2021

Kicking Horse Canyon Habitat Enhancement Project – 2021 Final Report

PROJECT COL-F22-W-3541

PREPARED FOR: FISH AND WILDLIFE COMPENSATION PROGRAM

PREPARED BY: BRIAN GUSTAFSON, MSC, EP

CIRQUE ENVIRONMENTAL CONSULTING
BOX 2544 GOLDEN BC
V0A 1H0
FOR: GOLDEN DISTRICT ROD AND GUN CLUB

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Executive Summary

The Kicking Horse Canyon Habitat Enhancement Project funding provided by the Fish and Wildlife Compensation Program was put towards the project development phase to move forward on FWCP Upland and Dryland Action Plan priority action - COLUPD.SOI.HB.30.01 Ungulate habitat enhancements-P1. Treatment prescriptions have been developed and treatment boundaries have been delineated for 128 ha of ungulate winter range habitats with 91 ha being scheduled to start treatment in the spring of 2022. A baseline of habitat use data has been collected through pellet plot surveys in the Vacation Creek enhancement area and the use of GPS collar data in the Lower kicking Horse Canyon area. To mitigate concerns of invasive weed spread, a survey and treatment planning has occurred to address current infestations and potential points of weed spread in the project area. The Golden District Rod and Gun Club (GDRGC) has worked with stakeholders including government ministries, First Nations, landowners and industry to collaboratively progress this project.

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Introduction

The Kicking Horse Canyon Habitat Enhancement Project (The Project) took focal areas that were identified through 2020 FWCP project seed funding (COL-F21-W-3350) Golden Area Ungulate Winter Range Project Development (Gustafson, 2021) and moved forward to address project recommendations. The Project initiated an effectiveness monitoring program, identified project treatment unit boundaries, developed treatment unit prescriptions, conducted stakeholder engagements and submitted for provincial approval to move forward with on-the-ground enhancement works. The two focal areas targeted for enhancement work in this project are the southwest facing Rocky Mountain elk *(Cervis canadensis nelsoni)* winter range habitats at Vacation Creek and the low elevation – Douglas fir *(Pseudotsuga menziesii)* dominated Rocky Mountain bighorn sheep (Ovis canadensis) habitats in the Lower Kicking Horse Canyon. Both locations present challenges in moving projects forward, The Vacation Creek treatment unit clearing has committed funding through the Columbia Basin Trust Ecosystem Enhancement Program while the Lower Kicking Horse Canyon (KHC) habitats will take a variety of approaches to reach the end project goal.

The habitat enhancement projects being developed in this work are inline with the habitat-based actions in the FWCP Upland and Dryland Action Plans - COLUPD.SOI.HB.30.01 Ungulate habitat enhancements-P1 - for the Columbia Region.

Goals and Objectives

The long-term goals of this project are to enhance winter range habitats for Rocky Mountain elk in the Vacation Creek area and enhance bighorn sheep habitat in the Lower Kicking Horse Canyon. Through the evolution of developing of this project it has become apparent that theses two habitat enhancement areas need to be treated as two separate projects, moving forward; The Vacation Creek Project and the Lower Kicking Horse Canyon Project. The objectives of the projects are similar but require different treatment approaches, stakeholder involvement and effectiveness monitoring.

The long-term overarching project objectives:

1) Establish an effectiveness monitoring protocol to compare habitat use prior to treatment and post treatment;
2) Treat habitats to improve forage availability, sightlines and habitat connectivity.

The differing approaches to reaching these objectives are further discussed in the Results and Outcomes section of this report.

Study Area

This project development was focused on two areas of ungulate winter range habitats; Vacation Creek and the Lower Kicking Horse Canyon. Both of these project locations are within the traditional territories of the Ktunaxa and Secwépemc peoples. Figure 1 spatially represents the location of the planned habitat enhancement works. The identification of target areas for The Project is a result of a review of previously conducted conservation efforts in the Golden area. The Vacation Creek area was previously treated to enhance elk habitats and is in need of maintenance work to restore the values that are important to support elk winter range use. A feasibility study and on-the-ground planning work was

completed for the Lower Kicking Horse Canyon area in 2005 (Klafki & Pezderic, 2005) but enhancement work was never completed. This project builds off of previous efforts to improve habitats in areas of locally known importance for the target species (elk and bighorn sheep).

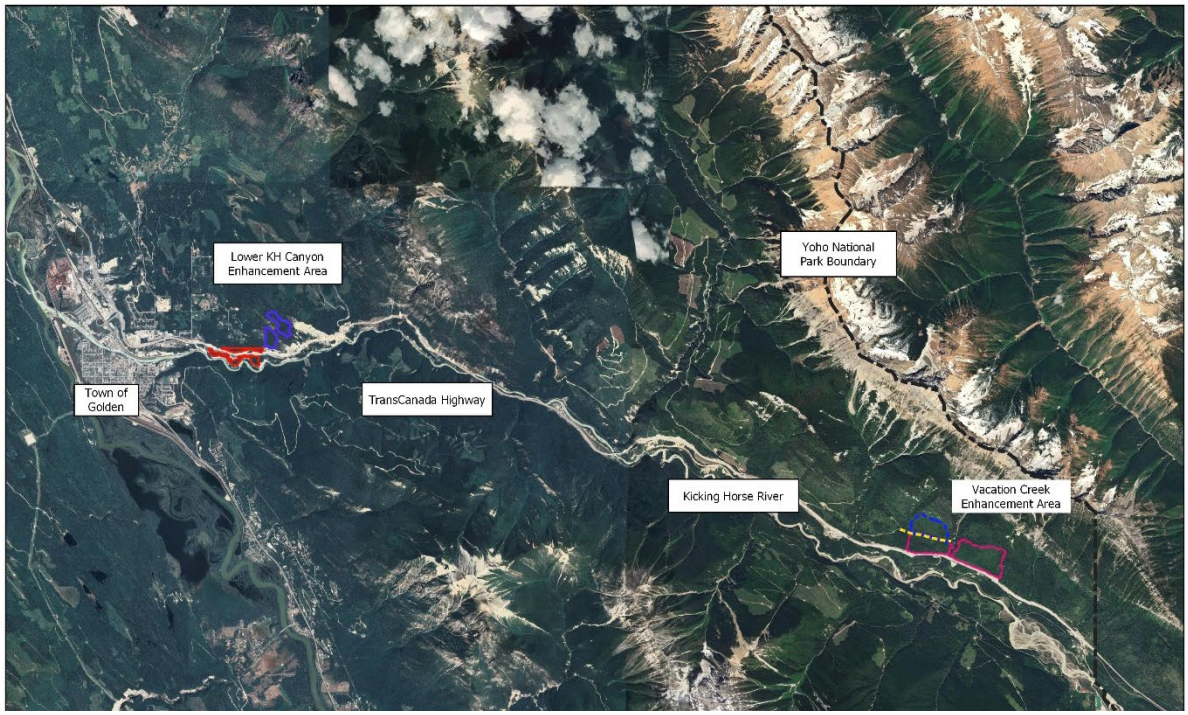

Figure 1: Overview map of project area with highlighted areas of focus.

