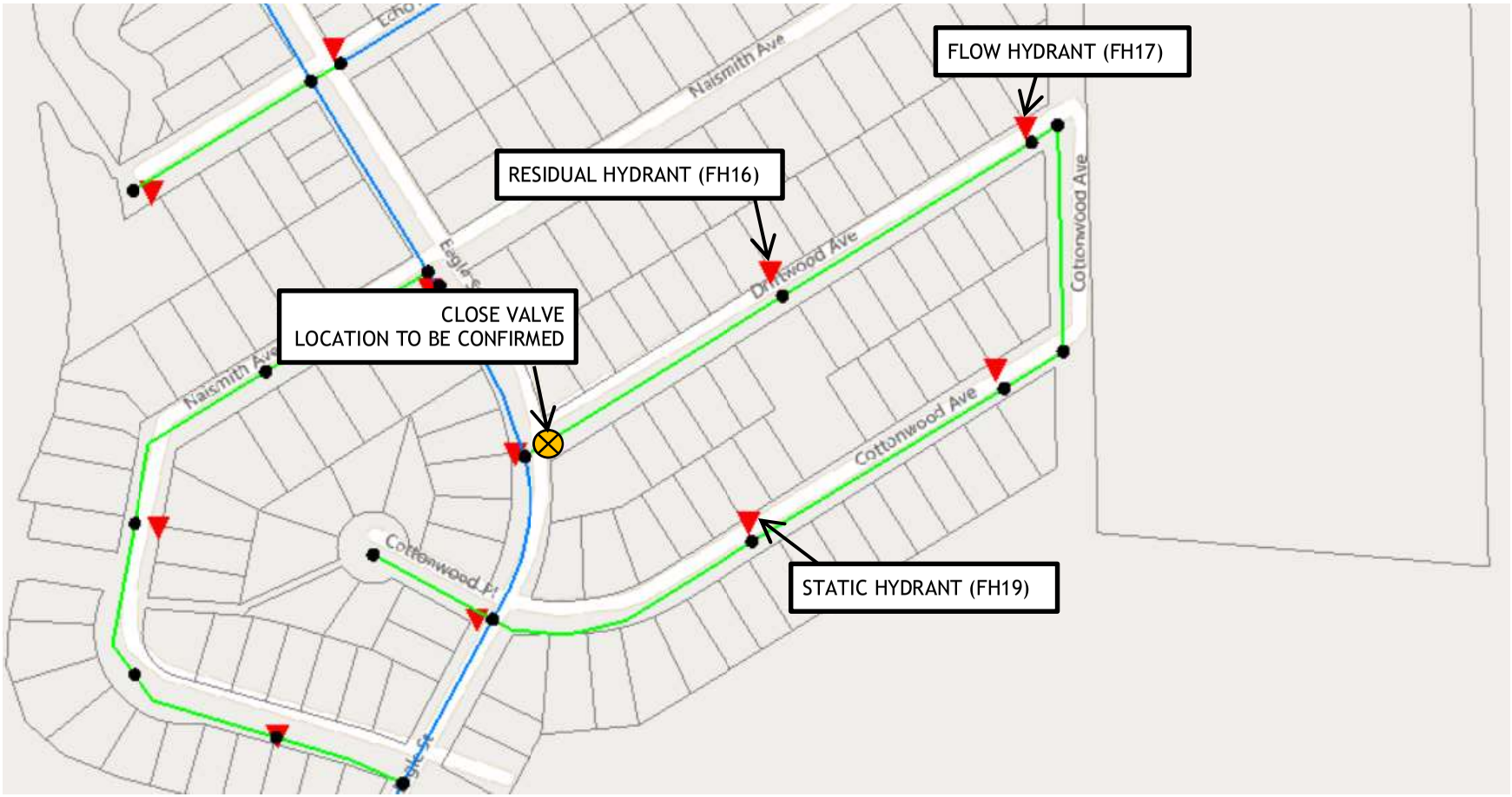
100	250
150	300
200	350

Fire Flow Test 3: McPherson Dr

Pipe Diameter (mm)

