Preliminary Hydrogeological Assessment

Vavenby Groundwater Issues Community Presentation

- **October 22, 2020**
- Bryer Manwell, M.Sc., P.Eng.
- Hydrogeological Engineer

THOMPSON-NICOLA REGIONAL DISTRICT

CAULWELL ENGINEERING GEOSCIENCE

Presentation Overview

- PROJECT OBJECTIVES AND SCOPE OF STUDY
- SITE SETTING, PHYSIOGRAPHY, LAND USE AND COMMUNITY INFRASTRUCTURE
- CLIMATE, GEOLOGY, HYDROLOGY, HYDROGEOLOGY
- CONCEPTUAL FLOW OF GROUNDWATER AND DISCHARGE ESTIMATES
- SUMMARY OF INTERVIEWS WITH AFFECTED PROPERTY OWNERS
- CONCLUSIONS AND RECOMMENDATIONS

Who am I?

- **Bryer Manwell – Hydrogeological Engineer (Hydrogeologist)**
  - 20 years of experience in environmental engineering and hydrogeology
  - Masters of Science Environmental Engineering
    - – specializing in hydrogeology
  - Owner of Caulwell Engineering and Geoscience Ltd. - Based in Kelowna, British Columbia, Canada
  - Consultant:
    - Groundwater Supply Development
    - Contaminant Hydrogeology
    - Wastewater
    - Study (quantify) impacts of various land uses
    - Design passive wastewater treatment

