Binnie File No. 23-0862-05

PRELIMINARY SERVICING REPORT

Proposed Mixed Use Development
7451 & 7453 Frontier Street, Pemberton, BC

November 17, 2023

Reviewed by:
Tyler Ezzy, P.Eng.
Project Manager

Prepared by:
Jason Morden, E.I.T.
Project Engineer

R.F. BINNIE & ASSOCIATES LTD.
201 - 40147 Glenalder Place
Squamish, BC V8B 0G2
Main: 604-892-8222

ENGINEERS & GEOSCIENTISTS BRITISH COLUMBIA | OQM CERTIFIED

BINNIE

TABLE OF CONTENTS

APPENDICES

1 INTRODUCTION

This report has been created to fulfill the Village of Pemberton's requirements for a conceptual servicing report, water system plan, sanitary catchment plan, and stormwater management plan to support the rezoning of 7451 & 7453 Frontier Street, Pemberton BC. Included herein is a description of the existing surrounding infrastructure as well as the servicing requirements for a commercial residential development within the subject lots.

The following documents were reviewed and considered in the preparation of this report:

- Village of Pemberton Subdivision and Development Control Bylaw No. 677, 2011
- Master Municipal Construction Document (MMCD) Design Guideline Manual, 2022
- Doug Bush Survey, DWG 21202D_Metric, 2021-08-13
- Stark Architecture, 7451 & 7453 Frontier Street – Rezoning Application Drawing Set, 2023-10-11
- BC1Call Record Drawings, Requested 2023-11-07
- Flood Construction Level memo, Kontur Geotechnical Consultants, May 10, 2023

2 EXISTING CONDITIONS

The site currently exists as two separate lots zoned as R-1 (Residential) which combine to equal 0.16 ha in area. 7451 Frontier Street consists mostly of landscaped areas and 7453 Frontier Street hosts a house with a gravel driveway. The site fronts Camus Street to the south, Frontier Street to the east and Menzel Lane to the west. The existing grade is relatively flat, sloping northwards at approximately 210m elevation.

2.1 Existing Water System

150mm diameter PVC watermains supply water under both Camus Street and Frontier Street. Additionally, an asbestos cement watermain lies under Menzel Lane with an unknown diameter. Various record drawings suggest conflicting diameters for the Menzel Lane watermain, varying from 50mm in diameter to 200mm in diameter. The nearest fire hydrant is located on the north side of Camus Street outside the southwest corner of 7451 Frontier Street. Refer to Appendix F for a plan that shows the existing water system surrounding the site.

2.2 Existing Storm System

A 300mm diameter concrete storm sewer exists under Menzel Lane to the west of the proposed development site. This existing storm sewer outlets to a ditch north of the site within Menzel Lane. There is an existing AE 24x54 precast concrete oil interceptor upstream of the headwall outlet to the ditch. Per available record drawings, 100mm diameter storm services exist for both 7451 & 7453 Frontier Street to the existing 300mm diameter storm sewer within Menzel Lane.

A storm sewer drains east within Camus Street, collecting the drainage of the right-of-way, but no details were available at the time of this report. No stormwater features are apparent within the Frontier Street frontage. Refer to Appendix D for a plan that displays existing stormwater features.

2.3 Existing Sanitary System

A 300mm diameter sanitary sewer main exists under Camus Street which flows east towards Frontier Street. Based on available record drawing information, the material of this existing sanitary sewer main is unknown. A 200mm diameter sanitary sewer exists within Menzel Lane that flows north to an existing lift station at Walnut Street, where sewage is pumped back up Menzel Lane via a 75mm diameter force main to the Camus Street gravity sewer.

2.4 Existing BCHydro Utilities

Overhead powerlines exist on the south side of Camus Street and the west side of Menzel Lane bordering the site. Underground primary lines exist on the north side of Camus Street bordering the site. These underground ducts are concrete encased and may limit the servicing connection locations for the proposed development site.

3 PROPOSED DEVELOPMENT

7451 & 7453 Frontier Street are proposed to be consolidated and rezoned from Residential to Comprehensive Development to support a multi-story mixed use commercial and residential building. Details of the proposed development can be found on the Stark Architecture plans submitted for rezoning, dated October 11, 2023. The first floor at 211.07m elevation is proposed to contain primarily commercial units, while the three floors located above are residential. An underground parkade is also included. The proposed development includes 5 commercial units and 33 residential units that include 28 one-bedroom units and 5 two-bedroom units.