100	250
150	300
200	350

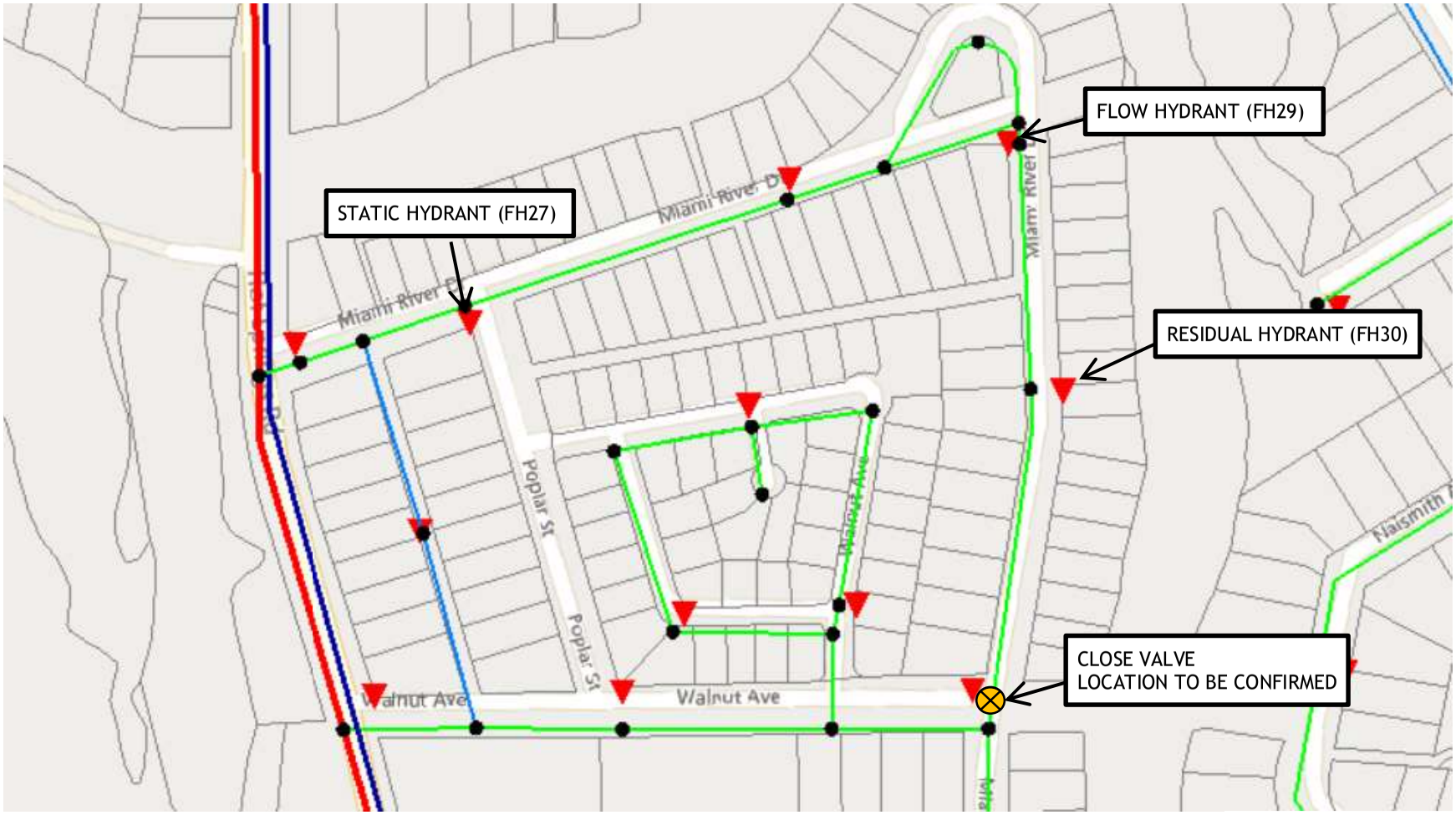
Fire Flow Test 4: Cottonwood & Driftwood Ave