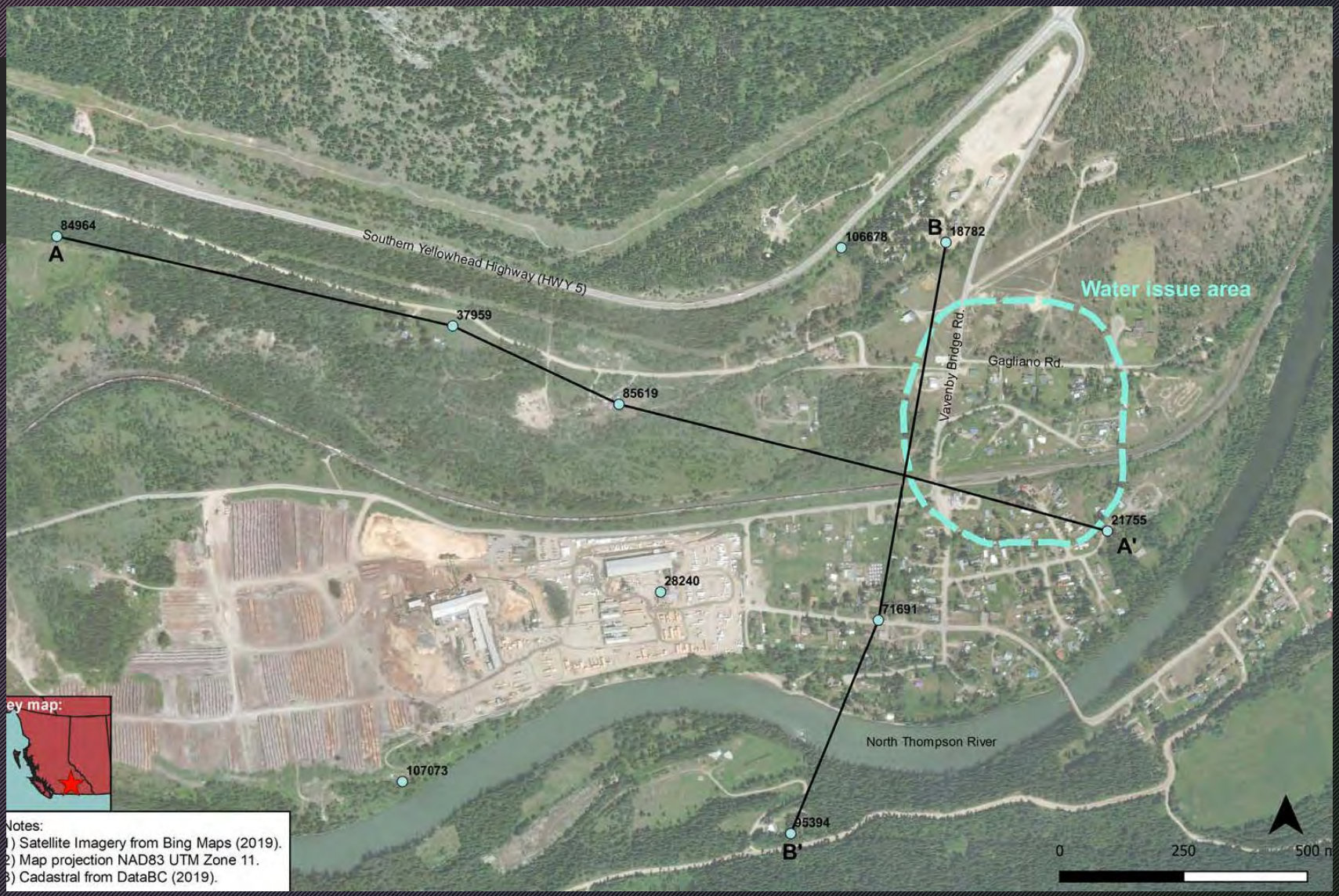
PROJECT OBJECTIVES AND SCOPE OF STUDY

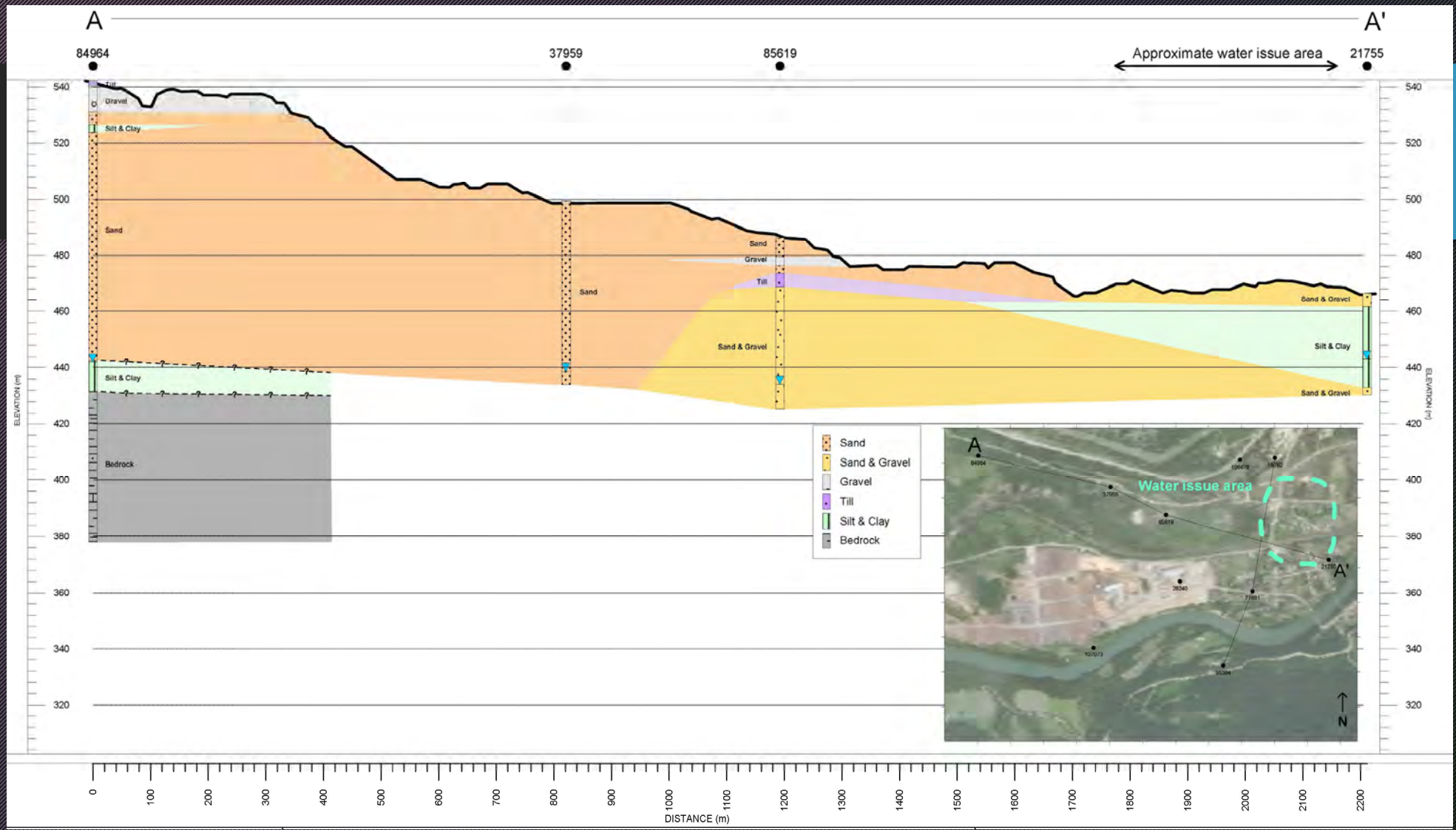
- Assess the reasons for ongoing groundwater issues for properties at Vavenby
- Study was preliminary in nature and relied on existing information (anecdotal accounts and desktop data)

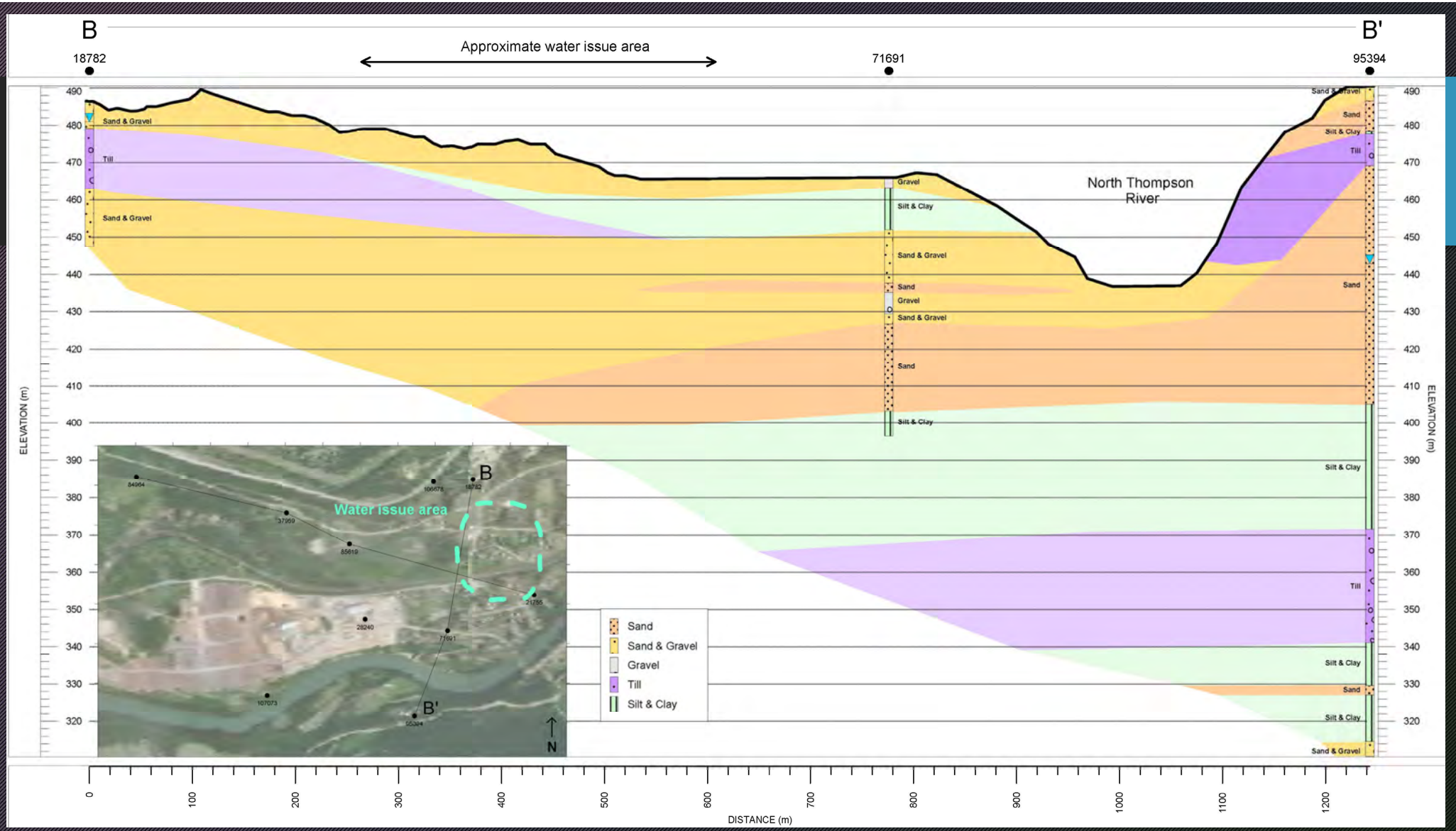
SITE SETTING, PHYSIOGRAPHY, LAND USE AND COMMUNITY INFRASTRUCTURE

CLIMATE, GEOLOGY, AND HYDROLOGY

- The seasonal high temperatures occur in July and August and the seasonal lows occur in December and January
- The annual average precipitation is 278 mm and the average daily temperature is 9˚C
- North Thompson River is the most dominant surface water body. The River is a high order stream draining approximately 20,750 km²