4 STORMWATER MANAGEMENT

It's feasible to service the proposed development per the Village of Pemberton bylaw requirements and standard engineering design guidelines. Off-site infrastructure improvements will need to be confirmed during design.

4.1 Storm Service Connection

Considering that the designers of the Menzel Lane storm sewer specified 100mm diameter service laterals to both lots, there is likely capacity in the main for future development discharge if release rate is controlled. Neither service is suitable for this proposed land use as the capacity is likely not sufficient to convey required flows, and because the bylaw requires a minimum diameter of 150mm for commercial/industrial land uses. It's feasible to connect a building service to this existing 300mm diameter concrete storm sewer to convey the proposed developments rainfall runoff. Capacity and condition of the pipe will need to be confirmed during design.

Any services off the existing Menzel lane storm sewer will need special design consideration to the shallow depth as the existing sewer and services have less than 600mmm cover. As well, special consideration will need to be given to ensure the Menzel Lane Sewer's HGL is lower than the service invert during rainfall events. Provided the above is satisfactory, it's feasible to provide a service connection to the property line at an elevation of approximately 209.2m. Should this not be acceptable, a connection towards the sewer under Camus Street is feasible.

4.2 Stormwater Treatment

Water quality improvement devices should not be required for the development per the Village of Pemberton Subdivision and Development Control Bylaw and the Master Municipal Contract Document (MMCD) Design Criteria. Additionally, readers should note that record drawings suggest an existing precast concrete oil interceptor within Menzel Lane downstream of the development's likely discharge location. The capacity of this existing oil interceptor should be confirmed during design.

4.3 Stormwater Detention

Changing the land use will result in an increase in impermeable area and an increase in stormwater runoff if proper civil design and construction is not completed. The Village of Pemberton requirement is to limit post-development peak runoff rates to the 5-year return period pre-development peak runoff rates. This is typically completed through restricting flow through an orifice at the downstream end of the on-site system, and detaining as much rainfall as required to limit flow to the pre-determined level.

To quantify the design peak release rate, the rational method can be used to estimate pre-development flows.

$$Q = RAIN;$$

$$where\ R = Runoff\ coefficient, A = Catchment\ area\ in\ Hectares\ (ha),$$
$$I = \ rainfall\ intensity\ (mm/hr), and\ N = 1/360$$

Following the Village of Pemberton Subdivision and Development Control Bylaw and Master Municipal Contract Document (MMCD) Design Criteria, inputs for the pre-development estimate can be assumed to equal:

- R(pre) = 0.32 (MMCD suburban residential with 0.9 adjustment factor)
- Tc(pre) = 10 minutes (MMCD single family lot)
- I(5-year return period, Tc = 10 minutes) = 26.77mm/hr

  Rainfall intensity interpolated from Village of Pemberton DWG VOP-S16 – Rainfall Intensity Data (Village of Pemberton Subdivision and Development Control Bylaw No. 677, 2011)

Using the above parameters, the five-year return period pre-development runoff can be estimated as:

$$Q_{5-pre} = 0.32 * 0.16hectare * 26.77mm/hr * \frac{1}{360} = 0.004m^3/s$$

Similar to the pre-development calculation, the following parameters can be used to estimate the 10-year post-development peak site discharge:

- R(post) = 0.80 (MMCD commercial)
- Tc(post) = 5 minutes (MMCD commercial development)
- I(10-year return period, Tc = 5 minutes) = 44.49mm/hr

The ten-year return period post-development peak uncontrolled runoff can then be estimated as:

$$Q_{10-post} = 0.80 * 0.16hectare * 44.49mm/hr * \frac{1}{360} = 0.016m^3/s$$

Using these values and assumptions, the detention volume required to limit flows to the pre-development rates, can then be estimated using the modified rational method. The Village of Pemberton Bylaw is unclear on which return period storm events are required to be limited to 5-year pre-development rates, so it is assumed that the standard practice of controlling up to 10-year return period post-development flows will be required.

$$V_{10-post\ to\ 5-pre} = 5.6m^3$$

This estimate assumes that no infiltration will take place on site, as the site layout will likely not allow infiltration.