Pipe Diameter (mm)

100	250
150	300
200	350

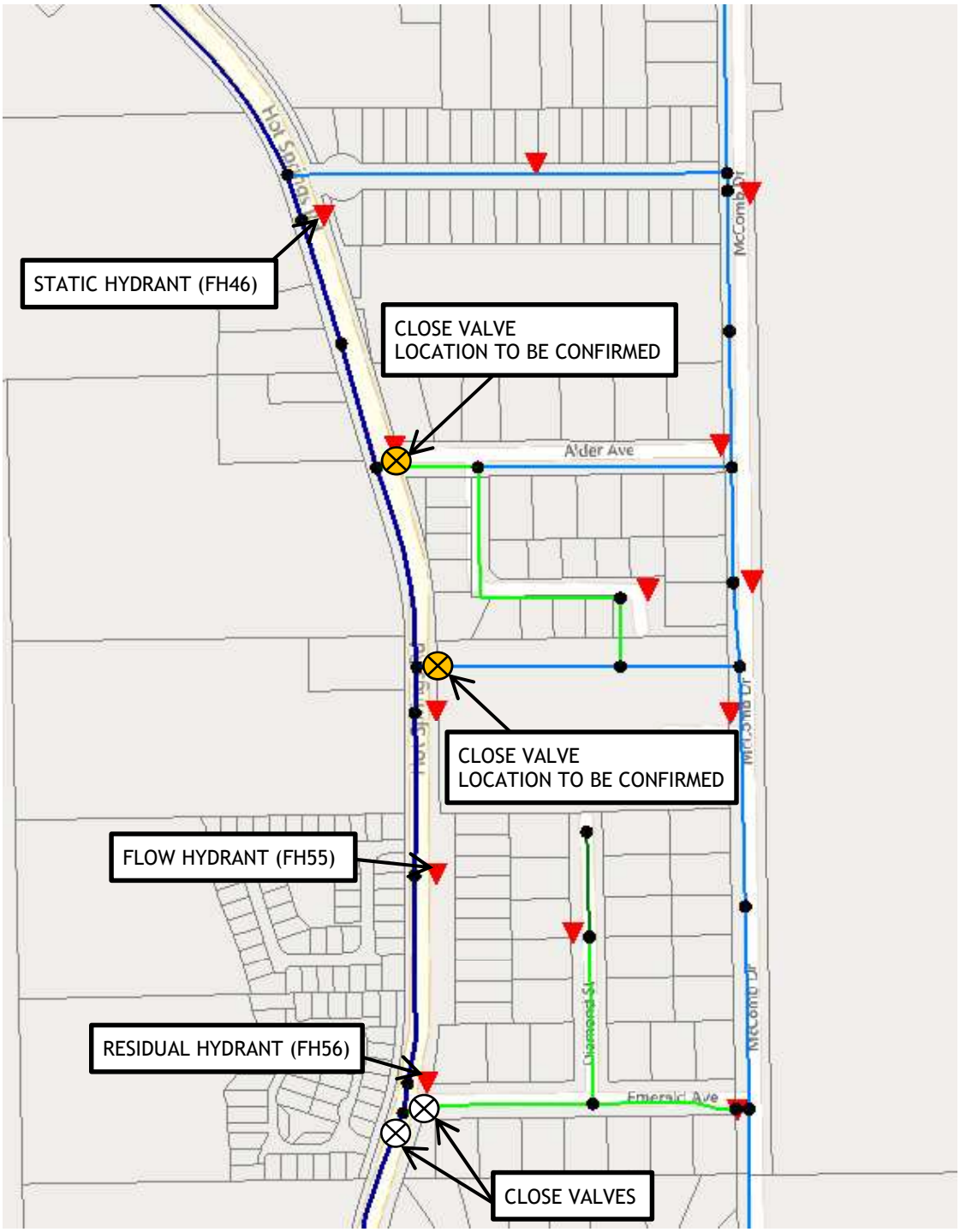
Fire Flow Test 5: Miami River Dr



Pipe Diameter (mm)