Vacation Creek

This portion of The Project is located 25 kms east of the town of Golden and 6 kms west of the Yoho National Park boundary. This area is predominantly south facing and is within the Dry Cool Montane Spruce (MSdk) ecosystem which is suggested to provide areas of high value elk winter range habitats (MacKillop, D.J., A.J. Ehman, K.E. Iverson, 2018). The area targeted by this project was previously treated for habitat enhancement, in the mid-80s (Figure 2). Tree planting followed up the previous slash and burn treatment resulting in a stem density (1125-4600 stems/ ha) that prevents understory forage growth, predator detection and the movement of animals across the landscape (Nyberg, 1990)(Klafki & Pezderic, 2005). The target areas for treatment are immediately uphill of the TransCanada Highway.

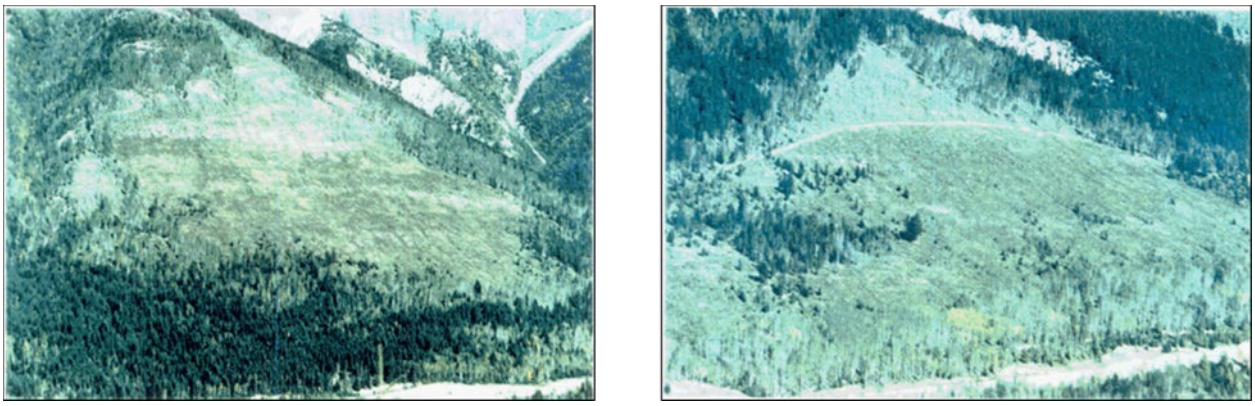

Figure 2: *Photos of Vacation Creek treatment units from Harvey Research Ltd. for MOTH (1994)*

Lower Kicking Horse Canyon

This portion of The Project boarders with town of Golden immediately to the east along the TransCanada Highway. The planned treatment units are located in the northeastern extent of the Dry Cool Interior Douglas Fir (IDFdk5) biogeoclimatic zone which can provide important browse species such as blue bunch wheatgrass *(Pseudoroegneria spicata)* for bighorn sheep. The IDFdk5 ecosystem has evolved with regular return low intensity fires that traditionally managed in-growth (MacKillop, D.J., A.J. Ehman, K.E. Iverson, 2018), the advent of fire suppression has resulted in thick in-growth producing conditions that limit understory forage growth and restrict sightlines important for detecting predator advances. The general landscape around the treatment area is presented in figure 3.

Figure 3: Frenchman's ridge sheep habitat. Enhancement areas are planned for below the TCH, Above the TCH and on the upper slopes.

Methods

Effectiveness Monitoring

Effectiveness monitoring was originally planned to be conducted in similar ways across both project areas but as the project evolved so did the approach to effectiveness monitoring. The target species for the Vacation Creek portion of the project is elk which lends well to conducting fecal pellet plots as elk are easily distinguished in comparison to the smaller pellets of other ungulates. The focal species in the Lower Kicking Horse Canyon is bighorn sheep and the fecal pellets of this species are much more difficult to differentiate between other species like deer *(Odocoileus sp.)* that use the same habitats. Bighorn sheep GPS collar data is currently being collected through another FWCP funded project (COL-F22-W-3516) that is being administered by the Golden District Rod and Gun Club. The collar data collected from the 4-bighorn sheep in the Kicking Horse Canyon herd will be used to compare bighorn habitat use prior to treatment and post treatment. Using collar data will show a clear change in habitat use which will not be confused with the use of other ungulates as could be the risk through using pellet count methods.

Vacation Creek

The project objective is to monitor the relative populations of ungulates within the project area pre and post-treatment, to indicate ungulate responses to habitat enhancement treatments most importantly elk. Ungulate species that may be present in the project area include: mountain goat *(Oreamnos americanus)*, Rocky Mountain elk, white-tailed deer *(Odocoileus virginianus),* mule deer *(O. hemionus),*

and moose *(Alces alces).* Figure 4 shows the grid pattern used to space out pellet count plots in the Vacation Creek treatment area.