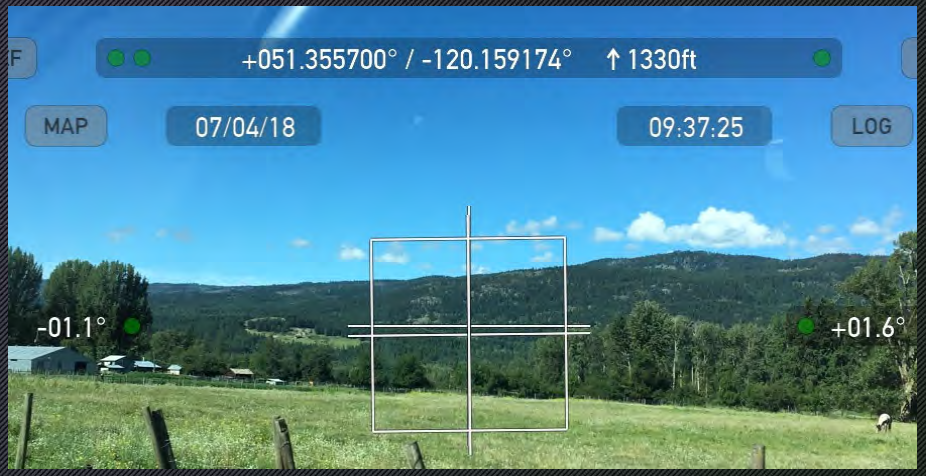

84964
A
Southern Yellowhead Highway (HWY 5)
37959
85619
106678
B
18782
Water issue area
Vavenby Bridge Rd.
Gagliano Rd.
21755
A'
28240
71691
North Thompson River
107073
95394
B'
0
250
500 m
ey map:
Notes:
) Satellite Imagery from Bing Maps (2019).
2) Map projection NAD83 UTM Zone 11.
3) Cadastral from DataBC (2019).


A
A'
84964
37959
85619
21755
Approximate water issue area
Till
Gravel
Silt & Clay
Sand
Sand
Gravel
Till
Sand & Gravel
Sand & Gravel
Silt & Clay
Silt & Clay
Sand & Gravel
Bedrock
Sand
Sand & Gravel
Gravel
Till
Silt & Clay
Bedrock
Water issue area
ELEVATION (m)
DISTANCE (m)
N


B
B'
Approximate water issue area
18782
71691
95394
North Thompson River
Sand & Gravel
Till
Sand & Gravel
Gravel
Silt & Clay
Sand & Gravel
Sand
Gravel
Sand & Gravel
Sand
Silt & Clay
Sand & Gravel
Sand
Silt & Clay
Till
Sand
Silt & Clay
Till
Silt & Clay
Sand
Silt & Clay
Sand & Gravel
ELEVATION (m)
490
480
470
460
450
440
430
420
410
400
390
380
370
360
350
340
330
320
Water issue area
84964
106678
18782
37999
85619
21755
28240
71691
107073
55394
B
B'
N
Sand
Sand & Gravel
Gravel
Till
Silt & Clay
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
DISTANCE (m)

HYDROGEOLOGY

- The province has mapped Aquifer 807IIB
- Based on a groundwater exploration report at the Canfor site, close to the North Thomson River, two aquifers have been identified
- The source of recharge to the aquifer(s) is partly from direct precipitation (rain or snow-melt), underflow from the valley sides, and the North Thompson River (BCGW).



CONCEPTUAL FLOW OF GROUNDWATER

- Locally, there is likely groundwater flow within the identified unconfined upper sand and gravel unit which transition into silt and clay at the 'water issue area' of Vavenby

- As that groundwater attempts to infiltrate on its flow paths towards the river it is restriction due to the low permeability silt and clay wedge encountered in the vicinity of the water issue area.

SUMMARY OF INTERVIEWS WITH AFFECTED PROPERTY OWNERS

- A total of six property owners were contacted
- Four were interviewed
- Three property owners on the northwest side of the River
- One property owner on the southeast side of the River
- Emergency Management BC (EMBC) does not provide funding to local governments to manage groundwater flow issues
- the issue on both sides of the River stem from the fact that the River valley bottom is a groundwater discharge zone for the North Thompson watershed.