100	250
150	300
200	350

Fire Flow Test 6: Hot Springs Rd



Pipe Diameter (mm)

100	250
150	300
200	350

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 1
Cedar Ave Water Main Looping
Priority: High

Project Description: Construct 127 m of 250 mm diameter water main

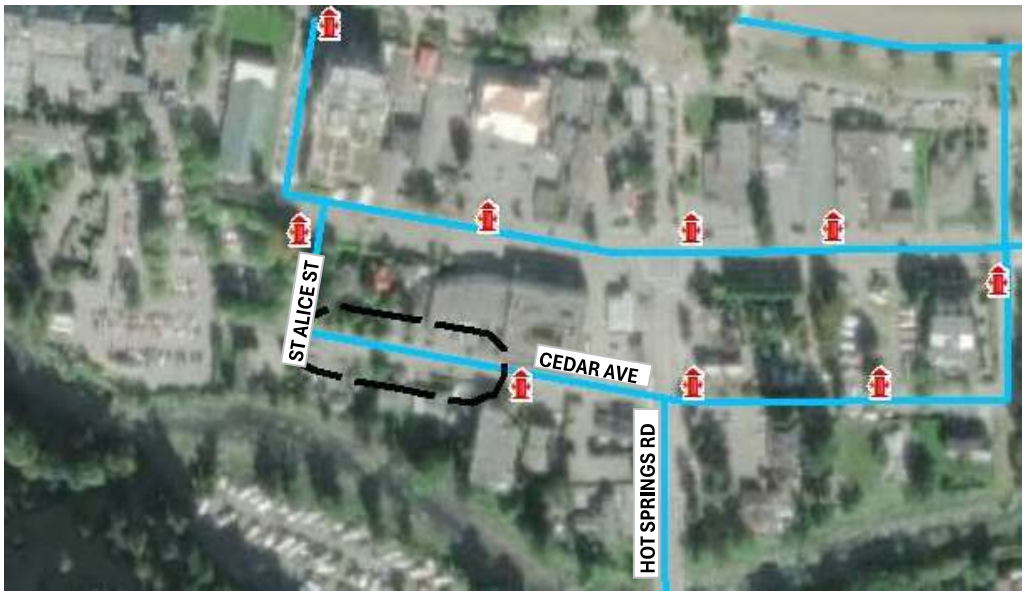
Deficiency: Unserviced properties without hydrant protection, inadequate fire flows to protect existing

Primary Justification: Fire protection

DCC Eligible: Partial

Grant Opportunities: Canada Community Building Fund, British Columbia Growing Communties Fund

Additional Notes: Planned project, to be completed in conjunction with sewer improvements on Cedar Ave (Sewer Project 4 in the Sanitary Sewer Master Plan). Increases available fire flows at hydrants on Lillooet Ave, west of Maple St, and provides servicing and hydrant protection to unserviced properties on Cedar Ave.



Assumptions: 90 m hydrant spacing for multi-family and ICI areas. New service connections and meters installed for all existing residential properties that are currently unserviced (one per lot).

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price	Estimated Amount
1	250 mm Dia. Water Main	m	110	$ 1,308.00	$ 143,880
2	Water Hydrant	ea.	1	$ 16,025.00	$ 16,025
3	Water Service and Meter	ea.	3	$ 9,585.00	$ 28,755
			Subtotal:		**$ 188,660**
	Design / Construction Management / Contingency (%)			**50%**	**$ 94,330**
			Total Estimated Cost:		**$ 282,990**
			Rounded Total Estimated Cost:		**$ 283,000**

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 2
Lillooet and Echo Ave Water Main Looping
Priority: High