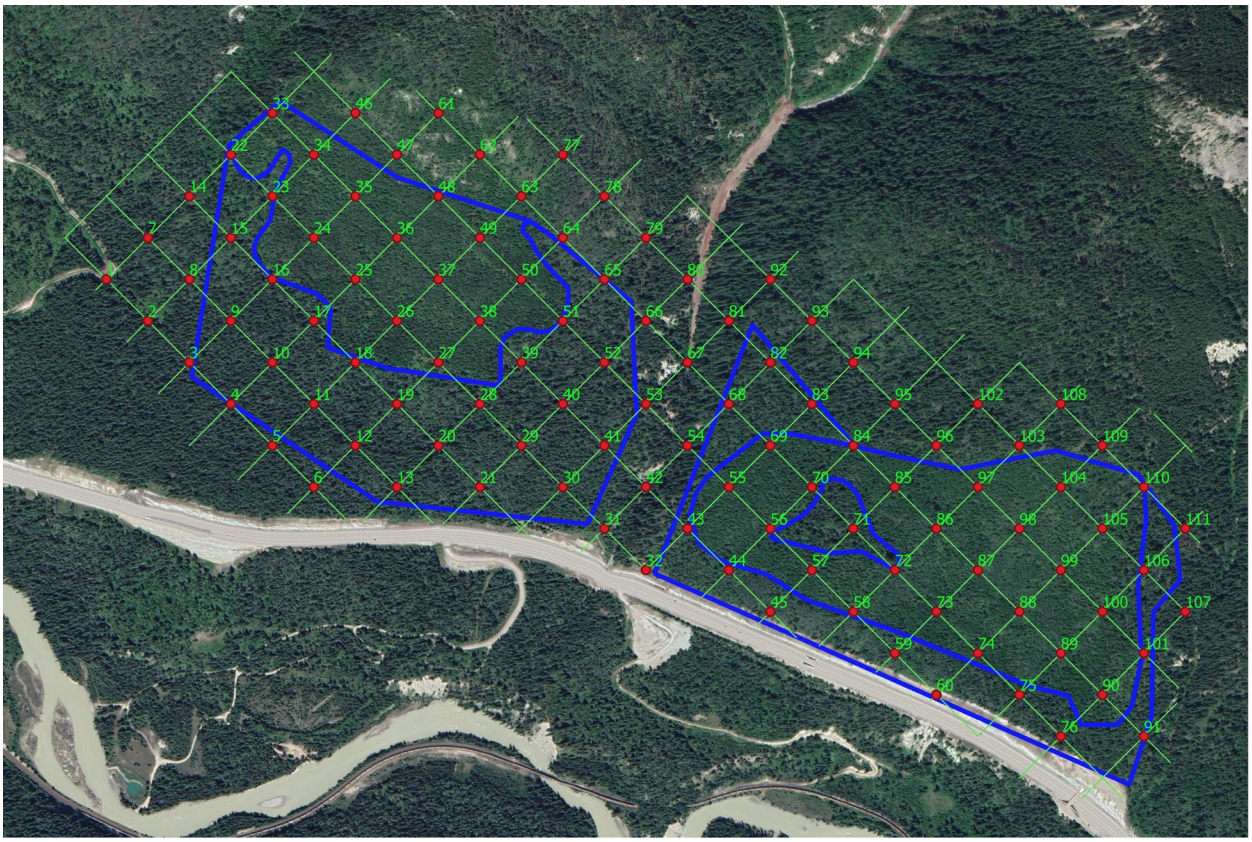

Figure 4: Sampling grid for fecal pellet plot surveys in and around the Vacation Creek treatment areas.

Data Collection

Fecal pellet group counts were determined to be a suitable, reliable and economical monitoring method for the project area. The interior Douglas fir IDFdk5, and montane spruce MSdk biogeoclimatic zones are relatively dry ecosystems (MacKillop et al. 2018), in which the decomposition rate of fecal pellets is greater than the annual sampling intervals. This method is commonly used to estimate relative abundance (or absolute abundance with greater margins of error), based on assumptions of a defecation rate and total days of occupancy on a winter range (Resources Inventory Committee, 1998). Bounded circular plots, as described by (Robinette et al., 1958), were chosen as the most suitable sampling design for the project area, as this method is known to balance cost and effort with precision and accuracy (Resources Inventory Committee, 1998).

For the current project, plot spacing was determined by applying the methodology used by Klafki (2001), following Krebs et al. (1994) and similar to Smith et al. (1969); as per the Resources Inventory Committee (1998) recommendation to use this methodology in British Columbia. The size of circular plot is dependent upon the density of pellet groups and the spacing of plots is dependent upon the primary species within the respective area being studied. We considered scaling the plot size and spacing based

on biologically meaningful spatial extents in relation to the primary species within the project area, elk, as compared to the study by Klafki (2001) which focussed on deer.

Errors associated with the pellet group count method have been documented by Van Etten and Bennett (1965), Neff (1968), Smith et. al. (1969), White and Eberhardt (1980) and Fuller (1991), among others.

Common sources of error include pellet-groups being missed by the observer, or pellet groups not being counted due to the observer incorrectly classifying the groups as having occurred prior to the count period. The former is minimized by the sub-plot sampling units, as they are clearly defined, marked for the duration of the project, relatively small areas and cleared after each count. The latter source of error is minimized by undertaking data collection prior to green-up from May to June, and by specifying to observers that all pellet groups lying on top of dead vegetation are to be counted. Reliability and precision of the method is documented by DeCalesta (2013).

Sample design overview:

- Linear transects with circular plots, spaced at regular intervals of 100-200 m along the transect, depending upon forest type as described by Klafki (2001).
- 100 m spacing was used in dense, aspen dominated, forest stands. This smaller spacing was used to maintain statistically comparable data between habitat types while accounting for a smaller spatial extent within the project area covered by this habitat type.
- 200 m spacing was used in open, Douglas fir dominated, forest stands.
- Each plot is comprised of five circular sub-plots (sampling units), each with a radius of 1.78 m and an area of 10 m2, arranged with a sub-plot in the centre (marked with a stake) and four surrounding that sub-plot at 10 m spacing in each of the cardinal directions, as indicated in the diagram by Klafki (2001), Figure 5.
- Klafki (2001) used the sub-plot methodology to balance an increased sampling efficiency (Neff, 1968) while minimizing the variance of estimates (Ryel, 1971).

Each grouping of fecal pellets within a sub-plot is counted and classified by species, or potential species if it is indiscernible due to similarities in fecal pellet appearance between species.

- A pellet-group is defined as five or more pellets in a group.
- If five or more pellets of group is within the respective boundary, it was counted.
- Plots are counted and cleared each year.
- The data is preferably collected in May or June, prior to vegetation green-up obscuring observation of pellet groups.
- All pellet groups lying on top of dead vegetation are counted.

