MINISTRY OF FORESTS: POST-WILDFIRE NATURAL HAZARD RISK ANALYSIS – SHETLAND CREEK - LEVEL 2 RECONNAISSANCE REPORT

NOTE: The results given on this form are reconnaissance in nature and are intended to be a warning of potential hazards and risks. It is not a detailed risk analysis and further work may alter the conclusions. Please read the appendix of this report for important limitations. Contact the author for more information.

FIRE NUMBER/STATUS: K70910 Shetland Creek. The fire was classified as being held on August 18, 2024.	**FIRE YEAR:** 2024	**DATE OF FIELD REVIEW:** July 25, August 16, and August 30, 2024. **DATE OF REPORT:** September 13, 2024
AUTHOR: *Gareth Wells, P. Geo., Geomorphologist, Thompson Okanagan Region*		
REPORT PREPARED FOR: Kamloops Fire Center (KFC)		

Fire Size:	**Location:**	**Land Ownership:**
27,956 ha	The fire is located ~1 km north of Spences Bridge and ~10 km southwest of Ashcroft.	The fire is located on Nicoelton Indian Reserve (IR) 6, Upper Tsinkahtl IR 8A, Basque IR 18, Oregon Jack Creek IR 5, Peq-Pay IR 22, Hay Meadow IR 1, provincial public land and private property. Elements are identified below by the local jurisdiction they fall under. This includes the Thompson Nicola Regional District (TNRD), Cook's Ferry Indian Band (CFIB) or Oregon Jack Creek Indian Band (OJCIB).

POTENTIAL VALUES AT RISK:

1. Private property, residences, and outbuildings in the Venables Valley, Oregon Jack Creek valley at the outlet of Twaal Creek, and along Highway 1.
2. Highway 1, Murray Creek Road, and Twaal Creek Road.
3. Twoyqhalsht IR16, Spences Bridge IR4C, Nicoelton IR6, and Peq-Paq IR 22.

SUMMARY OF TERRAIN CONDITIONS AND THE EFFECTS OF THE FIRE:

The Shetland Creek Fire affected many watersheds in the traditional territory of the Nlaka'pamux. The northern fire perimeter follows Oregon Jack Creek; the eastern fire perimeter extends down through the Venables Valley and towards Highway 1 along the Thompson River. The southern boundary extends to Spences Bridge and Arthurs Seat. The western perimeter extends up Murray Creek, past Lookout Point and Blue Earth Lake towards Hat Creek.

Fire impacts in each of these watersheds vary. The valley sidewalls in portions of Twaal Creek, Murray Creek, and the Venables Valley were burned at particularly high severity. Elsewhere, the fire resembles more of a mosaic with larger swaths of low burn severity and scattered patches of moderate or high burn severity interspersed with unburnt areas. Many areas of the fire are rocky with sparse timber or covered with grassland and sagebrush. These areas were typically burned at low severity and not highly affected by the fire. Rates of raveling and erosion may increase in these areas.

Potential post-wildfire natural hazards include flooding (elevated peak flows), debris floods, debris flows, landslides, and rockfall. Over the first few years after a fire hazardous events are typically triggered by short-duration, high intensity (i.e., convective) rainfall. Widespread overland flow development, rilling, debris floods and debris flows have been observed in recent fires nearby (i.e. Lytton Creek Fire). Most of these hazards threaten elements located on alluvial fans in the valley bottom or on lower to middle valley sides. Post-wildfire run off related natural hazards may persist for many years until the tree canopy recovers.

Only limited field assessment of soil and vegetation burn severity were conducted during the reconnaissance fieldwork for the K70910 fire due to remoteness, steep topography, and limitations to access during fire suppression activities. The vegetation burn severity mapping used for this analysis was corroborated with visual observations made during helicopter overflights of the fire and observations

made during field assessments. Initial field observations indicate that soil burn severity is less severe than the vegetation burn severity. More fieldwork is necessary to verify the agreement (or disagreement) between soil and vegetation burn severity. No signs of significant post-wildfire erosion of soils or rilling were observed during the aerial overflight conducted on August 16, 2024, or during fieldwork conducted on August 30, 2024. Additional details regarding burn severity in specific watersheds are presented below.

WATERSHEDS AFFECTED:	TOTAL AREA	WATERSHED AREA BURNED	AGGREGATE BURNED AT MODERATE AND HIGH SEVERITY
Murray Creek	14,941 ha	7,648 ha (51%)	39%; 22% mod + 17% high
Twaal Creek	9,517 ha	8235 ha (86%)	77%; 26% mod + 51% high
Upper Venables Creek	809 ha	792 ha (98%)	94%; 20% mod + 74% high
Venables 1	237 ha	213 ha (90%)	78%; 26% mod + 52% high
Venables 2	158 ha	156 ha (99%)	93%; 15% mod + 78% high
Venables 3	321 ha	300 ha (95%)	86%; 15% mod + 71% high
Venables 4	191 ha	189 ha (99%)	95%; 22% mod + 73% high
Venables 5	159 ha	114 ha (72%)	67%; 26 % mod + 41% high
Unnamed 1	467 ha	83 ha (18%)	7%; 6% mod +1% high

SUMMARY OF POST-FIRE HAZARD AND RISK

1. Hazard = P(H), the probability of occurrence of a hazardous event
2. Probability of spatial impact, P(S:H), the probability of a hazard reaching or affecting an element at risk
3. Partial Risk, the probability of a hazard occurring and affecting an element at risk = P(H) x P(S:H)
4: Location with the highest risk rating given; at other locations the risk may be lower

Post-wildfire run-off related hazards impacting structures at PID 004-617-461 in the Three Sisters area (TNRD).
Hazard P(H)[1] = **Moderate** Probability of Spatial Impact P(S:H)[2] = **Moderate**
Partial Risk[3,4] = **Moderate**

The 004-617-461 property is in the Three Sisters Area on the south side of Hat Creek Road. It includes the lower portion of a 350 m long northwest-aspect hillside that was recently logged. Several structures, including at least one residence, are in the middle of the property at the base of the northwest-aspect slope. The upper slope of the hillside above the private property is timbered. Burn severity on the hillside immediately above the structures appears to be an even mix of low, moderate and high, generally increasing in severity with elevation. The likelihood of post-wildfire overland run off on the slope above the property is rated as moderate due to the burn severity and slope gradients. The probability of spatial impact to the structures is rated as moderate.

Post-wildfire flooding along Twaal Creek impacting Hilltop campground (TNRD) and various water licenses along Twaal Creek.
Hazard P(H)[1] = **High** Probability of Spatial Impact P(S:H)[2] = **High** Partial Risk[3,4] = **Very High**

The Twaal Creek watershed covers ~9,517 ha. Eighty six percent of the watershed (8,253 ha) was burned and 76% of the watershed was burned at moderate or high vegetation burn severity. Due to the high aggregate of burned area at moderate and high severity the likelihood of post-wildfire increases in peak flow is rated as high. The Hilltop Campground is located at the outlet of Twaal Creek along Highway 1 in the base of a 60-80 m wide draw. The campground is prone to flooding during the freshet, during which time the campground is closed to guests. The spatial impact probability for flooding to impact the camp site is high. The partial risk rating is very high.

Post-wildfire run-off related hazards impacting Oregon Jack Creek IR2 (OJCIB) and PID 014-598-558 (TNRD) along Hat Creek Road.
Hazard P(H)[1] = **Low** Probability of Spatial Impact P(S:H)[2] = **Low**
Partial Risk[3,4] = **Very Low**

North-aspect slopes above Oregon Jack Creek IR2 and PID 014-598-558 were burned in the fire. There are several cabins or outbuildings present in the northwest corner of the private property. The cabins and the IR are located on the north side of Oregon Jack Creek, away from burned slopes on the south side of the valley. North valley sidewall slopes were not impacted by the fire. Burn severity on the southern hillside above the private property is a mosaic including unburnt timber with patches of low or moderate burn severity. The likelihood of post-wildfire run-off hazards is rated as low. The probability of spatial impact for the structures and IR2 is estimated as low.

Post-wildfire nuisance flooding, debris floods or debris flows affecting Nicoelton IR6, a cabin at the Spence Creek - Twaal Creek intersection (CFIB), and Twaal Creek Road (TNRD).