Project Description: Construct 445 m of 200 mm diameter water main

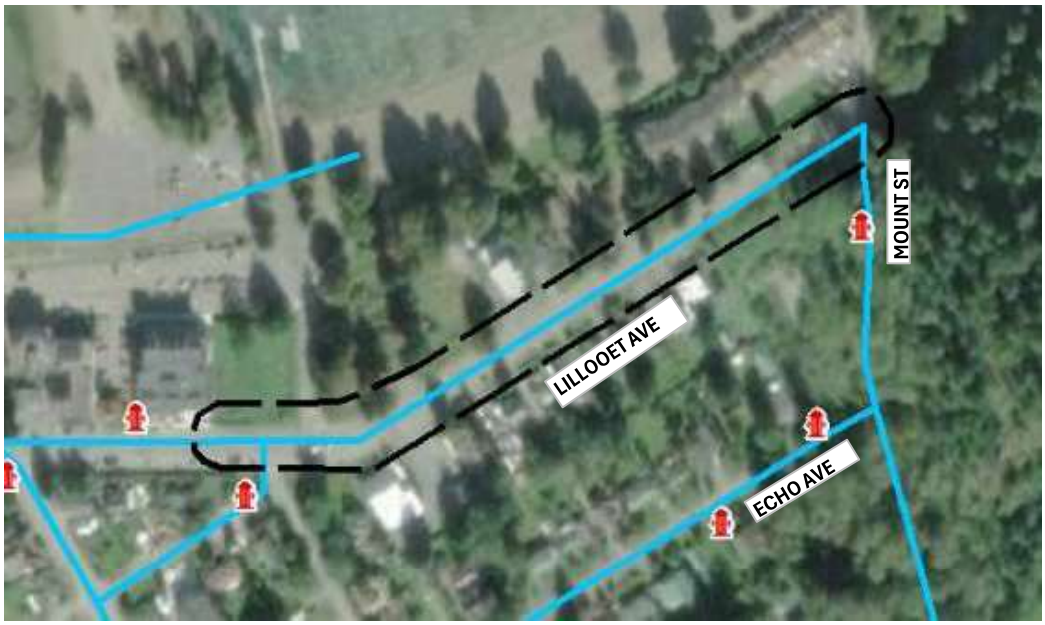
Deficiency: Unserviced properties without hydrant protection, inadequate fire flows to protect existing

Primary Justification: Fire protection

DCC Eligible: Partial

Grant Opportunities: Canada Community Building Fund, British Columbia Growing Communties Fund

Additional Notes: Planned project, to be completed during construction of multi-family development adjacent to Rendal Park. Increases available fire flows at hydrants on Lillooet Ave, east of Eagle St, and provides servicing and hydrant protection to unserviced properties on Lillooet Ave, east of Spruce St.



Assumptions: 90 m hydrant spacing for multi-family and ICI areas. New service connections and meters installed for all existing residential properties that are currently unserviced (one per lot).

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price	Estimated Amount
1	200 mm Dia. Water Main	m	397	$ 1,115.00	$ 442,655
2	Water Hydrant	ea.	4	$ 16,025.00	$ 64,100
3	Water Service and Meter	ea.	16	$ 9,585.00	$ 153,360
			Subtotal:		**$ 660,115**
	Design / Construction Management / Contingency (%)			**50%**	**$ 330,058**
			Total Estimated Cost:		**$ 990,173**
			Rounded Total Estimated Cost:		**$ 990,000**

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 3
Naismith Ave and Mount St Water Main Looping
Priority: Medium

Project Description: Construct 590 m of 150 mm diameter water main
Deficiency: Unserviced properties without hydrant protection
Primary Justification: Fire protection
DCC Eligible: No
Grant Opportunities: Canada Community Building Fund
Additional Notes: Provide servicing and hydrant protection to unserviced properties on Naismith Ave.

Assumptions: 150 m hydrant spacing for single-family areas. New service connections and meters installed for all existing residential properties that are currently unserviced (one per lot).