5 SANITARY SERVICING

It is feasible to convey the sanitary sewage away from the development via a gravity system into the existing 200mm diameter sanitary sewer in operation that flows north on Menzel Lane. This is possible while fulfilling the VoP's Subdivision and Development Control Bylaw requirements including a minimum pipe diameter of 150mm and a minimum slope of 1%. Based on available record drawing information, the invert at the property line for the 150mm diameter sanitary service may be approximately 208.8m. Design consideration needs to be given to the storm sewer and watermain crossings. Refer to Appendix E for a conceptual servicing overview.

The existing 200mm diameter sanitary sewer flows north to a sanitary lift station at Walnut Street which then pumps back to Camus. The capacity of the 200mm diameter sanitary sewer, lift station, and downstream infrastructure capacity shall be confirmed during design.

Should the above servicing option not work due to crossings, an alternative deeper servicing option is feasible directly into the main across Camus street. This option may be challenging provided the watermain, hydro ducts, and unconfirmed storm sewer.

5.1 Design Flows

Residential unit counts and commercial use areas were taken from architectural drawings for rezoning application by Stark Architecture dated October 11, 2023 to estimate sanitary flows. Assuming a Population Equivalent (PE) of 2 per bedroom, the PE can be estimated to equal 76 for the 38 bedrooms. The gross floor area of the commercial area is assumed to equal 945m2 or 0.0945ha, per Stark drawings.

Section 4.2 of the Village of Pemberton Subdivision and Development Control Bylaw and the Master Municipal Construction Documents (MMCD) methodology was considered as the basis for the initial loading estimate. The following was assumed:

- For residential units, an Average Daily Flow (ADF) of 410L/capita/day may be assumed,
- For commercial units, an Average Daily Flow (ADF) of 22,500L/hectare/day may be assumed,
- An Infiltration rate (I) of 0.17L/s/ha may be assumed,
- A commercial Population Equivalent of 75 people/hectare.

Considering the above assumptions:

- The average daily flow for the residential units can be estimated as
  - $ADF = \frac{410L}{capita*day} * 76capita * \frac{1day}{24Hr} * \frac{1Hr}{3600s} = 0.36L/s;$
- The average daily flow for the 1st floor commercial units can be estimated as
  - $ADF = \frac{22{,}500L}{hectare*day} * 0.0945hectare * \frac{1day}{24Hr} * \frac{1Hr}{3600s} = 0.02L/s;$
- The peaking factor can be estimated as:
  - $PF = 1 + \frac{14}{4+(\frac{84}{1000})^{0.5}} = 4.26;$
- The Peak Sewage Flow can be estimated as
  - $Peak\ Sewage\ Flow = \sum \text{ADF x PF} = 1.53\text{L/s};$
- The infiltration rate can be estimated using the total site area as
  - $I = \frac{0.17L}{s*day} * 0.1619hectare = 0.03L/s;$

- And the design flow for the development can be estimated to equal
    - $Peak\ Sewage\ Flow + I = 1.56 L/s$

6 WATER SERVICING

Tying into the Village of Pemberton's existing 150mm diameter PVC watermain within Camus Street or Frontier Street is feasible. Servicing the site off Frontier may be more favorable as it may be easier to isolate while utilizing existing valves.

The existing hydrant on the north side of Camus Street will likely need to be relocated to suit the future frontage design of the proposed development. As well, a new valve on the existing 150mm diameter Camus Street water main at the intersection of Menzel Lane should be considered during detailed design to isolate the Camus Street watermain from the Menzel Lane AC watermain.

6.1 Design Criteria for Water Servicing Demand

Section 3 of the Village of Pemberton Subdivision and Development Control Bylaw and the Master Municipal Construction Document (MMCD) Design Guideline Manual were considered as the basis for the initial water servicing assessment.

Inputs as per the Bylaw requirements:

- Average Daily Demand (ADD) = 455 L/capita/day
- Maximum Daily Demand (MDD) = 910 L/capita/day
- Peak Hourly Demand (PHD) = 1820 L/capita/day
- For commercial units, an Equivalent Population (EP) of 90 people per hectare may be assumed as per MMCD Design Guidelines,

Additional inputs for calculation of water servicing demand:

- For residential units, an Equivalent Population (EP) of 76 may be assumed for the proposed 38 Bedrooms (EP of 2/BR)
- Commercial area for design flow calculations assumed to be 0.0945ha, based on gross floor area for level one.

6.2 Calculated Domestic and Commercial Demand

Based on the design criteria, the water system demand for the proposed mixed-use commercial and residential development can be estimated as:

- ADD = 0.45 L/s
- MDD = 0.90 L/s

- PHD = 1.79 L/s

6.3 Calculated Fire Flow

Fire flow demand of 250 L/s is estimated using the Fire Underwriters Society (FUS) method. Refer to the FUS fire flow estimate is included in Appendix C of this report for assumptions and calculations.

Maximum watermain velocities during fire flow events should be reviewed with the water system model during design. It is likely that off-site watermain upgrades will be required considering that a 250L/s flow would cause velocities in the existing 150mm diameter watermain to exceed the maximum 3.5L/s requirement during fire flow events as calculated using the FUS method.

Readers should note that the Village of Pemberton Subdivision and Development Control Bylaw states that "the minimum allowable design velocity under fire flow conditions should be 3.5m/s". This statement should be interpreted as being erroneous, and that 3.5m/s is that maximum allowable design velocity under fire flow conditions.

6.4 Required Water Pressure

The required water pressure at the site should be per bylaw requirements, MMCD guidelines, and good engineering judgement. The VoP requirements are copied below for reader convenience.

VoP Bylaw Table 3.2 – Design Pressures

Minimum pressure at peak demand	300 kPa (44 psi)
Maximum allowable pressure	850 kPa* (123 psi)
Minimum pressure for Fire Flow plus Max Day Demand	150 kPa (22 psi)

6.5 Proposed Development Watermain Tie-In Capacity

It's feasible for the water service to tie directly into the 150mm diameter watermain on Camus Street. An analysis of the existing capacity of the water network is not included in this report. The existing system's pressures and available flow should be confirmed prior to design.

7 CLOSURE

This report has been prepared to provide a conceptual servicing strategy to support the rezoning application, as required by the Village of Pemberton staff. Generally, this site is serviceable, and may be serviced off the existing sanitary sewer and storm sewer in Menzel Lane, and off the existing watermain under Camus Street or frontier street. Further analysis of the system is required to determine the existing system's capacity and possible required upgrades. As well, further civil engineering design work is required to complete preliminary and detailed design.

Should additional information be required, please contact the undersigned.

Prepared by:

[redacted]

Jason Morden, E.I.T.
Project Engineer

Reviewed by:

[redacted]

ler Ezzy, P.Eng.
Project Manager

APPENDIX A

EXISTING SATELLITE IMAGERY

Figure 1 – Satellite Image, Village of Pemberton GIS 2021

BINNIE

APPENDIX B

EXISTING VILLAGE OF PEMBERTON GIS UTILITY PLAN

BINNIE

Figure 2 - Existing utilities, Village of Pemberton GIS 2021

APPENDIX C

FUS FIRE FLOW ESTIMATE

BINNIE
Your Challenges. Our Solutions. Build with Binnie.

Preliminary FUS Fire Flow Estimate

FILE NO: 23-0862
DATE: November 14, 2023
LOCATION: 7451 & 7453 Frontier Street, Pemberton
CALC. BY: BC

A) TYPES OF CONSTRUCTION: Type V Wood Frame Construction

B) AVERAGE FLOOR AREA: 932 **m²**

C) NO. OF STORIES 4

D) FIRE FLOW FORMULA: f = 220*c*a^0.5

a = Total floor area (if needed) **a =** 3,729 **m²**

The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

c = Coefficient related to the type of construction **c =** 1.5

= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).

f = **20,000** **L/min**

E) OCCUPANCY:

Non combustible	-25%
Limited combustible	-15%
Combustible	No charge
Free Burning	15%
Rapid Burning	25%

ADD OR SUBTRACT (±) -15 **% of D** **17,000** **L/min**

F) AUTOMATIC SPRINKLERS (yes/no): yes

Complete automatic sprinkler protection= -50%
Complete automatic sprinkler protection, and fire resistive or non-combustible -75%

SUBTRACT (-) 50 **% of E** **-8,500** **L/min**

G) EXPOSURES:

0	to 3	25% Max	
3.1	to 10	20% Max	
10.1	to 20	15% Max	
20.1	to 30	10% Max	
30.1	to 45	5% Max	

DISTANCE:			**ADD**	
1. South	24	metres	8	%
2. East		metres		%
3. West	20	metres	15	%
4. North	4	metres	16	%
		TOTAL	39	**% of E**

H) UNROUNDED FIRE FLOW REQUIREMENT **15,130** **L/Min** **(E-F+G)**

ROUNDED FIRE FLOW REQUIRED **15,000** **L/min** (nearest 1,000)
250 **L/sec**

Notes:
Calculations based on areas from architectural drawings provided Oct 24, 2023
Building assumed to be construction type V (wood frame construction)
Assume limited combustible contents based on residential occupancy
Assume that water supply is standard and fully supervised per BCBC

APPENDIX D

CONCEPTUAL STORMWATER MANAGEMENT PLAN

BINNIE

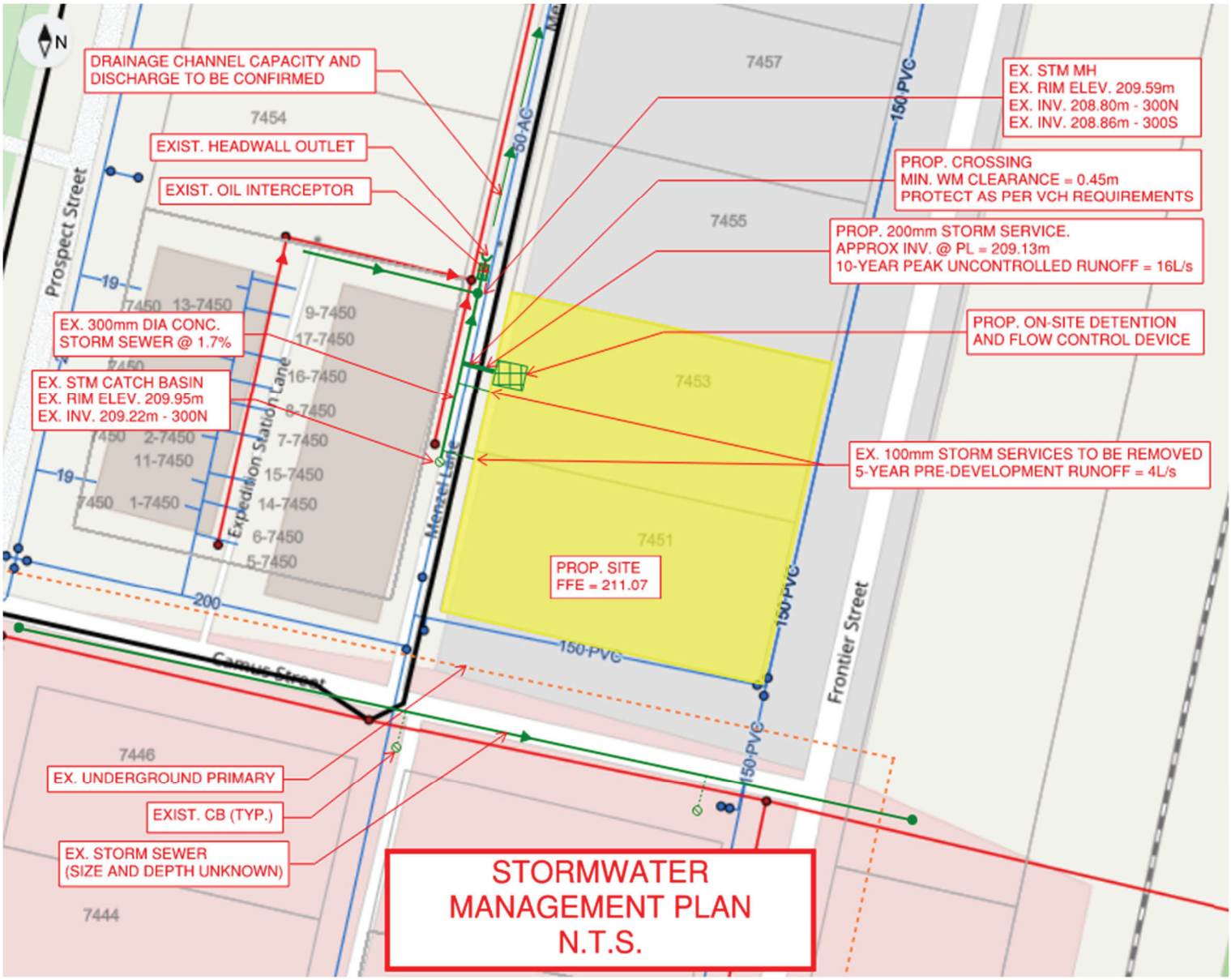

Figure 3 – Conceptual Stormwater Management Plan

APPENDIX E

CONCEPTUAL SANITARY CATCHMENT PLAN

BINNIE

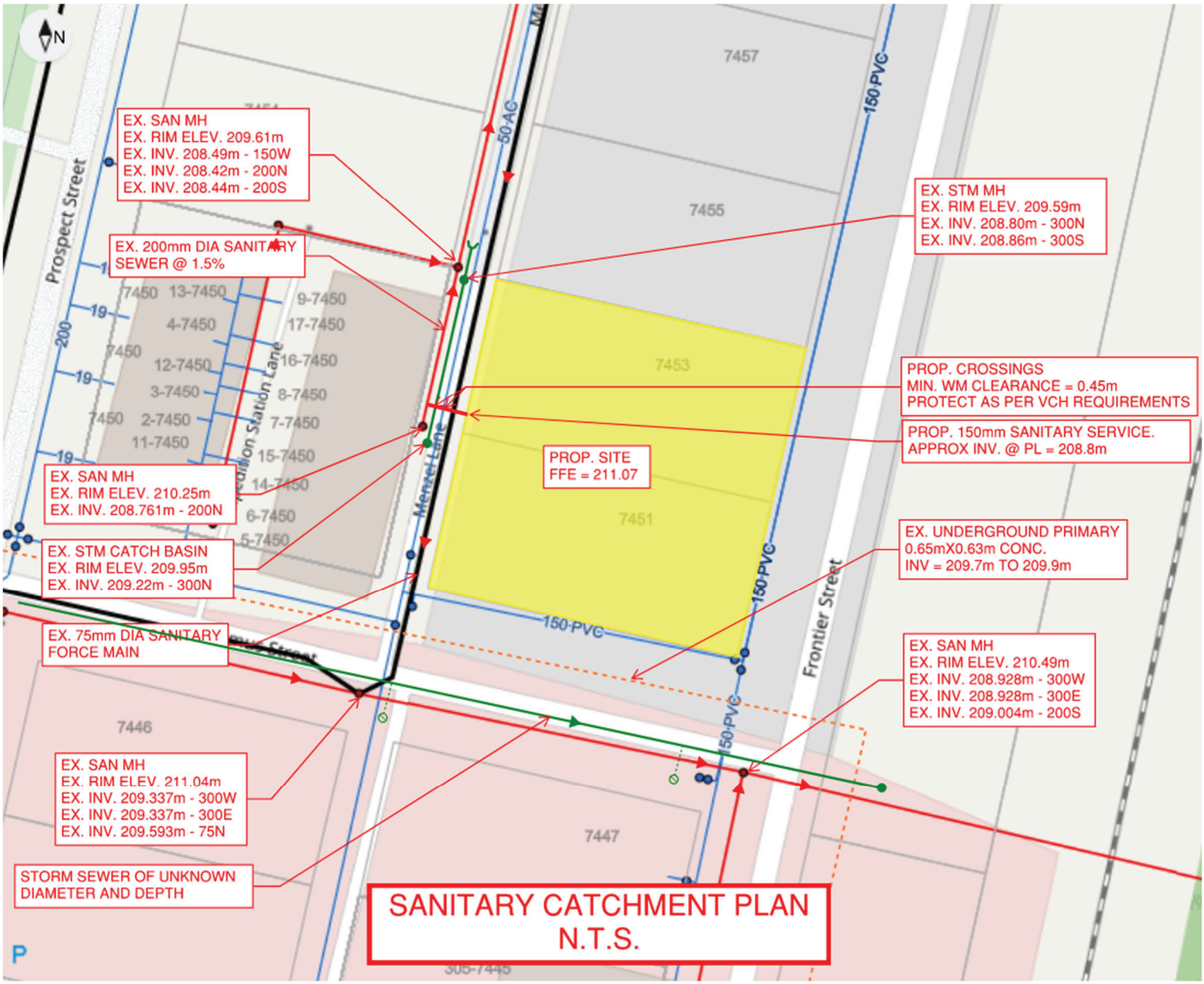

Figure 4 – Conceptual Sanitary Catchment Plan

BINNIE

APPENDIX F

CONCEPTUAL WATER SERVICING PLAN

BINNIE

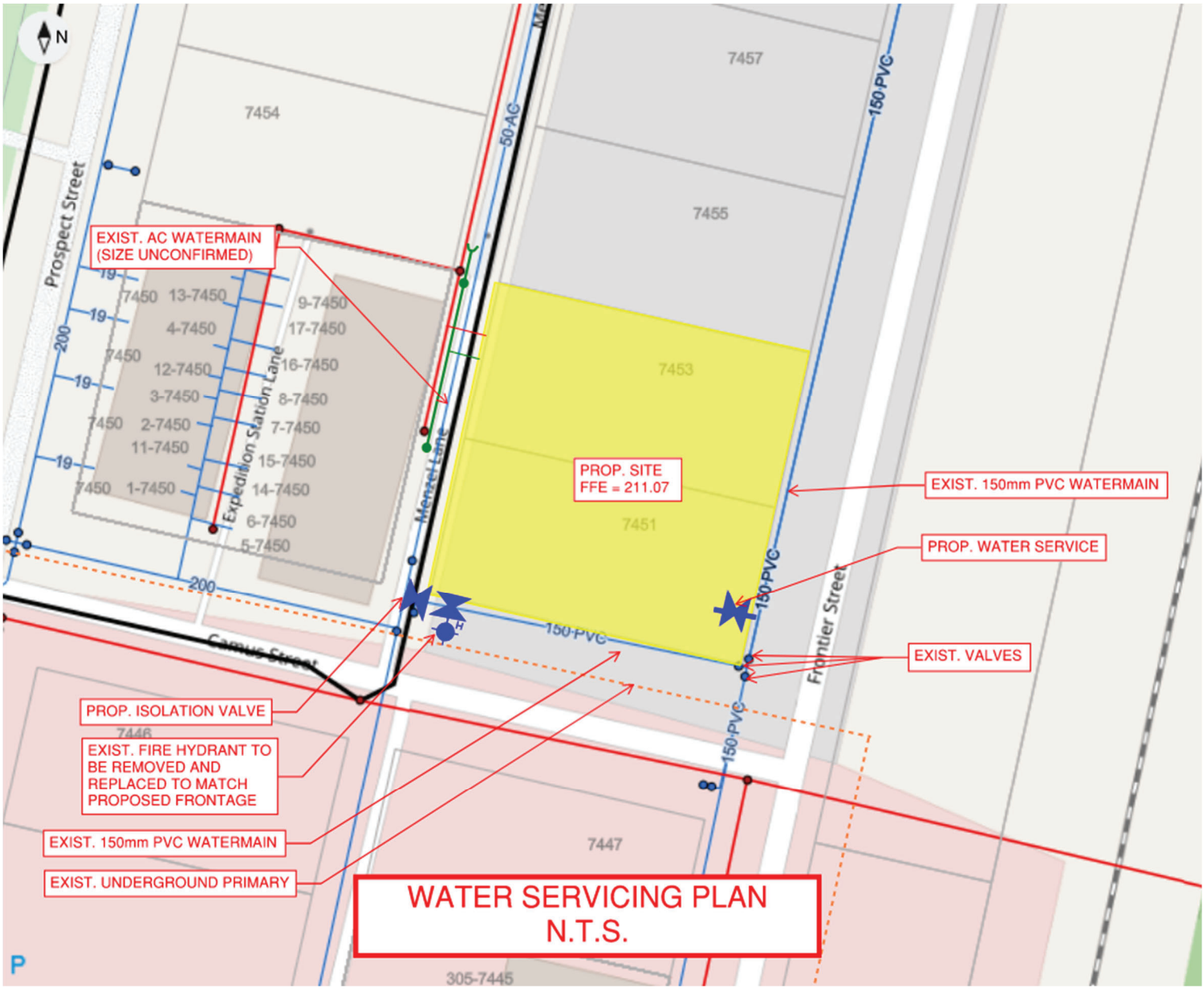

Figure 5 – Conceptual Water Servicing Plan