Hazard P(H)[1] = **Variable (Low to High)**
Probability of Spatial Impact P(S:H)[2] = **Moderate to High**
Partial Risk[3,4] = **Variable (Moderate to Very High)**

Nicoelton IR6 extends 12 km along the Twaal Creek valley from Twaal Lake (to the north) down towards Chuchhriaschin IR5 (to the south). Many of the slopes in or above IR6 were burned during the fire. In the upper half of the Twaal Creek valley sidewall slopes above the IR were burned largely at moderate and/or high severity. These slopes are typically between 700-1,700 m in length with moderate or moderately steep slope gradients. Many draws and swales descend these valley sidewalls with alluvial fans of various sizes at their outlets in the valley bottom. Twaal Creek Road crosses many of these alluvial fans. The likelihood of nuisance flooding or debris floods emanating from these highly burned slopes above IR6 in the upper valley is rated as high. Debris flows are possible in the steeper, more confined catchments. The probability of spatial impact for IR 6 and Twaal Creek Road is variable throughout the valley but typically falls between moderate and high.

Lower in the watershed the burn severity is less severe and the fire resembles more of a mosaic of low and moderate burn severity interspersed with unburnt areas. Here the likelihood of runoff related hazards like nuisance flooding or debris floods in defined channels is rated as low. The probability of spatial impact is moderate to high and the partial risk is rated as low to moderate.

There is a cabin on IR 6 at the intersection between Spence Creek and Twaal Creek. The cabin is located beneath a short, burned slope that is less than 100 m in length and convex. Little of the slope appears to drain towards the structure. Due to the short slope length, the low to moderate severity burn on this slope, and lack of concentrating drainage features, the likelihood of post-wildfire run-off hazards is rated as low. The cabin is located ~20 m from the toe of the slope so the probability of spatial impact is rated as moderate. The partial risk to the cabin is rated as low.

As demonstrated, the partial risk ratings to various elements on Nicoelton IR6 and Twaal Creek Road vary. A more detailed (level 3) assessment is recommended to verify the hazard and risk to IR6 land, potentially occupied structures, and Twaal Creek Road.

Post-wildfire debris floods/debris flows impacting Twoyqhalsht IR16 or Spences Bridge IR4C (CFIB).
Hazard P(H)[1] = **Low** Probability of Spatial Impact P(S:H)[2] = **High**
Partial Risk[3,4] = **Moderate**

Twoyqhalsht IR16 & Spences Bridge IR4C are located on the alluvial fan of an unnamed stream that extends up towards upper agricultural valley and Chuchhriaschin 5A. The lower stream draw, beneath the upper valley, has experienced numerous debris floods/debris flows which have depositing material on the alluvial fan in recent years. There is no continuous channel that extends into the upper portion of the watershed.

Drainage connectivity from the upper watershed in the Chuchhriaschin area is believed to be largely subsurface. At the IRs two separate stream channels spill out onto the fan surface at the apex; a western channel which drains an upper watershed area several kilometres long and several kilometres wide, and an eastern channel that collects runoff from a series of parallel swales on the hillside immediately north of the fan. Both channels appear to have experienced events in the past five years. In both catchments there are large areas of exposed sediment with sparse timber and minimal vegetation cover. The previous events that impacted the fan are believed to have been triggered by heavy precipitation, slope wash, and incision in the stream channels. The K70910 Fire did not reach the lower stream draw where these previous hazardous events appear to have initiated. Only seventeen percent of the upper watershed burned mostly at low or moderate severity. Most of the runoff in the upper watershed infiltrates into the ground before reaching the lower stream draw. For these reasons, the likelihood of an incremental increase in debris floods or debris flows impacting Twoyqhalsht IR16 or Spences Bridge IR4C is rated as low. The partial risk to both IRs is rated as moderate due to the high probability of spatial impact.

Elevated post-wildfire peak flows along Murray Creek impacting the Murray Creek intake (CFIB, TNRD, BC Parks).

Hazard P(H)[1] = **Moderate** Probability of Spatial Impact P(S:H)[2] = **High** Partial Risk[3,4] = **High**

There are four active water licenses on Murray Creek. One waterworks license held by the TNRD, two irrigation licenses held by Cook's Ferry Indian Band and BC Parks, and a domestic water license held by Cook's Ferry Indian Band. Around fifty percent of the watershed was impacted by the fire and 39% of the watershed was burned at moderate to high severity. Based on an aggregate of burned area the watershed is assessed as having a moderate peak flow hazard. The partial risk for the water licenses and intake structures is rated as high.

Post-wildfire debris floods or debris flows affecting Murray Creek Road (TNRD).

Hazard P(H)[1] = **Variable (Low to High)**
Probability of Spatial Impact P(S:H)[2] = **Variable (Moderate to High)**
Partial Risk[3,4] = **Variable (Low to Very High)**

Portions of the Murray Creek Road cross beneath steep, highly burned slopes or drainages where post-wildfire debris floods or debris flows may initiate. Due to the wide variety of terrain the road crosses, and significant variability in the burn severity upslope of the road, the hazard and risk varies along the length of the road. A more detailed level 3 assessment is recommended for the Murray Creek Road to verify the hazard and risk to road segments.

Post-wildfire geohazards affecting District Lot 384 (Vedic Eco Village, PID 003-594-793) in the Venables Valley (TNRD).

Hazard P(H)[1] = **Variable (Low to High)**
Probability of Spatial Impact P(S:H)[2] = **Variable (Low to Moderate)**
Partial Risk[3,4] = **Variable (Low to Moderate)**

The Vedic Eco Village is located on District Lot 384 at the southern end of the Venables Valley. TNRD property information indicates that Lot 384 includes the following residential addresses: 4660, 4665, 4680, 4721, 4728, 4745, and 4788 Minnabariet Road. There are numerous homes and outbuildings around the property as observed on satellite imagery, on the ground, and during an aerial reconnaissance flight. These structures all have different likelihoods of spatial impact based on their position relative to the steeper valley sidewall slopes. Those which are located at the toe of steep slopes or on alluvial fans have higher spatial impact probabilities. Those which are located several tens or hundreds of metres away from steep valley sidewall slopes generally have lower spatial impact probabilities.

The residence at 4788 Minnabariet Road is located at the toe of a concave hillside, about 70-80 m back from a steeper colluvial slope with scattered bedrock outcrops. Timber is sparse on the hillside and the soils are blanketed with a layer of coarse colluvium. Vegetation burn severity is predominantly moderate and soil burn severity is low to moderate. The likelihood of post-wildfire landslides, rockfall, or overland flow is rated as low. The spatial probability of impact for landslides, rockfall, or overland flow is rated as moderate. The resulting partial risk is low.

A yurt and several outbuildings at 4660 Minnabariet Road in the northeast corner of Lot 384 are located at the toe of a low sparsely timbered hillside. Burn severity above the structures on the rocky hillside is generally low. The slopes above the structures in the northeastern corner of the property are rated as having a low likelihood for landslides, rockfall, or overland flow. The spatial impact probability for the structures is rated as moderate and the resulting partial risk is low.

An unnamed watershed (see Venables 1 on attached mapping) along the western margin of Lot 384 extends almost 3 km to the west onto Nicoelton Mountain. The watershed covers over 240 ha; more than 90% of the upper watershed was burned during fire with 50% of the upper watershed burned at high severity, and an addition 26% burned at moderate severity. This proportion of burn severely substantially elevates the likelihood of post-wildfire runoff related hazards. The likelihood of overland flow development and debris floods is rated as high. A yurt is located on the lower 1/3 of a large alluvial fan at the outlet of this watershed into the Venables Valley. Due to the structure's position in the lower portion of the fan away from the mapped stream, the probability of spatial impact is rated as low, resulting in a moderate partial risk.

As demonstrated, the partial risk ratings to various elements on District Lot 384 vary. A more detailed (level 3) assessment for properties in the Venables Valley, including Lot 384 is recommended to verify the hazard and risk to individual residences and other potentially occupied structures.

Post-wildfire geohazards affecting District Lot 383 (PID 003-594-769) in the Venables Valley (TNRD).

Hazard P(H)[1] = **High** Probability of Spatial Impact P(S:H)[2] = **Low** Partial Risk[3,4] = **Moderate**

District Lot 383 is also located at the southern end of the Venables Valley. TNRD property information indicates that Lot 383 includes the following residential addresses: 4501 Minnabariet Road, 4697 and 4709 Rathayatra Way, as well as 4745, 4757 and 4789 Govardhan Hill Terrace. Residences or outbuildings appear to be clustered on the western half of the property along Minnabariet Road and Govardhan Hill Terrace at the distal edge of two coalescing paleo fans.

Southwestern sidewall slopes in the Venables Valley burned extensively at high severity. This includes two unnamed watersheds (Venables 2 & 3 on attached mapping) above Lot 383. Several ephemeral streams are mapped emanating from these watersheds. Many shallow swales were observed in the field on the fan surfaces suggesting streamflow across the fan has occurred historically. With that said, no signs of recent streamflow were observed. Prior to the fire, water flowing down these watersheds is believed to have generally flowed subsurface recharging the lake in the valley bottom. Watershed 2 was 98% burned in the fire with 78% of the watershed burned at high severity, and 15% at moderate severity. Watershed 3 was 94% burned during the fire with 15% of the watershed burned at moderate severity, and 71% burned at high severity. Post-wildfire run off, whether that may be sub surface or above ground, in Watersheds 2 and 3 is anticipated to be substantially higher than that during pre-fire conditions. Surficial runoff may extend considerably further down into the valley bottom before infiltrating into the ground. Elevated post-fire run off may trigger in-channel debris floods which are anticipated to travel to the fan surfaces before beginning to dissipate. Most residences on Lot 383 are located well away from steep terrain several hundred metres into the valley bottom. The residences at 4697, 4745, and 4757 Govardhan Hill terrace are located within 200 m of the toe of the hillside at the edge of the large fans. The probability of spatial likelihood is rated as low based on their position on the fan surfaces. Due to the substantial proportion of

moderate and high burn severity in Venables 2 and 3, the likelihood of significant increases in post-wildfire run off, peak flows, and debris floods in these areas is rated as high. The partial risk is rated as moderate.

A more detailed (level 3) assessment for Lot 383 in the Venables Valley is recommended to verify the hazard and risk to individual residences and any other other occupied structures.

Post-wildfire geohazards affecting District Lot 18 (PID 003-594-734) in the Venables Valley (TNRD).

Hazard P(H)[1] = **Moderate** Probability of Spatial Impact P(S:H)[2] = **Variable (Low to Moderate)**
Partial Risk[3,4] = **Variable (Low to Moderate)**

District Lot 18 is in the middle of Venables Valley and includes the southern portion of Venables Lake. TNRD property information indicates that Lot 18 includes the following residential addresses: 5012, 5028, 5044, 5072, 5232 Venables Valley Rd, 4320, 4340, 4432, 4452, 4448, 4453, 4460, 4461, 4469, 4485, 4500, 4521, 4540 Rathayatra Way, 4544 Talavan Cres, 4489, 4496 Jaganatha Trail, and 4433 & 4493 Bhakti Blvd. There are many homes and outbuildings around the property as observed on the ground, on satellite imagery, and during an aerial reconnaissance flight. These structures all have different likelihoods of spatial impact based on their positions relative to the steeper valley sidewall slopes or on the distal edge of alluvial fans.

In the southwestern corner of Lot 18 a residence at 4544 Talavan Cres is surrounded by highly burned forest. The hillslope above this residence was burned at high severity. Due to the significant proportion of high burn severity the likelihood of overland flooding rated as moderate. The residence is located on the edge of a 50 + m wide bench with no discrete draws or swales directing runoff directly towards it. The likelihood of spatial impact is rated as low and the partial risk is low.

The residence at 4469 Rathayatra Way is located at the toe of a moderate gradient slope which was also burned at moderate to high severity. No distinct swales or draws descend the hillside towards the house. The hazard for dispersed overland flooding for the slope above 4469 Rathayatra Way is rated as moderate. The spatial probability of impact for the residence is also rated as moderate, resulting in a moderate partial risk. The remaining residences on Lot 18 are located sufficiently far away from valley sidewalls to be considered at negligible risk from post-wildfire geohazards.

A more detailed (level 3) assessment for properties in the Venables Valley, including Lot 18 is recommended to verify the hazard and risk to individual residences and any other occupied structures.

Post-wildfire geohazards affecting District Lot 17 (PID 003-594-726) in the Venables Valley (TNRD).

Hazard P(H)[1] = **Variable (Moderate to High)**
Probability of Spatial Impact P(S:H)[2] = **Variable (Low to Moderate)** Partial Risk[3,4] = **Low to Moderate**

District Lot 17 is also located at the southern end of the Venables Valley, to the south of Venables Lake. TNRD property information indicates that Lot 17 includes the following residential addresses: 4561, 4581, 4593, 4604, 4609, 4620, 4625, 4632, 4640, 4641, 4653, 4665, 4672 Rathayatra Way, as well as 4540 Harekrishna Lane, and 5280 & 5320 Venables Valley Road. Residences and outbuildings are scattered across the lot.

Residences in the southwest corner of the lot (i.e., 4677, 4665, 4653, 4641, Rathayatra Way) are located along the outer margin of several large coalescing alluvial fans. Numerous shallow swales between 0.2-1.0 m deep wind their way across the fan surfaces down through the forest towards a fire guard constructed behind residences along Rathayatra Way. No signs of recent stream flow were observed on the ground; however, discussions with residents indicate that these streams do occasionally host streamflow during the spring freshet. Venables Watershed 3 on the attached mapping includes several unnamed drainages upslope (to the west) of Lot 17. Ninety-five percent of Watershed 3 was burned with 71% of the watershed burned at high severity. Most of the steeper upper catchment areas were burned at high severity. Portions of the lower valley sidewall and fan surface were burned at low or moderate severity.

The likelihood of post-wildfire overland flow and/or debris floods initiating on the steeper, upper valley sidewall slopes is rated as high. The homes along Rathayatra Way are located on the lower portions of these merged alluvial fans, several hundred metres away from steep hillsides. The probability of spatial impact for these structures is rated as low. The resulting partial risk is moderate.

The Saranagati Temple is located at 5280 Venables Valley Road on the east side of the lot at the toe of the east valley sidewall. The hillside above the Saranagati Temple rises about 100 m in elevation. Slopes above the temple were burned at low to moderate severity. The likelihood of post-wildfire geohazards initiating on this slope is rated as low. Due to the temples position at the toe of the hillside the spatial probability is rated as moderate. The resulting partial risk is low.

A more detailed (level 3) assessment for properties in the Venables Valley, including Lot 17 is recommended to verify the hazard and risk to individual residences or any other occupied structures.

Post-wildfire geohazards affecting District Lot 19 (PID 003-594-742) in the Venables Valley (TNRD).

Hazard P(H)[1] = **High** Probability of Spatial Impact P(S:H)[2] = **Low to Moderate**
Partial Risk[3,4] = **Variable (Moderate to High)**

District Lot 19 is in the northern end of the Venables Valley and includes the northern end of Venables Lake. TNRD property information indicates that Lot 19 includes the following residential addresses: 4140, 4165, 4185, 4209, 4219, 4229 Bhaktivedanta Pl, 4812, 4852 Venables Valley Rd, 4087, 4089, 4169, 4088, 4180, 4228, 4641 Prabhupad Pl, 4240, 4221, 4280, 4285 Rathayatra Way, and 4277 Talavan Cres. There are numerous homes and outbuildings in the southwestern half of the property, as observed on satellite imagery, on the ground, and during an aerial reconnaissance flight. These structures all have different likelihoods of spatial impact based on their position relative to the steeper valley sidewall slopes or proximity to existing stream channels. Those which are located at the toe of steep slopes, adjacent to streams, or on alluvial fans have elevated spatial impact probabilities. Those which are located hundreds of metres away from steep valley sidewall slopes generally have lower spatial impact probabilities.

Vegetation burn severity was examined in two unnamed watersheds (Venables 4 and 5 on attached mapping) upslope of Lot 19. Almost all of Watershed 4 was burned and 72% of Watershed 5 was burned. Over 90% of Watershed 4 was burned at moderate or high severity and 67% of Watershed 5 was burned at moderate or high severity. These elevated proportions of moderate or high burn severity have the potential to significantly increase post-wildfire runoff and peak flows from these slopes. Elevated runoff rates may cause flooding downslope or trigger debris floods in defined channels. Residences in the northwest corner of Lot 19 are sufficiently far away from steep valley sidewall slopes, separated by hundreds of metres of gentle terrain or climbing terrain, that they are unlikely to be impacted by post-wildfire runoff hazards.