8/28/2019
N
5
Cedarhelm Rd
Caglione Rd
Allingham Way
Image © 2019 CNES / Airbus

DISCHARGE ESTIMATES

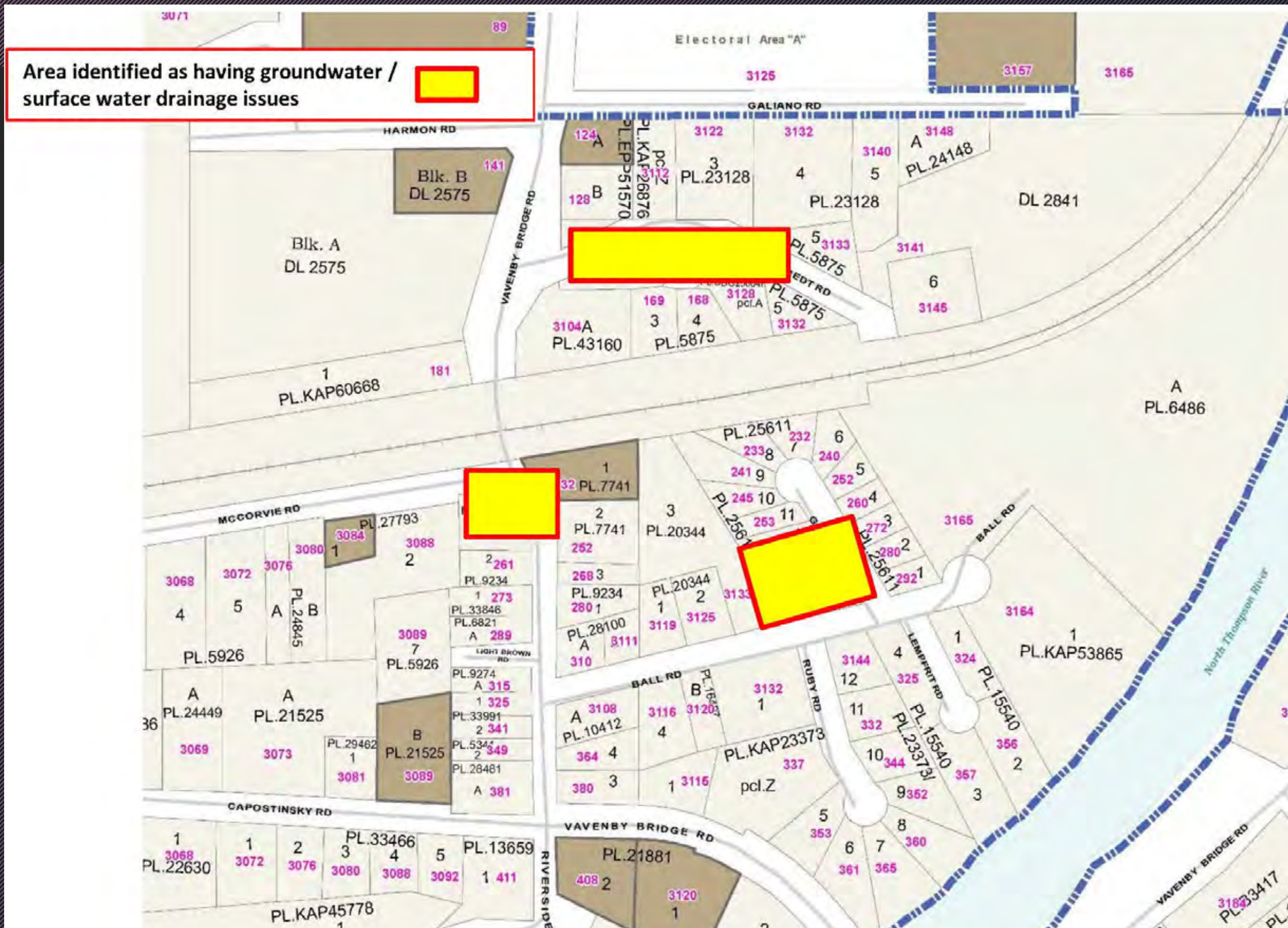
- Q = kia

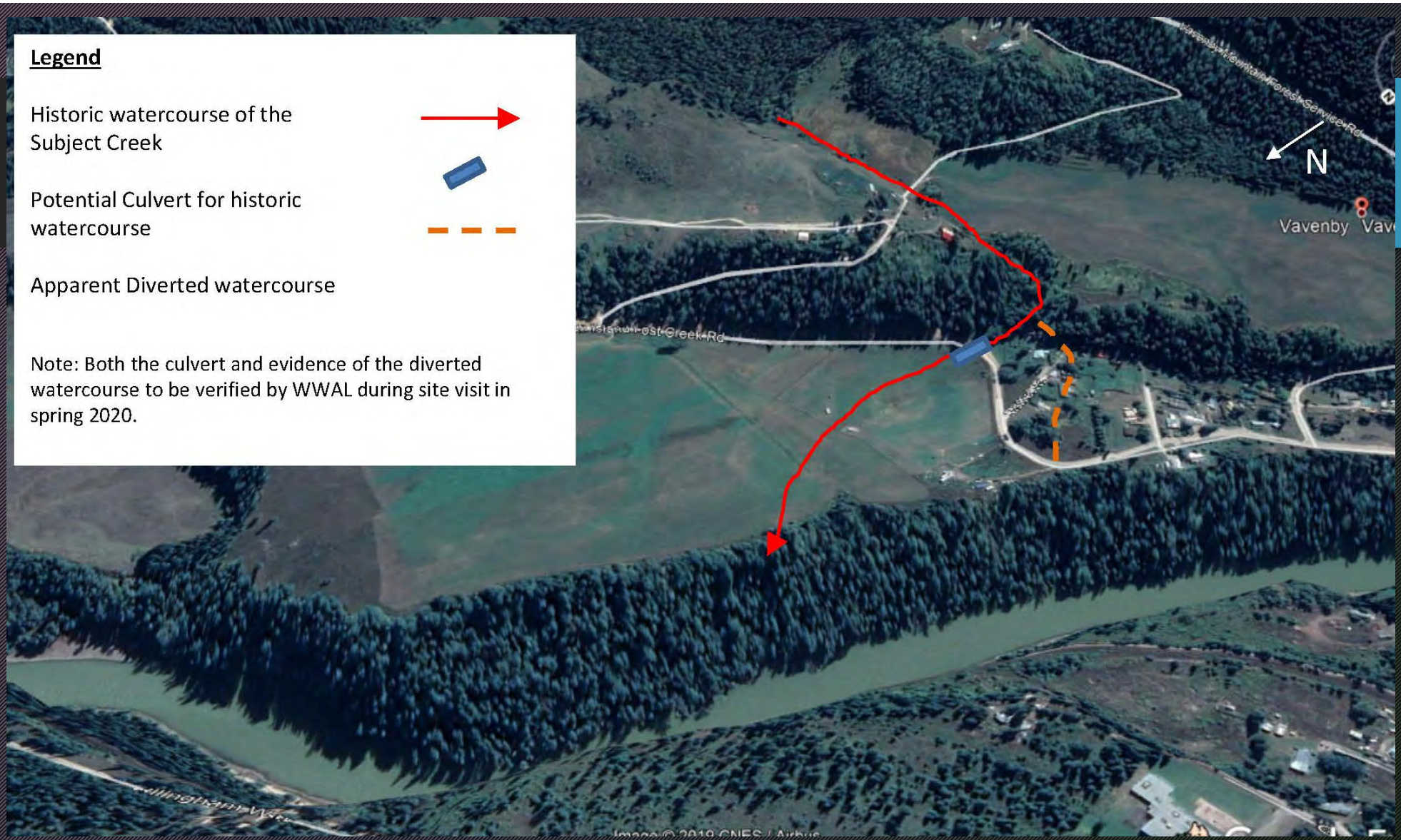
- Where:
  - Q = groundwater discharge (length3/time)
  - k = hydraulic conductivity (length/time)
  - i = hydraulic gradient (unitless)
  - a = aquifer (saturated flow) cross sectional area (length2)

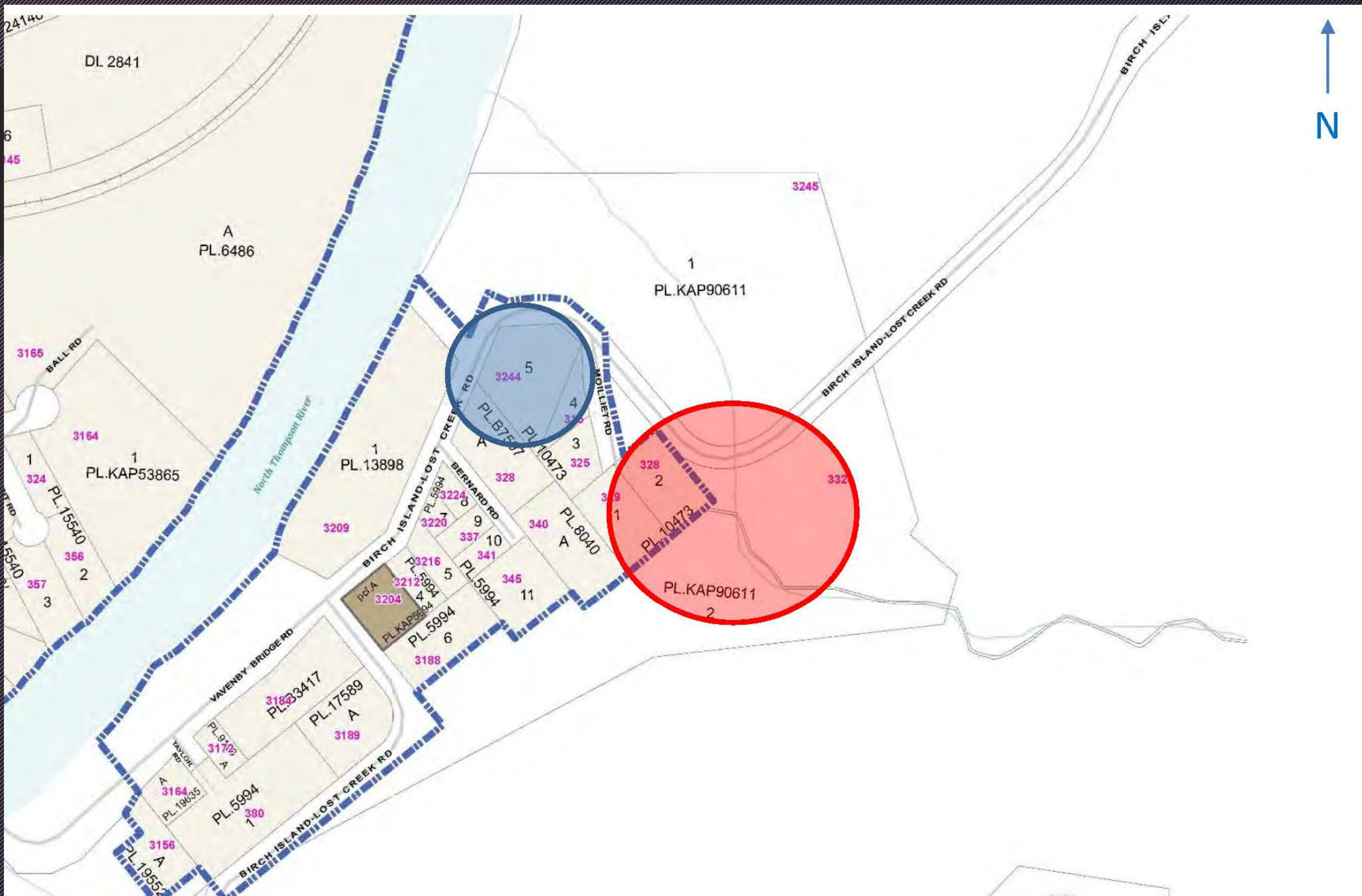
DISCHARGE ESTIMATES

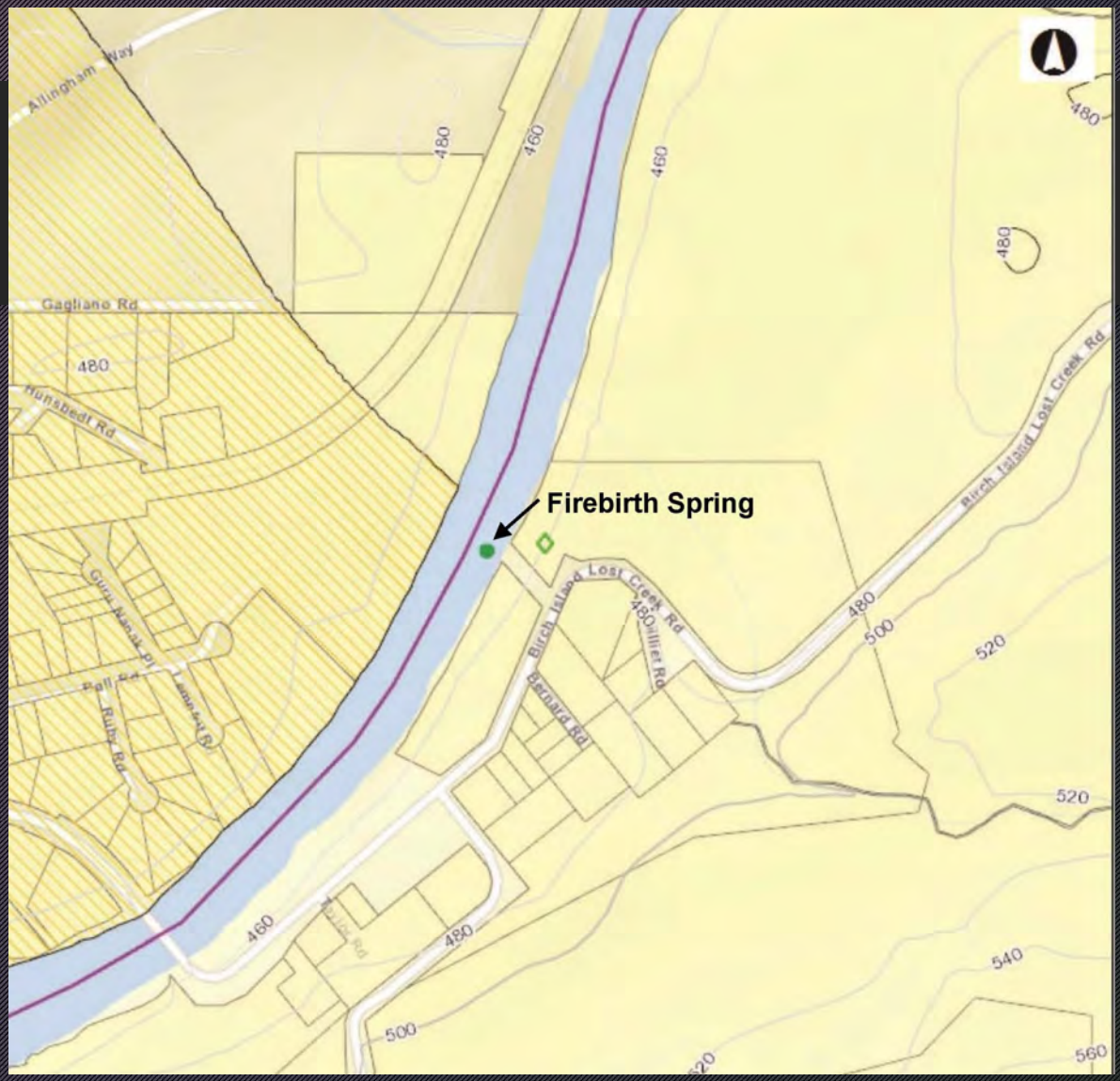
Groundwater Discharge Estimate for the Issue Area from Darcy's Flux