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price	Estimated Amount
1	150 mm Dia. Water Main	m	587	$ 960.00	$ 563,520
2	Water Hydrant	ea.	4	$ 16,025.00	$ 64,100
3	Water Service and Meter	ea.	23	$ 9,585.00	$ 220,455
			Subtotal:		**$ 848,075**
	Design / Construction Management / Contingency (%)			**50%**	**$ 424,038**
			Total Estimated Cost:		**$ 1,272,113**
			Rounded Total Estimated Cost:		**$ 1,272,000**

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 4
Water Hydrants
Priority: Medium

Project Description: Install 5 new hydrants

Deficiency: Properties with water main frontage that have insufficient hydrant protection

Primary Justification: Fire protection

DCC Eligible: No

Grant Opportunities: Canada Community Building Fund

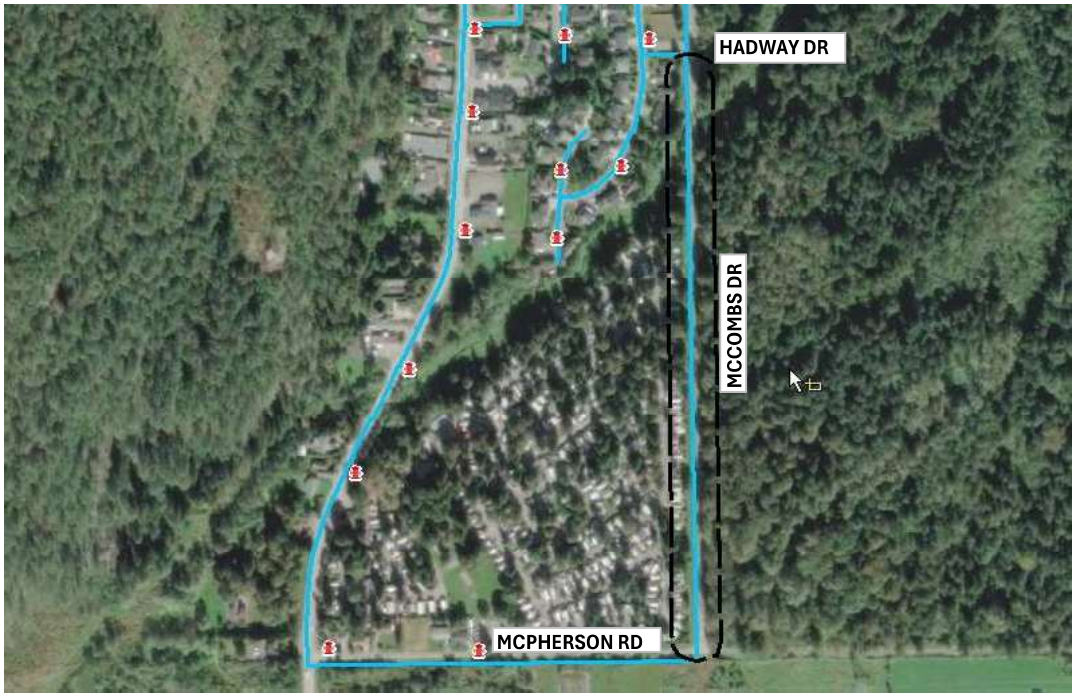
Additional Notes: Provides hydrant protection where FUS linear spacing and coverage guidelines are not met. Recommendation per the 2015 Water Master Plan.

Assumptions: n/a

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price	Estimated Amount
1	Water Hydrant	ea.	5	$ 16,025.00	$ 80,125
			Subtotal:		**$ 80,125**
	Design / Construction Management / Contingency (%)			**50%**	**$ 40,063**
			Total Estimated Cost:		**$ 120,188**
			Rounded Total Estimated Cost:		**$ 120,000**

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 5
McCombs Dr Water Main Looping
Priority: Medium

Project Description: Construct 650 m of 200 mm diameter water main
Deficiency: Water quality concerns due to dead-end
Primary Justification: Water quality
DCC Eligible: No
Grant Opportunities: Canada Community Building Fund
Additional Notes: Planned project. Addresses potential water quality concern on McPherson Rd.