In the southwest corner of the lot one residence at 4277 Talavan Cres is located on the middle of a large fan. The structure was impacted by the fire. The likelihood of post-wildfire run off related hazard like overland nuisance flooding or debris floods emanating from the steep upper slopes on the west side of the valley is rated as high. The spatial impact probability to 4277 Talavan Cres is rated as moderate. The remaining properties are located further downslope at the distal edge of the fan or in the valley bottom where the probability of spatial impact is rated as low. The partial risk to 4277 Talavan Cres is rated as high. The partial risk to the remaining residences is rated as moderate or low.

As demonstrated, the partial risk ratings to various elements on District Lot 19 vary. A more detailed (level 3) assessment for properties in the Venables Valley, including Lot 19 is recommended to verify the hazard and risk to individual residences and any other potentially occupied structures.

Flooding, debris floods, or debris flows impacting Highway 1 from face units between Twaal Creek and Oregon Jack Creek (TNRD).

Hazard P(H)[1] = **Low** Probability of Spatial Impact P(S:H)[2] = **Moderate to High** Partial Risk[3,4] = **Low to Moderate**

East-aspect hillsides and face units in the Thompson River valley above Highway 1 were burned between Twaal Creek and Oregon Jack Creek. The area has numerous subtle and more defined watercourses. Apart from the larger drainages (i.e., Twaal and Oregon Jack Creek), few of these watercourses host regular streamflow. Some draws show signs of slope wash extending down towards the highway. These events emanate from bare mineral soil exposures located less than 200 m above the highway. These bare soil exposures are prone to erosion and transport by slope wash during periods of heavy rain. Most of the slopes that were affected by the fire were burned patchily and primarily at low severity with isolated areas of moderate or high burn severity. For this reason, the incremental increase in the likelihood of post-wildfire run off related hazards such as flooding, debris floods, or debris flows in draws, swales, or gullies that descend the face units to Highway 1 is rated as low. The probability of spatial impact to the highway is rated as moderate to high depending on the geometry of the drainage. The partial risk is low to moderate. Ministry of Transportation and Infrastructure (MOTI) should investigate the capacity of crossing structures along this corridor to ensure they are functioning as desired and capable of handling any potential increases in peak flow.

Post-wildfire run-off related hazards affecting Peq-Paq IR22 in the Venables Valley (CFIB).

Hazard P(H)[1] = **High** Probability of Spatial Impact P(S:H)[2] = **Moderate** Partial Risk[3,4] = **High**

Peq-Paq IR22 is in the north end of the Venables Valley at the base of a ~800 m rocky hillside (part of White Mountain) on the west valley sidewall. The upper slopes of the mountain are almost entirely bedrock with sparse timber. Steep mid-slopes of the mountain have colluvial soils and increasing tree cover. All the trees on the east aspect have been burned and the vegetation burn severity is mostly high. Post-wildfire rockfall, landslides, and run-off related hazards are anticipated on the heavily burned side slopes of the mountain. The likelihood of these hazards is rated as high. The northwest corner of Peq-Paq IR22 is located about 500 m away from the toe of the mountain separated by gently sloping concave or slightly irregular terrain. Post-wildfire landslides or rockfall will deposit at the base of the mountain prior to reaching the IR. Run-off related hazards like debris flows or debris floods have the potential to run out further across the gentler terrain but are generally anticipated to deposit prior to reaching Peq-Paq IR 22. The probability of spatial impact for these hazards is rated as moderate. The resulting partial risk is moderate.

A more detailed (level 3) assessment for Peq-Paq IR22 in the Venables Valley is recommended to verify the hazard and risk to the IR.

Post-wildfire geohazards affecting Section 10 (PID 014-497-247) in the Venables Valley (TNRD).

Hazard P(H)[1] = **High** Probability of Spatial Impact P(S:H)[2] = **Variable (Low to Moderate)** Partial Risk[3,4] = **Moderate to High**

Section 10 is in the north end of the Venables Valley. There is at least one residence in the middle of the lot and a secondary structure along the western lot margin ~100 m from the base of a moderate gradient hillside. The secondary structure is located on the southern margin of a large alluvial fan. The primary structure is in the valley bottom, off the main fan surface. Burn severity on the hillside and in the unnamed watershed above Section 10 is mostly high and the hillside is relatively steep. For this reason, the likelihood of post-wildfire runoff related hazards like nuisance flooding or debris floods in the defined channel above the fan is rated as high. The secondary building at the south margin of the fan and toe of the steeper hillside has a moderate spatial probability of impact. The primary building has a low probability of spatial impact. The partial risk is rated as high and moderate, respectively.

A more detailed (level 3) assessment for numerous properties in the Venables Valley, including Section 10 is recommended to verify the hazard and risk to individual residences or any other occupied structures.

Post-wildfire flooding along Venables Creek affecting the Blue Earth Forest Farm on Section 15 (PID 014-598-388) in the Venables Valley (TNRD).

Hazard P(H)[1] = **High** Probability of Spatial Impact P(S:H)[2] = **Variable (Low to Moderate)**
Partial Risk[3,4] = **Moderate to High**

Section 15 is located in the Venables Valley at the outlet of upper Venables Creek on the east side of White Mountain. The Venables Creek watershed upstream of Section 15 was extensively burned during the fire. Ninety-seven percent of the watershed was burned with over 70% of the watershed burned at high severity. This proportion of high burn severity is anticipated to have a significant impact on runoff timing and flow volumes. The likelihood of increases in post-wildfire runoff and peak flows is rated as high. Impacts to low-flows and flow timing should also be anticipated. Venables Creek appears to flow subsurface for most of the year near Section 15. No assessment has been conducted on the ground on the private property of Section 15. The probability of spatial impact to the structures on Blue Earth Forest Farm rating is estimated as low. These ratings are based on discussions with the property owner, observations of topography, and photos taken during a helicopter overflight.

A level 3 assessment is recommended for Section 15 to verify the upslope hazards and risk ratings for the residence and any other potentially occupied structures.

FURTHER ACTIONS:

A more detailed level 3 post-wildfire assessment is recommended to verify the hazard and risk for:

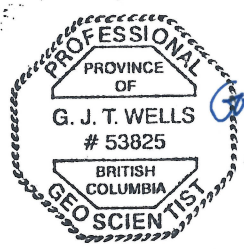
- Niceolton IR6 and Peq-Paq IR22 (CFIB).
- Private TNRD properties including potentially occupied structures in the Venables Valley: District Lot 383 (PID 003-594-769), Lot 384 (PID 003-594-793), Lot 17 (003-594-726), Lot 18 (PID 003-594-734), Lot 19 (PID 003-594-742), Section 10 (PID 014-497-247), and Section 15 (014-598-388).
- Murray Creek Road, Twaal Creek Road, and the Hilltop Campground (TNRD).

MOTI should assess the function and capacity of crossing structures along Highway 1 between Twaal Creek and Oregon Jack Creek to ensure they able to convey any potential increases in peak flows.

Licensees and MOF should review active logging roads to check that culverts are clear and adequately sized to convey post-wildfire flows for the next few years. If salvage logging is proposed within the Shetland Creek fire perimeter, site specific post-wildfire natural hazard assessments that also consider the cumulative impacts of harvesting and wildfire on peak flows are recommended. Any salvage operations within the fire (or downslope of fire-affected areas) are recommended to include rainfall shutdown criteria commensurate with the post-wildfire natural hazards and risk present to protect worker safety.

Water license holders should assess the need to conduct additional maintenance or upgrades of their water intakes.

SIGNATURE, SEAL, FIRM PRACTICE #:



2024-09-13

Reviewed by: Sarah Crookshanks, P. Geo
Permit to Practice: 1003022

ATTACHMENTS:

Appendix A,
Appendix B,
K70910 Shetland Creek Fire and Catchment Area Overview Map,
Vegetation Burn Severity Map
Venables Valley Maps (3).

Appendix A to PWNHRA Reconnaissance Level 2 Reports

Scope of Level 2 Reports

Reconnaissance (Level 2) reports are primarily intended to identify whether post-wildfire hazards are likely to occur and need detailed investigation to protect identified elements at risk. Identified elements at risk are generally limited to public safety and infrastructure. Reconnaissance reports may also be used to assess safety conditions for wildfire fighters. In some cases, the MOF District Manager or other MOF personnel may request assessments for non-standard elements at risk or for other reasons.

Definitions of Hazard and Risk

Wildfire may produce conditions conducive to a suite of hazards. Debris flows, debris floods, and floods are often the most important hazards, but other types of landslide hazards including rockfall, debris slides and earthflows can also occur in response to wildfire. Wildfire can also cause snow avalanches and may affect water quality, cause erosion and result in sedimentation. Terrain, watershed, and channel conditions that produce post-wildfire hazards may also produce similar hazards in unburned conditions; these hazards may be mentioned but are not evaluated in this report.

P(H), P(S:H) and partial risk are presented for each identified elements at risk. Multiple types of channel hazards (debris flows, debris floods, floods) may affect an element at risk. These hazards are ranked by severity, with debris flow as the most damaging and destructive and flood as the least damaging and dangerous, and ratings are given for the highest rating hazard that may affect an element at risk. For example, where a channel has the potential for a debris flow and an element at risk may be affected, the lower ranking debris flood and flood hazards are not rated, since discharge and velocity are likely to be less than for a debris flow. These processes may cause erosion or sedimentation that affects the element at risk. Hazards that are unlikely to affect an identified element at risk are not discussed.

Table A1 shows the annual probability ranges for qualitative definitions of P(H). The probability of the hazard occurrence is for the post-wildfire period of elevated hazard, which in many cases may be less than five years, but in some cases may extend for several more years.

Table A1. Qualitative descriptions of post-wildfire hazard likelihood, hazard criteria, and related quantitative probabilities.

Post-wildfire hazard rating	Description	Annual Probability Range
Very High	An event is expected to occur. Most of the catchment or face unit has burned with a significant proportion burned at moderate and/or high severity	>0.2
High	An event is probable under adverse conditions. Most of the catchment or face unit has burned with a significant proportion (i.e., >50 %) of terrain conducive to post-wildfire natural hazard initiation burned at moderate or high severity. Existing indicators of pre-fire terrain instability within stream channels, on fans or face units.	0.01 - 0.2
Moderate	An event could occur under adverse conditions. It is not probable but possible over a several year period. More than 20% of the terrain conducive to post-wildfire natural hazards in the catchment or on the face-unit has burned with moderate and/or high severity. Historic geomorphic indicators of instability are present.	0.002 – 0.01
Low	An event could occur under very adverse conditions. It is considered unlikely over a several year period. Only a limited proportion of the catchment or face unit has burned. Few or no signs of pre-fire instability present along stream channels, fans or face units.	0.0004 – 0.002
Very Low	An event will not occur or is conceivable though considered exceptionally unlikely. A limited proportion/none of the catchment was burned. No terrain instability indicators are present	<0.0004

Table A2 defines spatial impact to an element of risk. Post-wildfire event magnitude is considered when rating spatial impact.

Table A2. Post-wildfire spatial impact.

Likelihood of spatial impact	Description	Probability range
H	It is probable that the event will impact the element at risk.	>0.5
M	It is possible that the event will impact the element at risk.	0.5 - 0.1
L	It is unlikely that the event will impact the element at risk.	< 0.1.

Table A3 is a matrix which combines the hazard likelihood (Table A1) with the spatial impact likelihood (Table A2) to determine partial risk.

Table A3. Post-wildfire risk matrix partial risk matrix.

Hazard Likelihood P(HA) (Table 1)	Spatial Impact Likelihood (P(S:H)) (Table 2)		
	High	Moderate	Low
Very High	Very High	Very High	High
High	Very High	High	Moderate
Moderate	High	Moderate	Low
Low	Moderate	Low	Very Low
Very Low	Low	Very Low	Very Low

Report Standards

FLNRORD Land Management Handbook 69 is the primary standard followed in this report. LMH 69 describes the process to complete a detailed report. This reconnaissance report uses the framework of LMH 69 but does not follow it where detailed assessment procedures are described.

Land Management Handbook 69 Post Wildfire Natural Hazards Risk Analysis in British Columbia 2015
https://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh69.htm

Additional guidance is provided in the MOF SOG for PWNHRA and the 2014 FLNRO Landslide Risk Management Procedure.

Other professional guidance standards that may be used for the preparation of reconnaissance reports are listed below. These guidelines have similar report content to this reconnaissance assessment, but are for different purposes, have different levels of appropriate effort, and do not recognize the potential emergency nature of this reconnaissance assessment. These guidelines include:

EGBC Guidelines for TSA in the Forest Sector 2010
https://www.egbc.ca/getmedia/684901d7-779e-41dc-8225-05b024beae4f/APEGBC-Guidelines-for-Terrain-Stability-Assessments.pdf.aspx

EGBC Guidelines for Legislated Landslide Assessments 2010
https://www.egbc.ca/getmedia/5d8f3362-7ba7-4cf4-a5b6-e8252b2ed76c/APEGBC-Guidelines-for-Legislated-Landslide-Assessments.pdf.aspx

Legislated Flood Assessments in a Changing Climate in BC 2018
https://www.egbc.ca/getmedia/f5c2d7e9-26ad-4cb3-b528-940b3aaa9069/Legislated-Flood-Assessments-in-BC.pdf

Watershed Assessment and management of hydrologic and geomorphic risk in the Forest Sector
https://www.egbc.ca/app/Practice-Resources/Individual-Practice/Guidelines-Advisories/Document/01525AMW2ATQA5BSODHJAKBAGZDYTRL6FJ/Watershed%20Assessment%20a

nd%20Management%20of%20Hydrologic%20and%20Geomorphic%20Risk%20in%20the%20Forest%20Sect

Other standards may also apply, depending on the professional qualifications of the writer.

Statement of Limitations

Reconnaissance PWNH Level 2 assessments are typically done in constrained timelines where personnel, resources, data collection, and analysis methods are limited. Post-wildfire hydrogeomorphic hazards in BC are not well understood and therefore hazard and risk assessments are estimates only. While probabilities ranges are given in Tables A1 and A2, the state of the science in BC does not allow for precise assessments, particularly near the borders of classes. Numeric probabilities ranges do not imply precision.

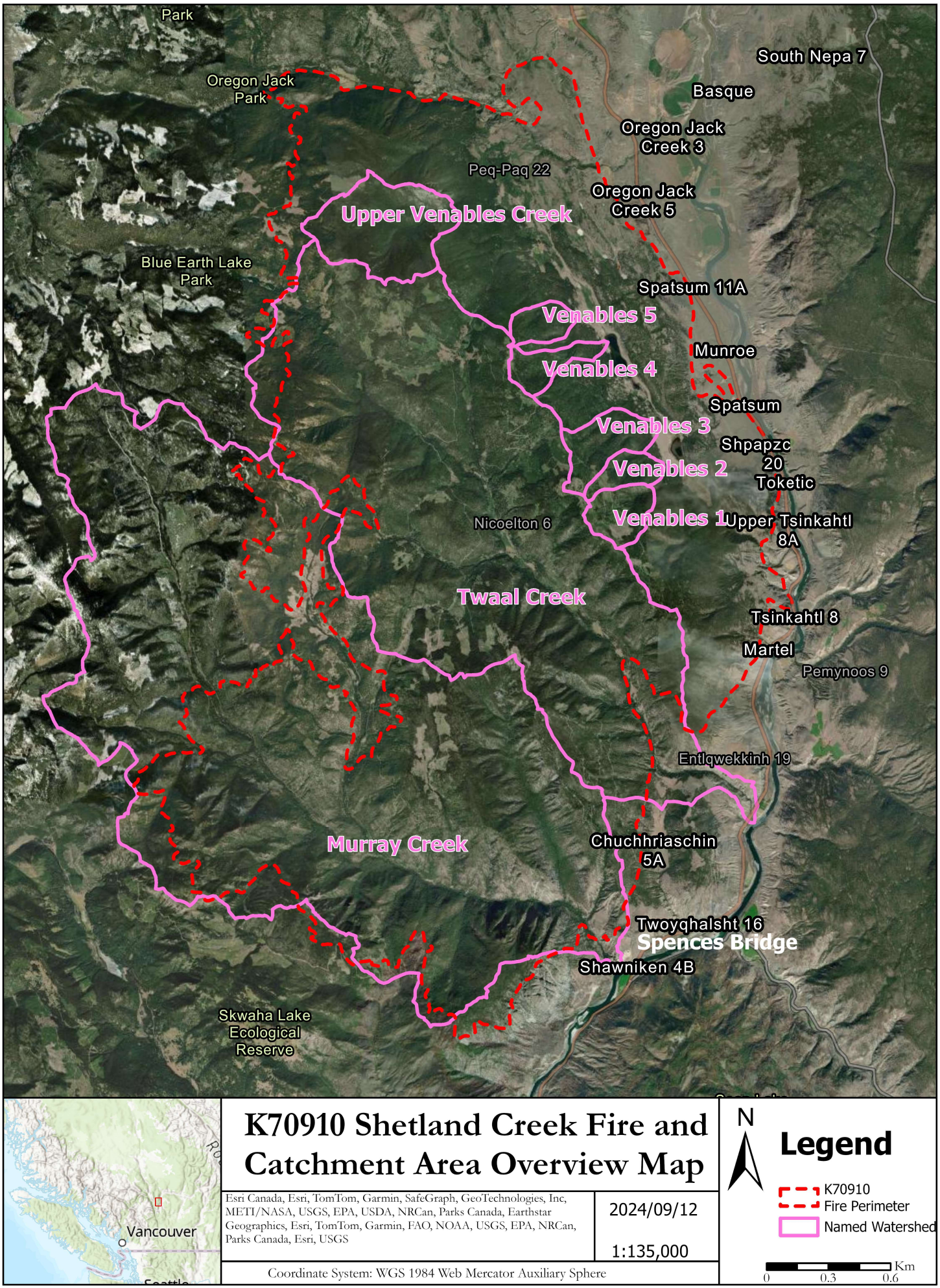
Identification of elements at risk relies on BC government data layers, satellite imagery, and perhaps an overview flight. BCWS and the MOF district office may provide additional information. No further confirmation of elements at risk was conducted.

Comments, conclusions, and suggestions contained in this reconnaissance assessment reflect my experience and judgement considering the information available to me at the time that this report was prepared and are considered appropriate for the reconnaissance nature of the review. The review has been carried out in accordance with generally accepted professional practices. This assessment and its contents are intended for the sole use of post-wildfire hazard management by provincial agencies, First Nation governments and local governments. I do not accept any responsibility for the accuracy of any of the data, the interpretation, or the conclusions contained or referenced in the report when the report is used or relied on for any other purpose than specified. Any such unauthorized use of this report is at the sole risk of the user.

Appendix B Water Licence Information

Licence	Client Name	Client Address	Purpose Use	Source Name	Parcel Identifier
C024068	Thompson Nicola Regional District	300-465 Victoria Street, Kamloops BC V2C 2A9	Waterworks: Local Provider	Murray Creek	
C034674	Cooks Ferry Indian Band	PO Box 130, Spences Bridge BC V0K 2L0	Irrigation: Private	East Murray Creek	
F003645	BC Parks Foundation	1800-510 West Georgia Street, Vancouver BC V6B 0M3	Irrigation: Private	Murray Creek	014567776
F009008	Cooks Ferry Indian Band	PO Box 130, Spences Bridge BC V0K 2L0	Domestic	Murray Creek	
C122683	Saranagati Village Holdings Inc	c/o Treasures Office, PO Box 99, Ashcroft BC V0K 1A0	Stream Storage: Non-Power	Venables Creek	003594734
C122683	Saranagati Village Holdings Inc	c/o Treasures Office, PO Box 99, Ashcroft BC V0K 1A0	Stream Storage: Non-Power	Venables Creek	003594742
C122683	Saranagati Village Holdings Inc	c/o Treasures Office, PO Box 99, Ashcroft BC V0K 1A0	Stream Storage: Non-Power	Venables Creek	003594793
C123150	Saranagati Village Holdings Inc	c/o Treasures Office, PO Box 99, Ashcroft BC V0K 1A0	Irrigation: Private	Venables Creek	003594793
C123150	Saranagati Village Holdings Inc	c/o Treasures Office, PO Box 99, Ashcroft BC V0K 1A0	Irrigation: Private	Venables Creek	003594769
C123150	Saranagati Village Holdings Inc	c/o Treasures Office, PO Box 99, Ashcroft BC V0K 1A0	Irrigation: Private	Venables Creek	003594734
C123150	Saranagati Village Holdings Inc	c/o Treasures Office, PO Box 99, Ashcroft BC V0K 1A0	Irrigation: Private	Venables Creek	003594742
C123150	Saranagati Village Holdings Inc	c/o Treasures Office, PO Box 99, Ashcroft BC V0K 1A0	Irrigation: Private	Venables Creek	003594726
C123151	Saranagati Village Holdings Inc	c/o Treasures Office, PO Box 99, Ashcroft BC V0K 1A0	Irrigation: Private	Venables Lake	003594793
C123151	Saranagati Village Holdings Inc	c/o Treasures Office, PO Box 99, Ashcroft BC V0K 1A0	Irrigation: Private	Venables Lake	003594769
C034431	Marilyn Mabel Lytton et al	PO BOX 23, SPENCES BRIDGE BC V0K 2L0	Irrigation: Private	Twaal Creek	013255681

C034673	Cooks Ferry Indian Band	PO Box 130, Spences Bridge BC V0K 2L0	Irrigation: Private	Twaal Creek	
C054977	John Zahradnik	PO BOX 182, SPENCES BRIDGE BC V0K 2L0	Domestic	Twaal Creek	004748433
C054977	John Zahradnik	PO BOX 182, SPENCES BRIDGE BC V0K 2L0	Irrigation: Private	Twaal Creek	004748433
C054978	Hilltop Gardens Farm Ltd.	BOX 119, SPENCES BRIDGE BC V0K 2L0	Domestic	Twaal Creek	012997005
C054978	Hilltop Gardens Farm Ltd.	BOX 119, SPENCES BRIDGE BC V0K 2L0	Domestic	Twaal Creek	012997013
C054978	Hilltop Gardens Farm Ltd.	BOX 119, SPENCES BRIDGE BC V0K 2L0	Irrigation: Private	Twaal Creek	012997013
C054978	Hilltop Gardens Farm Ltd.	BOX 119, SPENCES BRIDGE BC V0K 2L0	Irrigation: Private	Twaal Creek	012997005
C068153	Kenneth J Froese	11830 240TH ST, MAPLE RIDGE BC V4R 1M8	Irrigation: Private	Twaal Creek	014570122
C068154	Jens-Erik Skaaning and Kelly Deanne Skaaning	2219 North Massie Road, Christina Lake BC V0H 1E2	Irrigation: Private	Twaal Creek	014570203
C113784	C.P.G. Consulting Corp Limited	200-15240 56th Avenue, Surrey BC V3S 5K7	Domestic	Twaal Creek	004748433