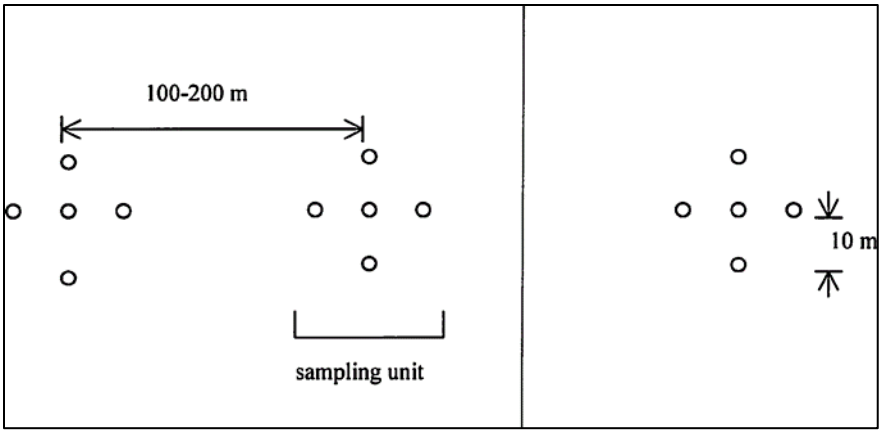

Figure 5: Configuration of sub-plots within each pellet group count plot. Figure taken from Klafki (2001), Figure 3, p. 9.

As recommended by the Resources Inventory Committee (1998), transect lines were oriented to cross drainages diagonally, and cross varying slope aspects and altitudinal zones in order to encompass the topographical variation within the project area.

Data Analysis

Habitat use is estimated by the mean of pellet-group counts per plot and habitat class for each species (or species group). Trends in habitat use over time may be detected by temporal changes in pellet-groups per habitat class.

Since Neff (1968) described the pellet group count method, it has been established by several authors that observed pellet-group data from elk, mule deer and white-tailed deer fit a negative binomial distribution based on two parameters: the mean 'm' and a positive exponent 'k'. The value of 'k' is related to the distribution of pellet-groups across the landscape, such that with a clumpier distribution 'k' approaches zero and with a more random (Poisson) distribution 'k' approaches infinity. Initial studies that used the pellet-group count method assumed a common 'k' value in order to estimate the means between populations. Then in 1980, White and Eberhardt employed computer programming to develop a method, and a set of FORTRAN subroutines, for estimating the mean number of pellet-groups for different populations without assuming a common 'k' value. More recently, Mandujano (2014) developed a semi-automatic computing procedure in Microsoft Excel, called PELLET, for estimating population density in different habitat types. We recognize the merits of this semi-automated computing approach in calculating population density by assuming that density has a probabilistic distribution and therefore we have chosen to use this method for the current project. PELLET takes into account a range of possible defecation rates, rates of fecal decomposition, and the spatial pattern of the pellet-group distribution. Mandujano's (2014) approach does not subjectively determine one value for each parameter and it accounts for uncertainty in the number of individual deer estimated by the pellet group-count.

Lower Kicking Horse Canyon

The Golden District Rod and Gun Club (GDRGC) with support from the FWCP, the Ktunaxa Nation Council (KNC), Ministry of Transportation and Infrastructure, Ministry of Forests Lands Natural Resource Operations and Rural Development, Parks Canada and the Wild Sheep Society of BC has been monitoring sheep activity with GPS collars since 2019. Figure 6 displays collaborative efforts in sheep monitoring in the Kicking Horse Canyon.

Figure 6: Collaborative efforts collaring sheep between MFLNRORD, Ktunaxa Nation Council, Parks Canada and the Golden District Rod and Gun Club (Photo: Hillary Evans, Dec. 6, 2021)

Collar data will be used to show the effectiveness of treatments in the Lower Kicking Horse units through the analysis of habitat use. The long-term goals of this project are to stabilize the KHC bighorn sheep populations by mitigating the current downward trend of this population. Through the GDRGC and KNC efforts to the monitor this herd, collisions between vehicular traffic and sheep are noted to be the most prevalent limiting factor for this herd with 5 vehicle related mortalities in a year span between 2020 and 2021. Mitigations through habitat enhancement are intended to promote habitat use away from the TCH corridor by improving forage availability in habitats away from the TCH and improving habitat connectivity, also away from the TCH corridor. Habitat use comparisons through GPS collar location analysis pre and post treatment will show if sheep are lured away from forage zones near the highway corridor and if increased connectivity in these habitats will change habitat use patterns over time. A home range analysis will show expanded habitat use if it occurs as expected post treatment. Additional metrics that will be used over time to determine project success will be the mortality statistics of the herd and the over all population of the herd. As previously mentioned, the long-term goal is to stabilize the population of this herd through the mitigation of losses. So, a reduction of annual loss in this herd and consistent or growing population would also support that this project was successful.

There are a number of factors that are at play when looking at the habitat conditions for this herd, most notably, the current upgrades to the TCH through the middle of this herd's home range. Wildlife exclusion fencing is planned to be installed for the length of the TCH that bisects the KHC. This exclusion fencing is expected to substantially mitigate losses to this herd through vehicle collisions but is also expected to increase the fragmentation of habitats above and below the TCH and fragment seasonal habitats from the east and west portions of the KHC.

A total of 7 GPS collars have been deployed in to the KHC herd. With three losses and the addition of two new collars in December of 2021, there are currently 4 active collars. Table 1 below summarized the collar deployments in the herd.

Table 1: Summary of collaring in the KHC herd. Orange highlights identify mortalities while blue indicates rams and red indicated ewes.

Collar Id	Collar Date	Sex	Age at time of capture	Status
34087	March 27, 2019	F	4	Active
34091	March 27, 2019	F	6+	Train mortality
36002	May 14, 2019	M	7	Highway mortality
36003	May 14, 2020	M	4	Train mortality
36006	May 14, 2020	M	2	Active
80569	December 6, 2021	F	3	Active
80570	December 7, 2021	M	3	Active

Treatment Prescription Development

The Project initially kicked off with establishing plots that sampled the forest structure in the planned treatment units in both the Vacation Creek and Lower KHC. These plots measured stem density, species composition and collected site data used for ecosystem classification. These data in conjunction with professional judgement assisted in the development of the treatment prescriptions that will be employed in these treatment units. The condition in the two project areas differ in forest structure and thus differ in the approach needed to achieve targets.

In the Vacation Creek portion, treatment work will involve manual brushing and spacing paired with piling and burning of waste. The Lower KHC treatment units will use a combination of commercial forest harvest techniques and hand work to achieve the goals of treatment. Brian Amies, RPF, worked with the GDRGC to complete treatment prescriptions for the Vacation Creek area and portions of the Lower KHC as well. Both treatment areas are within Louisiana Pacific's forest tenure area in the Golden Timber Supply Area, prescription development considered LPs interest in harvesting in the areas.

The development of treatment prescriptions in the Vacation Creek area considered current forest structure and long-term goals for the area that would balance the need for forage production and snow

interception. Snow depth is one of the most limiting factors in ungulate winter range habitats (Poole & Mowat, 2005) so the goal in prescription development is to open the forest enough to allow for light penetration to stimulate forage growth while maintaining enough crown cover for snow interception. The primarily immature forest in the Vacation Creek treatment area is very dense in areas (up to 4200 stems/ha) and has a diversity of tree species including Douglas fir *(Pseudotsuga menziesii),* trembling aspen *(Populus tremuloides),* paper birch *(Betula papyrifera),* and Engelmann spruce *(Picea engelmannii).*

Alike the Vacation Creek units, the development of clearing prescriptions for the Lower KHC area also needed to focus on the balance of snow interception and creating openings to stimulate forage growth. The Lower KHC units differ from the Vacation units in the presence of mature forests. The mature forests in the Lower KHC units are primarily Douglas fir and require a more mechanical approach to reach target forest structure and recover merchantable timber. The GDRGC worked with RPF, Brian Amies, Pioneer Forest Consulting and planning staff from Louisiana Pacific to reach mutually beneficial treatment options within the harvestable portions of these treatment units. There are portions of the Lower KHC treatment units that will require manual hand work as the removal of merchantable timber is not economically feasible or overly required to reach target stand structure.

Delineation of Treatment Units

Treatment units were delineated in the field using the knowledge of limitations of the treatment methods that are planned to be implemented and the general goals of the units. Where hand or manual work is planned, restrictions are much less where as in locations of planned mechanical work or commercial forestry approaches are taken, the limitations are defined by the operational constraints of the machinery. Forestry professionals, Pioneer Forest Consulting, were contracted to delineate the boundaries of the treatment areas based on the planned treatment methods.

Noxious and Invasive Weeds

The identification of areas of with established noxious or invasive species was a priority in this phase of the project understanding that disturbance work, such as forest thinning, and the moving of personnel and equipment can contribute to the spread of weeds. The Columbia Shuswap Invasive Species Council was contracted to conduct surveys of key areas in the project area that could have infests of species of concern. Surveys were conducted to document areas of concern to prioritize treatment and mitigate proliferation in to the enhancement area.

Stakeholder Engagements

This project has gone through many stages of development and funding applications, engaging landowners, government, First Nations, industry and other land users has been a top priority throughout the process. Some stakeholders are consistent across the project areas and some are location specific. The Lower KHC project area has private land owners where the Vacation Creek project area does not have any land owner concerns. Engagements are ongoing, particularly in the Lower KHC portion of The Project where stakeholders are more plentiful. Stakeholders include:

- Shuswap Band
- Ktunaxa Nation Council
- Ministry of Transportation and Infrastructure

- Louisiana Pacific
- Various neighbouring land owners
- Ministry of FLNRORD
- Wildsight Golden

Results and Outcomes

The next phases of this project have been funded to some extent and the portions that have not been funded are under continual development to reach enhancement targets. Effectiveness monitoring will continue to be a priority for building a dataset that can imperially determine if this project is successful over time. Completed layout of treatment units and developed treatment prescription have been used to gain approval to proceed with treatment in the Vacation Creek units and will be used to reach agreements with stakeholders and proceed with permitting in the Lower KHC units. A major concern with this work is the proliferation of invasive species. The inventory and mapping completed in 2021 will assist in mitigating invasive species concerns in to the future phases of The Project.

Effectiveness Monitoring

Vacation Creek

The overall average number of pellet groups in the immature mixed forest type was 1.08, which was the greatest amount observed in any of the forest types. The immature mixed forest type accounted for 58.6% of all plots and covered plots with the greatest occurrence of elk pellet groups within the study area. The prevalence of elk pellet groups was 12 times greater than any other species' within this forest type.

The immature deciduous forest type was the least common amongst the plots, with only 2.7% of plots falling within this forest type. The second highest quantity of pellet groups was recorded in the immature deciduous forest type, with an average of 0.67 pellet groups per plot, equally comprised of deer and elk pellet observations.

The immature conifer forest type accounted for 4.5% of all plots. An average of 0.6 pellet groups were observed in this forest type, irrespective of species, with an equal proportion of deer, elk and goat observations.

The greatest quantity of pellet group observations was recorded in the mature mixed forest type, with an average of 0.93 pellet groups per plot, irrespective of species. The most prevalent species observations was 0.67 elk pellet groups per plot within this forest type.

The mature deciduous forest type comprised 4.5% of the plots within the study area, with an overall average of 0.2 pellet groups per plot. Pellet observations were only made at one of the 5 plots of this forest type.

The mature conifer forest type covered 17.1% of the plots within the study area. The lowest average number of pellet groups was recorded within this forest type, with 0.14 pellet groups per plot, comprised of deer and elk pellet observations. Many elk pellet groups were observed between plots and subplots within the mature conifer forest type.

Lower Kicking Horse Canyon

As of March 29, 2022, 18,363 location points have been collected across the 7 deployed collars in the KHC herd. Figure 7 displays the spatial distribution of collected location data to date. No analysis has been completed on this data set yet to establish pre-treatment habitat use patterns. This analysis will be completed at a later date. Without filtering for error and inaccurate locations, the points displayed in figure 7 are highly concentrated along the TCH corridor.

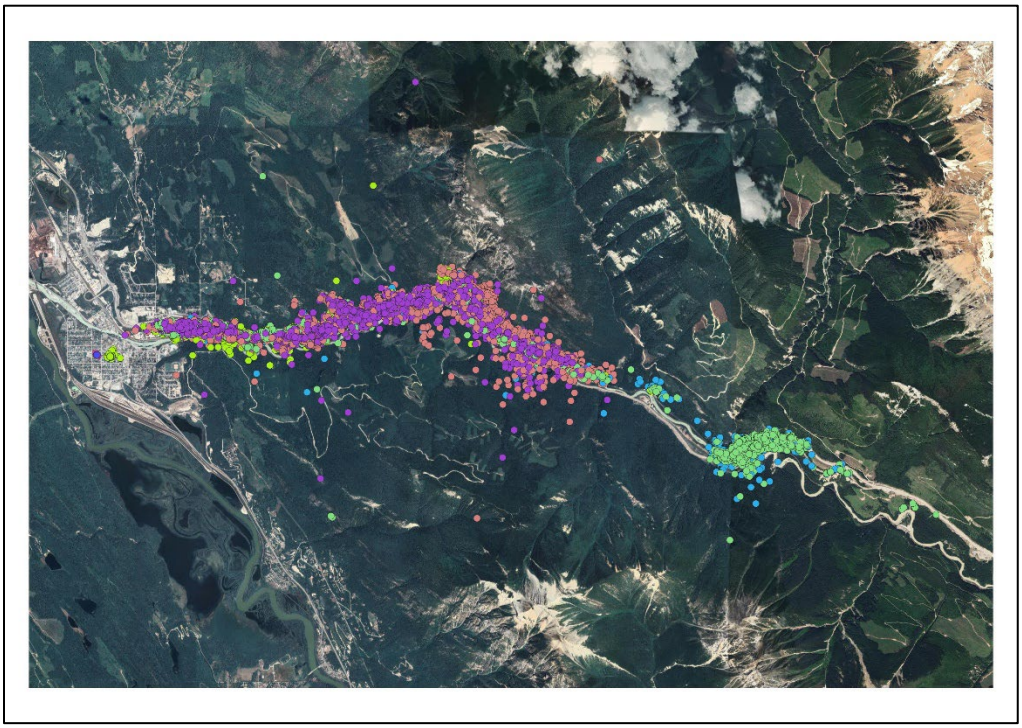

Figure 7: Unfiltered distribution of collar data points collected on BHS habitat use in the KHC. Distribution extends from the town of Golden to the West to Hunter Creek in the East. Different colored dots represent the different collared individuals.

Treatment Prescription Development

Vacation Creek

On the ground enhancement work for the Vacation Creek treatment units has been funded through the Columbia Basin Trust Ecosystem Enhancement Program and is to be administered by the GDRGC. Knowing that the funding is in place to move to the next phase of this project, provincial approval to conduct enhancement work has been sought. Following the completion of treatment prescription development, the prescriptions were forwarded to the Shuswap Indian Band and the Ktunaxa Nation Council for review and comment. After adjustments the final agreed upon prescriptions were then appended to a timber cash sale through the MFLNRORD. Approval has been granted and enhancement works are planned to commence in the Vacation Creek area in the spring of 2022. Approved treatment prescriptions are presented in Appendix A.

A wildfire was ignited and burned through a portion of the Vacation Creek treatment area in the summer of 2021, delaying some field works and the development of prescriptions for a portion of the

original planned treatment area. The GDRGC plans to work in collaboration with LP and the MFLNROD to find a suitable approach to enhancement in the burned portion of the planned enhancement area. Potential treatment options in burned area include tree planting, native grass seeding, brushing of patches of dense residual burned stems and potentially, no treatment.

Lower Kicking Horse Canyon

As previously mentioned, the treatment of habitats in the Lower KHC portion of The Project require a varied approach to remove mature timber and to remove areas of thick immature forest in-growth. The development of harvest units containing mature and merchantable timber has evolved in collaboration with LP, the forest tenure holder and land owners. Treatment prescriptions have been prepared for these units but are currently being provided to stakeholder for review and comment. Preliminary plans for these units are to progress with the development of forest harvest polygons in collaboration with landowners and LP in the fall/winter of 2022. Further funding is required to move forward with hand/manual treatments in this portion of the project. Funding will be pursued following the completion of appropriate stakeholder agreements and treatment prescription approval. Treatment of polygons requiring hand work is preliminary planned for the fall/winter of 2023.

Delineation of Treatment Units

Treatment units in both the Vacation Creek and Lower KHC locations have been delineated and GPS traversed to the standards of forest harvests areas prepared by a forest licensee. In order to ensure these standards were met, Pioneer Forest Consulting was contracted to the GDRGC.

Two units were delineated for treatment in 2022 in the Vacation Creek area. The layout of these treatment units followed completion of wildfire fighting activities in the area. The extent of the wildfire in this area is displayed in figure 8. As shown in the map below, a portion of the originally planned treatment area was burned by this wildfire. Treatment options will be explored for the burned portion of the planned treatment are in the summer of 2022. A total of 90.66 ha was laid out for treatment in this phase of The Project.

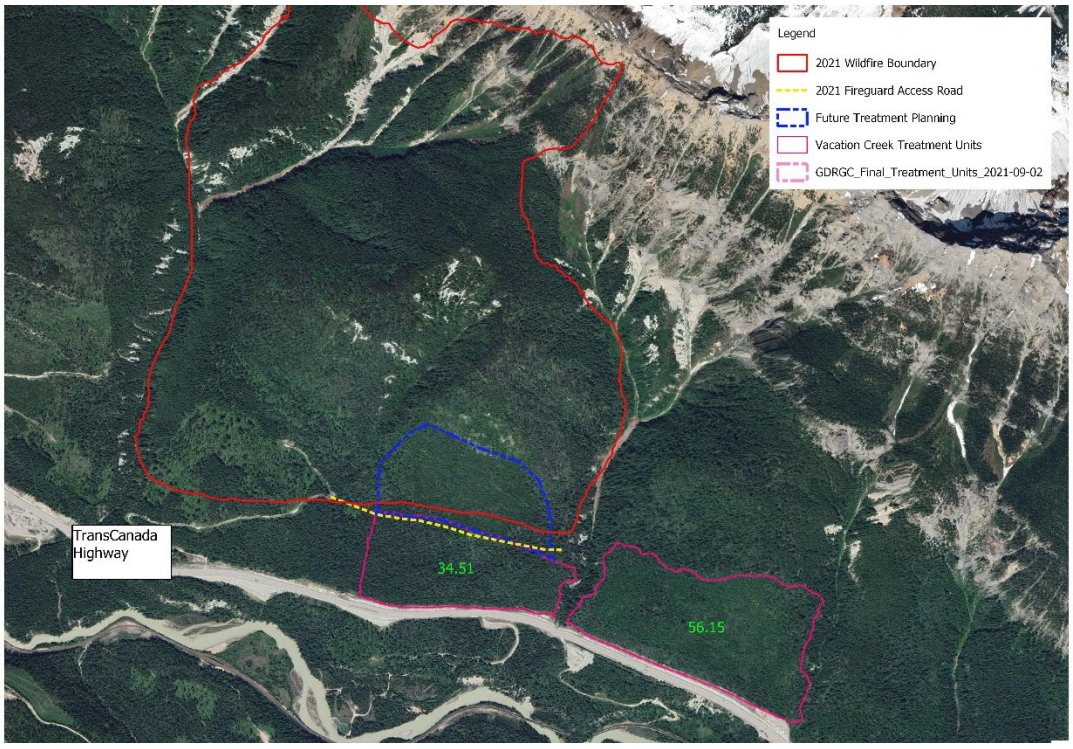

Figure 8: Final Vacation Creek units approved for treatment starting in 2022.

This Phase of the Lower KHC treatment planning has identified 4 units for treatment (36.89 ha) – 2 units for manual hand work (total - 15.92 ha) and 2 units for mechanical commercial tree removal (total - 20.97 ha) as displayed in figure 9. The treatment in this area requires more intensive stakeholder engagement that are underway. These engagements include reaching an agreement with the forest licensee (LP) and agreements for access through private land with land owners. In addition, engagements are ongoing with potential project partners like the Ktunaxa Nation Council and the Ministry of Transportation and Infrastructure for an approach to further fund the next phases of this project.

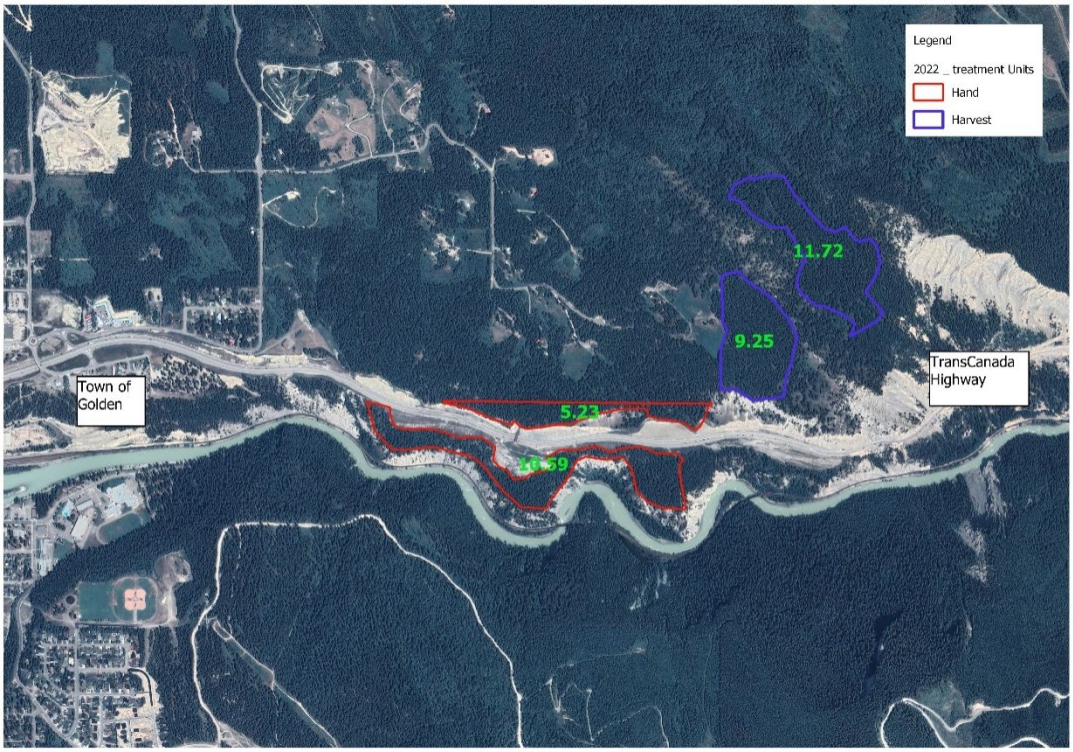

Figure 9: Habitat enhancement treatment units planned to promote habitat connectivity and forage growth away from the TCH corridor in the Lower KHC area.

Noxious and Invasive Weed Treatments

A summary was provided to the GDRGC from the CSISS listing species and areas of concern (Appendix B). Future phases of enhancement work will consider the best management practices for working around the areas identified in the CSISS report. Funding has been allocated in the next phases of The Project to adequately address and mitigate concerns of weed proliferation through the employment of industry best management practices for the particular species that have been identified.

Discussion

Progress has been made in the development of The Project to the point where enhancement work is slated to commence in the Vacation Creek treatment units in the Spring of 2022. The funding provided by the FWCP under project COL-F22-W-3541 is directly contributing to ungulate habitat enhancements as listed in the FWCP priority action plans. A total of 128 ha enhancement area has been brought to a point of being a shovel ready project with 91ha being permitted for treatment. The FWCP funding has supported the development of treatment prescriptions, the delineation and surveying of treatment area boundaries, the surveying and planning for the management of invasive and noxious weeds and the engagement of important project partners and stakeholders. This project has worked to build collaborative relationships between interested parties, land owners, government ministries and industry and is setting the stage for beneficial regional work between stakeholders for wildlife and habitats in the future.

Funding for enhancement work in the Vacation Creek portion of the project has been provided by the Columbia Basin Trust Ecosystem Enhancement Program which is planned to be spread over the next five years for total of $550,000. Further funding has been sought through the Habitat Conservation Trust Fund and the FWCP to continue with the progress of this portion of The Project.

Plans for the next phases of this project continue as a result of the funding from FWCP. The Lower KHC treatment units that require commercial logging activities are being reviewed by stakeholders with the aim to start treatment in partnership with LP in the fall of 2022. Hand treatment units in the Lower KHC are also being reviewed for input from stakeholders with an aim to secure funding, acquire permitting approval and start treatment in the spring and fall of 2023.

Recommendations

The next phases of this project involve the on the ground enhancement of habitats, continued stakeholder engagement, effectiveness monitoring and permitting for treatment.

The Vacation Creek area will require additional data collection to support effectiveness monitoring and additional work to plan enhancement in the area that was planned for enhancement that burned in the summer of 2021. Developing a plan for treatment of this burned area should include LP and their plans for development in the area. Road deactivation to remove the fireguard build to fight this fire should be considered in future treatments.

The Lower KHC portion of the project will require further stakeholder engagement with the hopes to encourage landowners to manage private properties in a similar manner to the crown lands that are targeted for treatment under this project. Treating private lands would increase habitat availability for sheep in this area. Supporting land owners to secure funding for habitat enhancement would assist in moving this forward. Vehicle collisions with the KHC bighorn sheep continue to be an issue and a limiting factor. Continuing to enhance habitats away from the TCH corridor and out of the exclusion fencing are is aimed at preventing further losses to this herd. Additional work in this area could include the revegetation of spoil sites immediately downslope of the overhead animal crossing structure in the Lower KHC. Improving this habitat could provide more forage opportunity and snow interception through the winter months for the KHC herd.

Acknowledgements

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Appendix A – Treatment Prescriptions Drafted for the Vacation Creek Enhancement Area

STAND MANAGEMENT PRESCRIPTION: Selkirk Forest District **Date: February 25, 2022**

A. LOCATION AND GENERAL DESCRIPTION OF AREA

SU	TREATMENT AREA (TA) IDENTIFIER (OPENING NO.; CUTBLOCK; TIMBER MARK; OTHER)	TREATMENT AREA (Net) (to the nearest 0.1 ha)
A	Located north of the Trans-Canada Highway and east of Vacation Creek	55.8

B. MANAGEMENT OBJECTIVES

B-1. HIGHER LEVEL PLANS

ARE ANY OF THE TREATMENT AREAS SUBJECT TO A HIGHER LEVEL PLAN? (X) YES ( ) NO

	PLAN NAME	Date Y	M	D
IF YES:	The prescription will be consistent with the applicable management objectives (KBHLUPO).	2002	10	26
	LU - G20 as per Kootenay Boundary Land Use Plan Implementation Strategy	1997	07	16
IF NO:				

SUMMARY OF HIGHER-LEVEL OBJECTIVES FOR THESE TREATMENT AREAS (Please rank specific objectives *[1 = highest priority, 10 = lowest]*):

( ) Timber ( ) Range ( ) Recreation (X) VQO (X) Wildlife habitat (X) Biodiversity (X) Wildlife trees ( ) Fisheries ( ) Water quality ( ) Other:

B-2. STAND-LEVEL OBJECTIVES

ARE CURRENT STAND-LEVEL OBJECTIVES AVAILABLE FROM SILVICULTURE PRESCRIPTIONS? ( ) Yes (X) No IF 'YES,' SEE ATTACHED FS 711A.

ARE CURRENT STAND-LEVEL OBJECTIVES STILL APPROPRIATE FOR THESE STANDS? (X) Yes ( ) No

TIMBER MANAGEMENT OBJECTIVES

The Treatment area has poor access and a high component of broadleaf with a minimal timber value of low priority. Timber management objectives in the short and mid-term are subordinate to the wildlife habitat values. This area has previously been treated to manage for elk habitat values (1980's) through a slash and burn treatment and was restocked following treatment.

WILDLIFE MANAGEMENT OBJECTIVES – HABITAT/BIODIVERSITY/WILDLIFE TREES

Improve the quality of the ungulate winter range for Rocky Mountain Elk utilizing various treatments to meet the following objectives:

1) Increase the production of forage grasses by creating and/or enlarging openings, spot burning and direct seeding;
2) Improve the production of forage shrub species but removing overstory tree competition, slashing thickets of shrubs to encourage resprouting;
3) Maintain/improve thermal cover and snow interception in proximity to foraging areas by retaining larger crowned Douglas-fir and spruce trees and groups of conifers around openings;
4) Improve sight-lines around approaches to highway crossing structures;
5) Retain high value wildlife trees (live and dead) on site;
6) Address blowdown to improve access to habitat
7) Target Cover to Forage Ratio – 40% / 60%.

WATERSHED MANAGEMENT OBJECTIVES

POD Number – PD24429 / License Number C047665 Vacation Creek (located in the Vacation Creek gully to the west of the Treatment Area

FISHERIES/STREAMS–WETLANDS MANAGEMENT OBJECTIVES

N/A

STAND MANAGEMENT PRESCRIPTION: Selkirk Forest District **Date: February 25, 2022**

RANGE MANAGEMENT OBJECTIVES	CATTLE USE? ( ) Yes (X) No	IF 'YES' RANGE UNIT PASTURE:
CATTLE PRIMARY ACCESS TRAILS? ( ) Yes (X) No	IF 'YES' LOCATE ON ATTACHED MAP	SEEDED? ( ) Yes (Year) ( ) No

N/A

VISUAL LANDSCAPE MANAGEMENT OBJECTIVES (VQO)	LANDSCAPE SENSITIVITY 3	VQO \ PR

The treatment area is located adjacent to the TCH, and above the cutbank which is 3-10 m high, the slopes above are between 15% and 40%, making visible at an oblique angle from the viewpoints.

RECREATION MANAGEMENT OBJECTIVES	FEATURE SIGNIFICANCE
KEY FEATURE	MANAGEMENT CLASS

N/A

OTHER RESOURCE VALUES/INTERESTS MANAGEMENT OBJECTIVES

Invasive and noxious species are of concern in the project area given the proximity to the TCH. An inventory of problem areas and treatment methods to mitigate spread is being developed for implementation during the life of this project.

- Prompt grass seeding in the spring following treatment will minimize risk of spread. The prescribed grass seed mix is found in Section D below.
- