Appendix 14-C

Limber Pine Distribution Assessment

Limber Pine Distribution Assessment

Crown Mountain Coking Coal Project

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1. Introduction

Limber pine (*Pinus flexilis*; Pf) is one of three five-needle pine species found in British Columbia (BC). It is a species of conservation concern, identified as a red-listed species[1] in BC and endangered[2] under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Keefer Ecological Services Ltd. (KES) was retained by NWP Coal Canada Ltd. to assess the health status, abundance, and habitat quality and quantity of this at-risk species within the Local Study Area (LSA) for the Crown Mountain Coking Coal Project (the Project) baseline studies that will be used to inform the environmental assessment (EA).

Limber pine grows on dry to moderately moist sites found in montane to subalpine habitats ranging typically from 1000 to 1500 m (900-1900 m less commonly) in British Columbia. Within the LSA, the typical elevation range for limber pine falls within the dry warm Montane Spruce subzone (MSdw) (MacKillop et al., 2018). Limber pine occurs most abundantly on steep, exposed south-facing slopes. It is associated with calcareous soils and limestone outcrops (Pigott and Moody, 2013). In Canada, limber pine reaches its northernmost extent near Field, BC (COSEWIC, 2014). Limber pine has been observed within two kilometers of the LSA, to the east of the south east corner of the LSA (Klinkenberg, 2019).

Limber pine is a long-lived species, surviving over 500 years and occasionally greater than 1,000 years, with cone production starting as early as 50 years, although it is often much later with the largest cone crops being produced decades after initial cone production (COSEWIC, 2014). Limber pine typically grows 3-15 m tall with a rounded to irregular crown. The form of the tree is dependent on local site conditions and competition levels. Trees take on a contorted, dwarfed form in many situations and a shrubby and sprawling form at treeline (Douglas *et al*., 1998).

Limber pine is associated with the Clark's nutcracker (*Nucifraga columbiana*). The Clark's nutcracker is the primary vector for seed dispersal. The Clark's nutcracker is heavily reliant on the seeds as they provide an important food source. In addition to the Clark's nutcracker, limber pine seeds are also a highly nutritious food source for bears and small mammals (COSEWIC, 2014).

[1] Red-listed species are defined by the BC Conservation Data Center (n.d.) as: Any species that is at risk of being lost (extirpated, endangered or threatened).

[2] Endangered is defined by COSEWIC as: A wildlife species that is facing imminent extirpation or extinction. COSEWIC wildlife species definition includes plants. https://www.canada.ca/en/environment-climate-change/services/committee-status-endangered-wildlife/wildlife-species-status-categories-definition.html

1.1 Threats to Limber Pine

Limber pine populations are a conservation concern as they are rapidly declining throughout Canada due to three main factors:

1) **White pine blister rust** – White pine blister rust is currently the main cause of population decline. White pine blister rust is caused by the fungus *Cronartium ribicola* which was introduced to British Columbia in 1910 from Europe (Pigott and Moody, 2013). The fungus requires alternate hosts from the *Ribes* (currant and gooseberry), *Pedicularis* (lousewort), or *Castilleja* (paintbrush) genera. Fungal spores are released from the alternate hosts in the spring and land on the needles of the limber pine tree (Pigott and Moody, 2013). The fungus enters through the needles, travels down the branch to the main stem where it girdles and eventually kills the tree (Pigott and Moody, 2013). In addition to direct mortality, white pine blister rust can also greatly reduce recruitment by reducing or preventing seed and cone production, thus reducing the fertility of the tree.

2) **Mountain pine beetle** – Although native, and having co-existed with limber pine for centuries, epidemic population levels of mountain pine beetle (*Dendroctonus ponderosae*) can kill and breed in limber pine. Trees already weakened by white pine blister rust may be more susceptible to mountain pine beetle attack (Alberta Whitebark and Limber Pine Recovery Team, 2014).

3) **Climate change** – The frequency, intensity and duration of drought is expected to increase due to climate change. This may lead to increased fire and susceptibility to pathogens. Regeneration failure and drought mortality are likely on the already moisture-limited sites that are home to limber pine (COSEWIC, 2014). Furthermore, climate warming contributes to greater mountain pine beetle populations (COSEWIC, 2014).

1.2 Limber Pine Recovery

Neither a national nor a provincial (BC) recovery strategy for limber pine has been produced. However, the province of Alberta has produced a recovery strategy that contains elements that may be applicable to the LSA (Alberta Whitebark and Limber Pine Recovery Team, 2014).

Key elements to limber pine recovery applicable to the LSA are:

i. Population monitoring (inventory and health assessment);

ii. Protection of limber pine stands and individual trees.

Depending on the outcome of the above two elements, further recovery activities (e.g., conserve genetic resources, screen, propagate and deploy rust-resistant limber pine) may be contemplated.

1.3 Objectives of Baseline Study

The objectives of this limber pine baseline study for the Project were to determine:

- The possible extent/distribution of limber pine within the LSA;
- Assess the health of limber pine within the LSA, if detected; and
- Record the reproductive status of limber pine within the LSA, if detected.

2. Methods

2.1 Study Area Description

The limber pine LSA spans 12,886 hectares (ha) and comprises the bulk of the Alexander, West Alexander and Grave Creek watersheds of southeastern British Columbia, north of Crowsnest Highway 3 (Figure 1). The LSA encompasses four biogeoclimatic units within the biogeoclimatic ecosystem classification (BEC) (MacKillop et al., 2018), which include the dry warm Montane Spruce subzone (MSdw), Kootenay dry cool Engelmann Spruce-Subalpine Fir variant (ESSFdk1), dry cool woodland Engelmann Spruce-Subalpine Fir subzone (ESSFdkw), and dry cool parkland Engelmann-Spruce Subalpine Fir subzone (ESSFdkp;). The known elevational range of limber pine extends from the MSdw to the ESSFdkw, with the most likely occurrence within the MSdw. Limber pine is most likely found within the Fd – Juniper (MSdw/102), Fd(LwPl) – Pinegrass (MSdw/103), PlFd – Juniper – Douglas maple (ESSFdk1/102) and BlPl – Grouseberry site series.

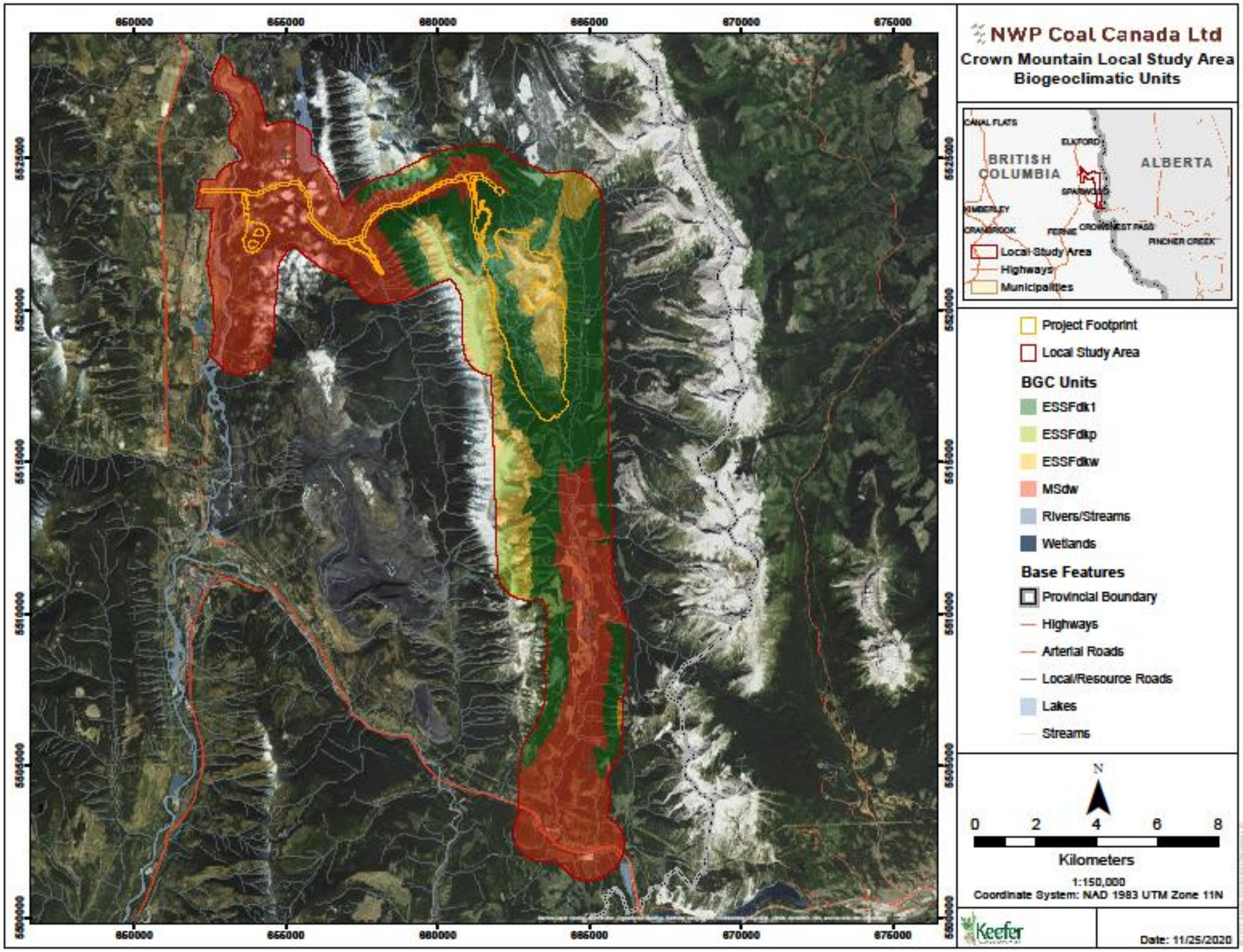

Figure 1. Local Study Area

2.2 Limber Pine Distribution

Limber pine was searched for during sampling for terrestrial ecosystem mapping (TEM; KES, 2018a), whitebark pine (KES, 2019a) and listed plant and ecological community studies (KES, 2019b). During all other ground surveys (e.g., proposed road and drill pad pre-clearing assessments, invasive plant sampling (KES, 2019c), soil (KES, 2019d) and terrain (BGC, 2019) mapping), the occurrence of limber pine would have been noted.

No standard distribution delineation method exists for limber pine. Thus, the potential distribution of limber pine throughout the LSA was delineated by identifying TEM polygons known to contain whitebark pine based on trees found through TEM field surveys in 2014, critical habitat surveys in 2018 and provincial Vegetation Resources Inventory (VRI) data. Limber pine is often found in similar habitats at a lower elevation (COSEWIC, 2014). Where no VRI data was available (i.e., Teck Private Land in the southern portion of Alexander Creek (about 2 km south of the confluence of West Alexander and Alexander Creeks and on the west side of the Erickson Ridge), TEM polygons were selected if they were predicted to contain limber pine based on biogeoclimatic classification, elevation, aspect, slope position and tree cover less than 50%. In some cases, TEM polygons were truncated if they extended above 1,900 m elevation (the upper elevation limit for limber pine in the study area). Polygons were adjusted to elevation limits to better represent areas where limber pine may be found. Accessible polygons were walked in transects by field staff.

Having detected no limber pine to summer 2019, a desktop exercise was performed to identify possible limber pine locations within the LSA based on BEC, elevation, geology and other habitat requirements that had not yet been visited by field staff. Forest cover data (provincial VRI), slope and aspect data and bedrock geology data (BC Geological Survey) were examined to determine other possible locations within the LSA where limber pine may be present and is ground accessible. These locations were then visited in the field during August 2019. As in all previous efforts, field staff walked transects across the identified polygons of potentially suitable habitat.

3. Results

3.1. Limber Pine Distribution

Accessible portions of the LSA have been extensively searched in conjunction with the TEM, whitebark pine, listed plant and ecological community and other ground surveys (e.g., proposed roads and drill pad assessments, soil and terrain mapping). No occurrences of limber pine have been observed. Further, no limber pine was detected in the VRI data.

The results of the 2019 desktop mapping exercise based on species-specific habitat requirements and bedrock geology indicated there were approximately six locations within the LSA that could be suitable for limber pine, are ground accessible and had not previously been assessed. Those areas identified as accessible by foot were visited in 2019 with no limber pine observed. Figure 2 displays portions of the LSA that have potential for limber pine occurrence based upon BEC terrestrial ecosystem mapping and ground samples where limber pine was searched for. Not all areas highlighted as potential limber pine habitat on Figure 2 contains suitable habitat due to additional habitat features important to limber pine being absent from some of the mapped areas and conversely there are areas within the LSA that contain suitable habitat that are not captured in Figure 2 due to issues of scale of mapping and limber pine being present on ecosystems other than those portrayed in Figure 2.

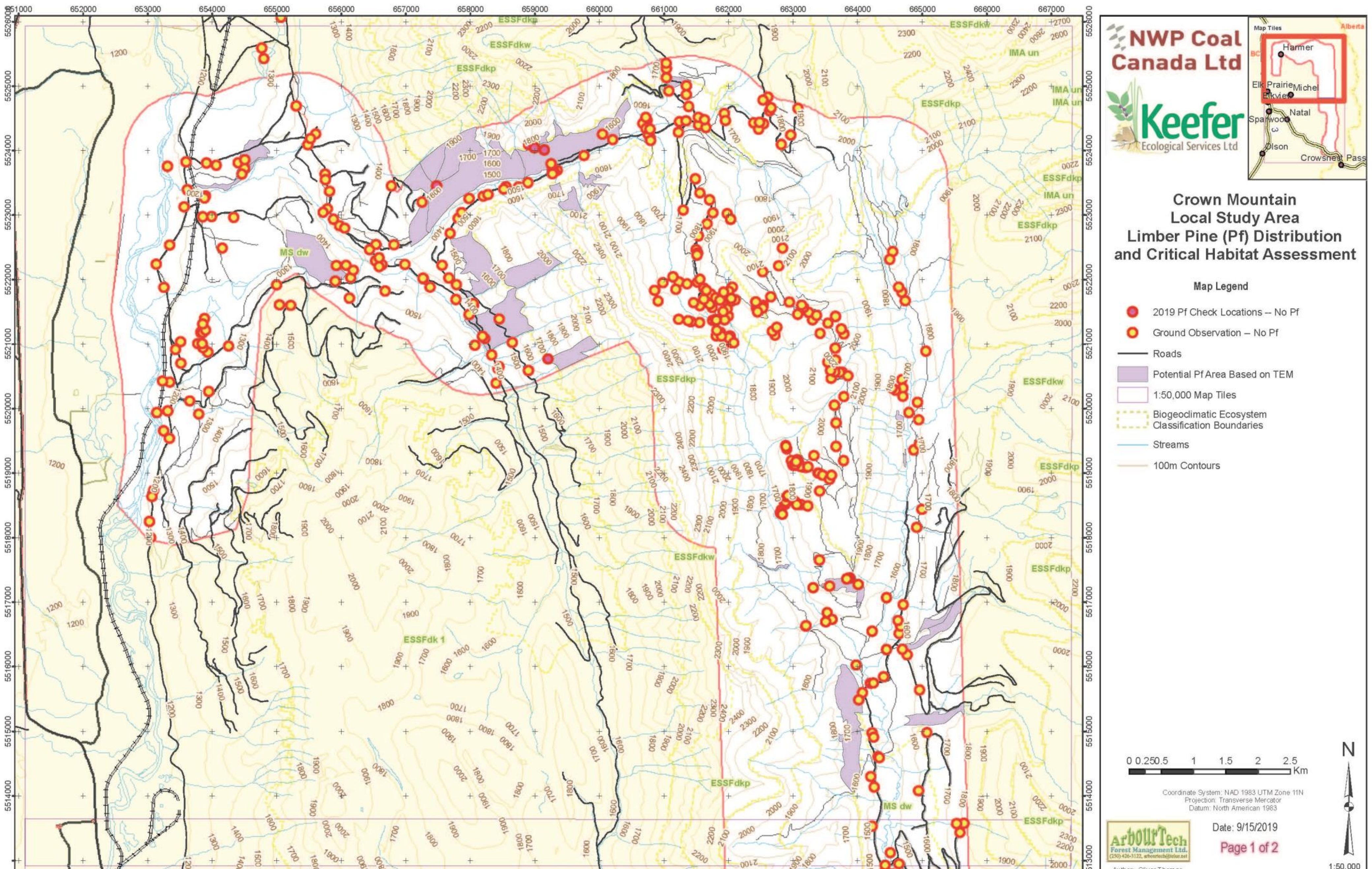

Figure 2. Potential Limber Pine Distribution and Survey Effort throughout the northern portion of the LSA