Parameter	Units	Info source	Length (m)	Thickness (m)	Values
A	m^2	From geological cross section of sand and gravel above till layer (saturated thickness) and length of the contour where groundwater flow issue is occurring below Galiano Road (360 m)	360	2	720
i		from surface topography			1.2%
b	m	Well lithology			2.00
k	m/sec	Estimated from Freeze and Cherry 1979 Table 2-2			0.001
k	m/day	Calculated from above value			86.4
Q	m^3/sec	Estimated from Darcy's Flux (Equation above)			0.01
	m^3/min				0.52
	m^3/day				746
	Usgpm				137


Area identified as having groundwater / surface water drainage issues
Electoral Area "A"
GALIANO RD
HARMON RD
VAVENBY BRIDGE RD
MCCORVIE RD
BALL RD
RUBY RD
LEMPRIT RD
CAPOSTINSKY RD
LIGHT BROWN RD
RIVERSIDE
North Thompson River
Blk. A
DL 2575
Blk. B
DL 2575
DL 2841
PL.KAP60668
PL.43160
PL.5875
PL.23128
PL.24148
PL.6486
PL.25611
PL.7741
PL.20344
PL.9234
PL.28100
PL.5926
PL.24845
PL.27793
PL.24449
PL.21525
PL.10412
PL.KAP23373
PL.15540
PL.KAP53865
PL.22630
PL.33466
PL.13659
PL.21881
PL.KAP45778


Legend
Historic watercourse of the Subject Creek
Potential Culvert for historic watercourse
Apparent Diverted watercourse
Note: Both the culvert and evidence of the diverted watercourse to be verified by WWAL during site visit in spring 2020.
N
Vavenby
Image © 2019 CNES / Airbus


N
DL 2841
A
PL.6486
1
PL.KAP90611
3245
BIRCH ISLAND-LOST CREEK RD
North Thompson River
PL.KAP53865
PL.13898
PL.8040
PL.KAP90611
2
VAVENBY BRIDGE RD
PL.5994
PL.17589
BALL RD
BERNARD RD
MOILLIET RD
TAYLOR RD


Allingham Way
Gagliano Rd
Hunsbedt Rd
Firebirth Spring
Birch Island Lost Creek Rd
Millet Rd
Bernard Rd
480
460
500
520
540
560

CONCLUSIONS

- As the community sits in the natural discharge zone of the watershed the community is susceptible to potential flooding associated with groundwater level increases In the spring, when the upper watershed drains into the River valley bottom.
- Over-time there have been changes in the groundwater drainage off the terrace deposits.
- There is a silt and clay deposit located beneath the properties on the northwest side of the river that experience the most groundwater issues.

CONCLUSIONS

- Phone interviews were conducted with property owners that have been negatively affected by flooding due to high groundwater levels in the area between Gallagher Road and Ball Road.
- The hydrogeologic setting creates a situation where high groundwater levels during the spring melt are inevitable.
- The estimated groundwater discharge through the water issue area is triple the average daily demand for the community of Vavenby.
- TNRD has engaged in significant leakage repair between 2016 and in 2018 the area around Wood Road and Hundsbedt Road. Property owners downgradient of this area may find less groundwater flow after these leaks, with these leaks being addressed in the past year.

RECOMMENDATIONS

- Consider creating an Integrated Community Drainage Plan. When property owners are looking to change site drainage patters an assessment of the predicated downgradient effects should be completed by a Qualified Professional and the work should not contradict the Drainage Plan.

- Consider using instruments to monitor the groundwater levels at the water issue area' over the next few years to see if the issue persists or if fixing the water system leaks will have had measurable effect.

Questions