Assumptions: 90 m hydrant spacing for multi-family and ICI areas. New service connections and meters installed for all existing residential properties that are currently unserviced (one per lot).

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price	Estimated Amount
1	200 mm Dia. Water Main	m	653	$ 1,115.00	$ 728,095
2	Water Hydrant	ea.	7	$ 16,025.00	$ 112,175
				Subtotal:	**$ 840,270**
				Design / Construction Management / Contingency (%) **50%**	**$ 420,135**
				Total Estimated Cost:	**$ 1,260,405**
				Rounded Total Estimated Cost:	**$ 1,260,000**

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 6
Universal Metering Study
Priority: Medium

Project Description: Complete a study to assess costs/benefits of universal metering
Deficiency: Unmetered properties
Primary Justification: Demand management
DCC Eligible: No
Grant Opportunities: British Columbia Infrastructure Planning Grant Program, Canada Community Building Fund
Additional Notes: Assess the costs and benefits of implementing universal metering.

Assumptions: Allowance only

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price		Estimated Amount
1	Project Allowance	ea.	n/a	n/a	$	30,000
				Subtotal:	**$**	**30,000**
				Contingency (%)	**20% $**	**6,000**
				Total Estimated Cost:	**$**	**36,000**
				Rounded Total Estimated Cost:	**$**	**36,000**

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 7
GIS System Data Update
Priority: Medium

Project Description: Update data in the Village's GIS system

Deficiency: Inaccuracies and/or missing data in Village GIS system

Primary Justification: Operational

DCC Eligible: No

Grant Opportunities: Union of BC Municipalities Asset Management Planning Program, Canada Community Building Fund

Additional Notes: Inaccuracies and/or missing data have been noted in the Village's GIS System. Collection and review of record drawings, and surverying where required, is recommended.

Assumptions: Allowance only

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price		Estimated Amount
1	Project Allowance	ea.	n/a	n/a	$	20,000
				Subtotal:	**$**	**20,000**
				Contingency (%)	**20% $**	**4,000**
				Total Estimated Cost:	**$**	**24,000**
				Rounded Total Estimated Cost:	**$**	**24,000**

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 8
Lillooet and Bear Ave Water Main Looping
Priority: Low

Project Description: Construct 38 m of 200 mm diameter water main

Deficiency: Inadequate fire flows to protect future (OCP) developments

Primary Justification: Fire protection

DCC Eligible: Yes

Grant Opportunities: n/a

Additional Notes: Contingent on future development. Increases available fire flows at the hydrant on the eastern end of Bear Ave.

Assumptions: 90 m hydrant spacing for multi-family and ICI areas.

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price	Estimated Amount
1	200 mm Dia. Water Main	m	31	$ 1,115.00	$ 34,565
				Subtotal:	**$ 34,565**
			Design / Construction Management / Contingency (%)	**50%**	**$ 17,283**
				Total Estimated Cost:	**$ 51,848**
				Rounded Total Estimated Cost:	**$ 52,000**

Village of Harrison Hot Springs Water Master Plan
December 2025 Cost Estimate
Project Number 9
Echo Ave and Eagle St Water Main Upgrade
Priority: Low

Project Description: Upgrade 20 m of the 150 mm diameter water main to 200 mm
Deficiency: Inadequate fire flows to protect future (OCP) developments
Primary Justification: Fire protection
DCC Eligible: Yes
Grant Opportunities: n/a
Additional Notes: Contingent on future development. Increases available fire flows at the hydrant at Echo Ave and Eagle St.

Assumptions: n/a

Item No.	Description	Unit	Estimated Quantity	Estimated Unit Price	Estimated Amount
1	200 mm Dia. Water Main	m	19	$ 1,115.00	$ 21,185
			Subtotal:		**$ 21,185**
			Design / Construction Management / Contingency (%)	**50%**	**$ 10,593**
			Total Estimated Cost:		**$ 31,778**
			Rounded Total Estimated Cost:		**$ 32,000**