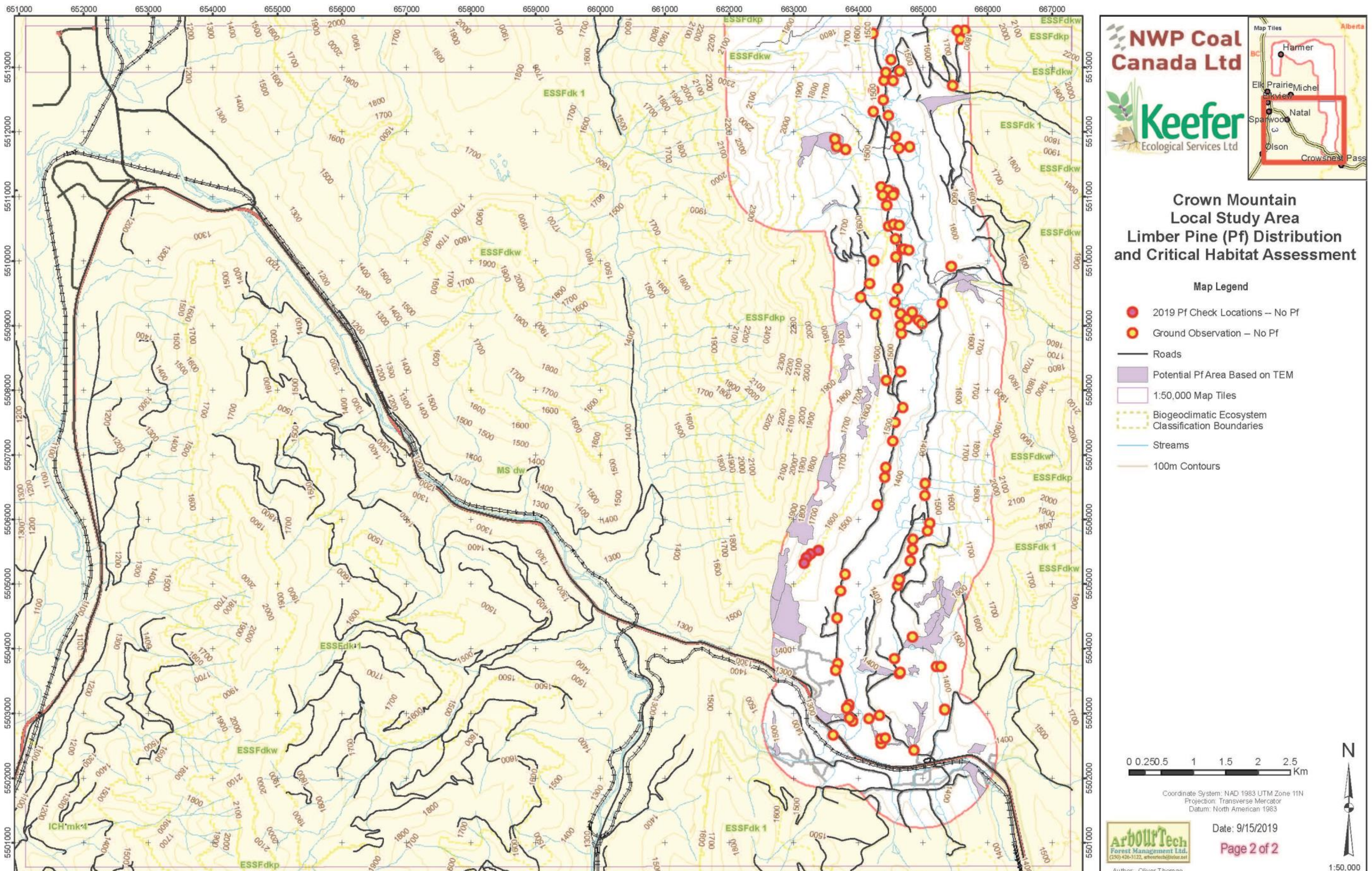

Figure 3. Potential Limber Pine Distribution and Survey Effort throughout the southern portion of the LSA

4. Discussion and Conclusion

While no limber pine has been found to date, it is likely that some occurrences exist in the LSA. The species has been found just south of LSA (Klinkenberg, 2019) in habitats similar to those found in the LSA. Calcareous bedrock is widespread within the LSA, with Grave Canyon, both sides of Erickson Ridge and the east slopes above Alexander Creek having potential for limestone, dolomite or calcareous sandstone occurrences (Grieve and Price, 1987) which may result in conditions favorable to limber pine. However, within a 100 m buffer of planned infrastructure, it is unlikely that limber pine occurs due to the thoroughness of search activities.

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