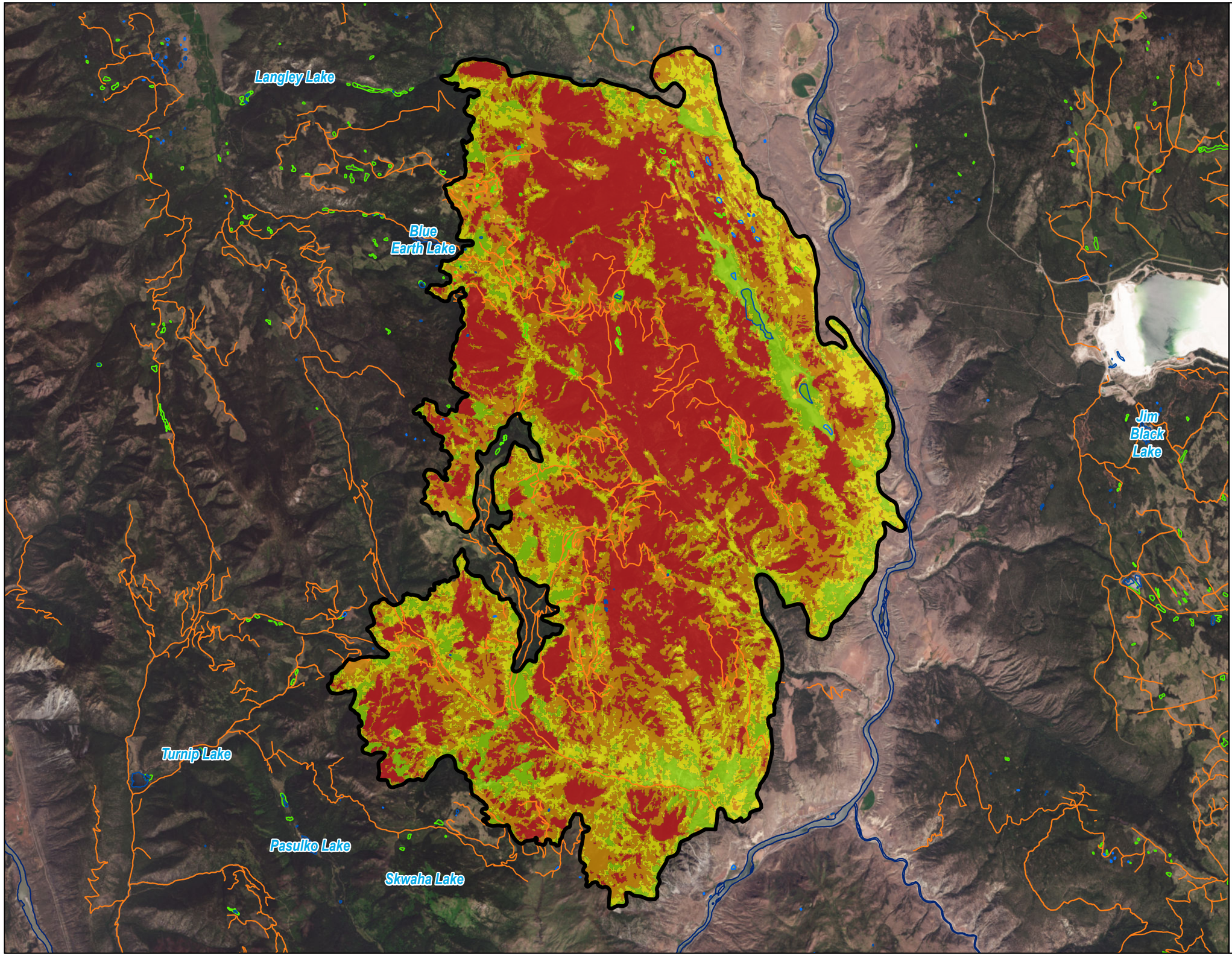
K70910 Shetland Creek Fire and Catchment Area Overview Map

Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, USDA, NRCan, Parks Canada, Earthstar Geographics, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NRCan, Parks Canada, Esri, USGS

2024/09/12

1:135,000

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere



K70910

Fire Year: 2024

Burn Severity Mapping

Fire Perimeter

Burn Severity

- High
- Medium
- Low
- Unburned
- Unknown

This burn severity mapping is created using a Differenced Normalized Burn Ratio (DNBR) calculation on pre and post-fire imagery which is classified into four Burned Area Reflectance Classification (BARC) categories. Default breakpoints are used for all timber types across BC and therefore may not accurately reflect field conditions. This is a same-year classification.

"Same-Year Classification" means that the burn severity mapping has been completed the same year the fire occurred (i.e. in summer/fall 2018 for 2018 fires).
"One Year Later Classification" means that the burn severity mapping has been completed using post-fire imagery from one year after the fire occurred (i.e. in summer/fall 2021 for 2020 fires).

Pre-Fire Image Date: 2024-07-08

Post-Fire Image Date: 2024-08-19

This fire is not yet extinguished. Fire perimeter and burn severity values are current as of map creation and above image date and may change without notice

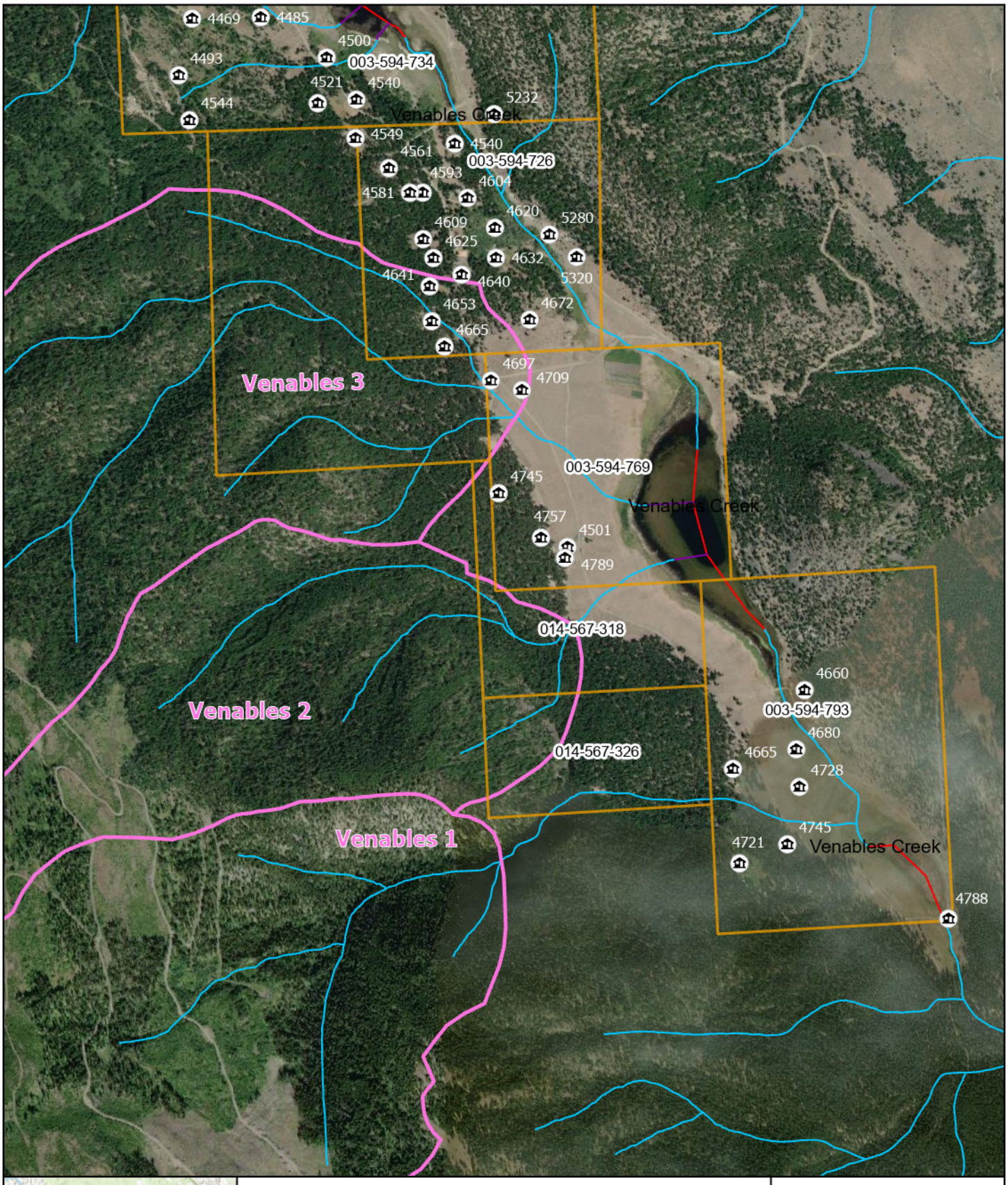
0 3 6

Kilometres

BRITISH COLUMBIA | Ministry of Forests

Last updated: 2024-08-20
Produced for: Ministry of Forests
Produced by: GeoBC Geospatial Services
Coordinate System: NAD 1983 BC Environment Albers

W:\srm\wml\Workarea\gshevche\burn_severity\burn_severity_2024.aprx [2024.08.20] [10:59:21]



Venables Valley Map 1/3

Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NRCan, Parks Canada, Esri, USGS, Maxar

2024/09/12

1:18,000

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere

N

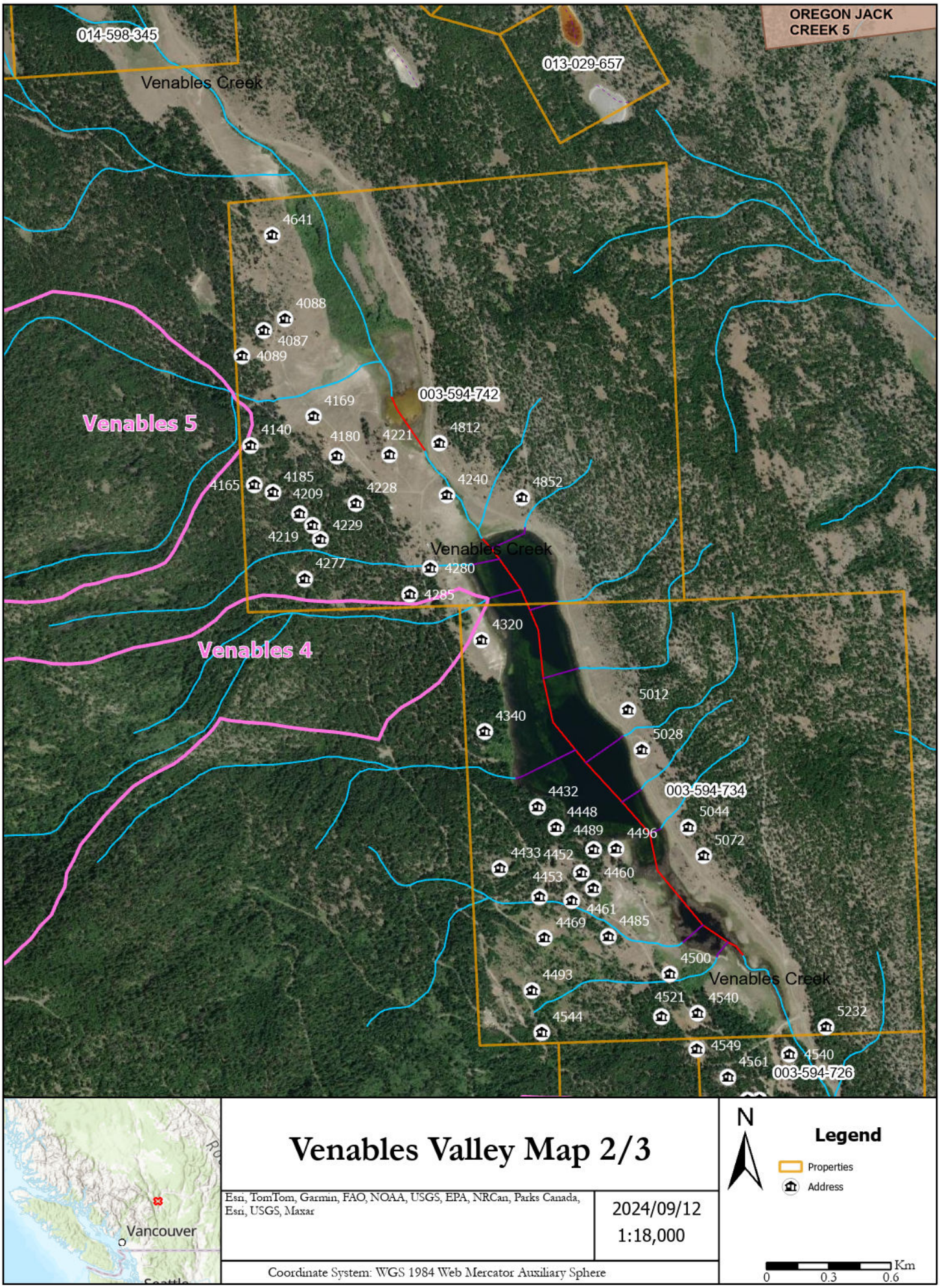
Legend

Properties

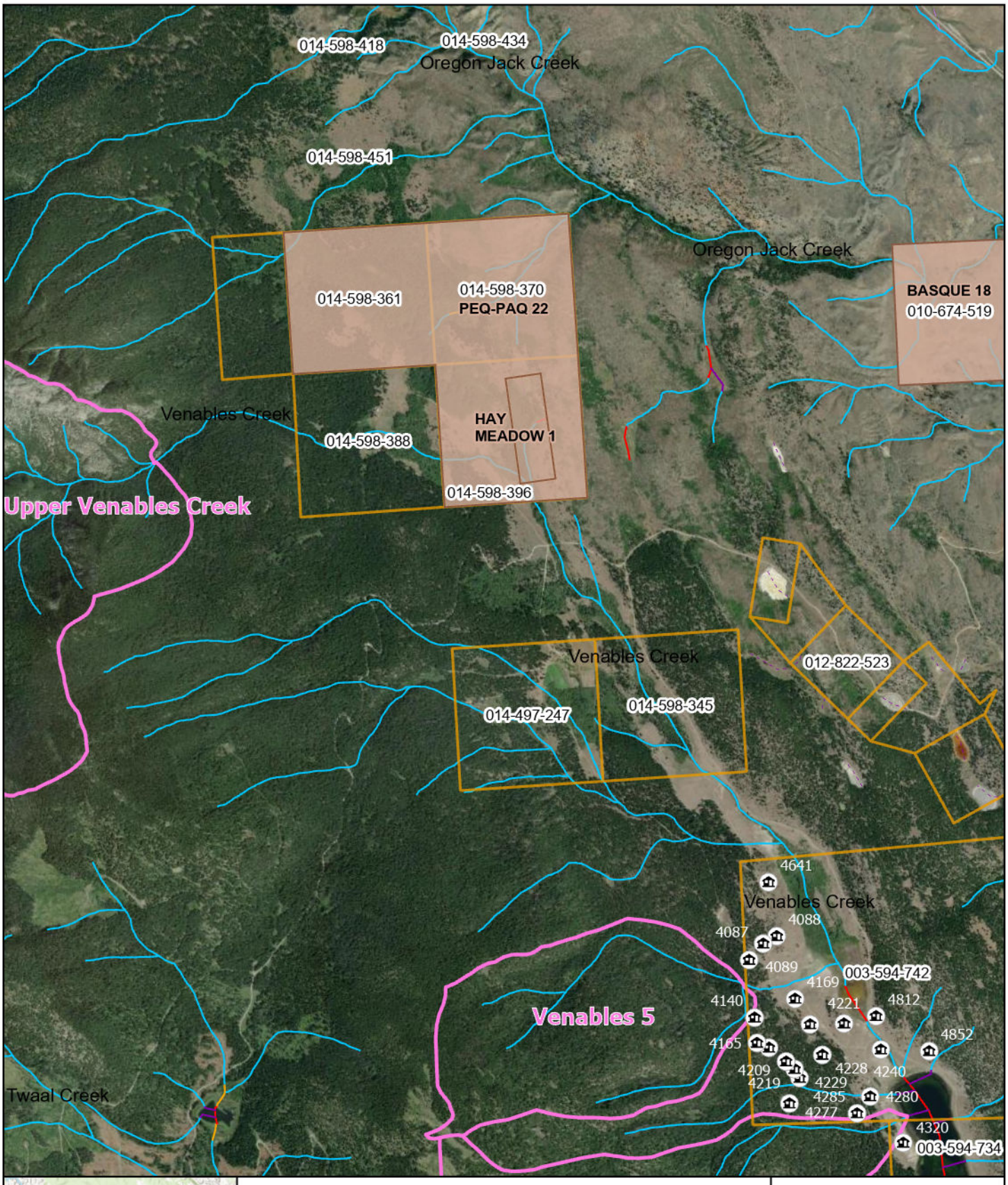
Address

Km

0 0.3 0.6



Venables Valley Map 2/3


014-598-418
014-598-434
Oregon Jack Creek
014-598-451
014-598-361
014-598-370
PEQ-PAQ 22
Oregon Jack Creek
BASQUE 18
010-674-519
Venables Creek
014-598-388
HAY
MEADOW 1
014-598-396
Upper Venables Creek
Venables Creek
014-497-247
014-598-345
012-822-523
4641
Venables Creek
4088
4087
4089
4169
003-594-742
4140
4221
4812
Venables 5
4852
4165
4209
4228
4240
4219
4229
4285
4280
4277
4320
003-594-734
Twaal Creek
Vancouver
Seattle
Venables Valley Map 3/3
Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NRCan, Parks Canada, Esri, USGS, Maxar
2024/09/12
1:30,000
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
Legend
Properties
Address
Indian Reserves
Km
0
0.3
0.6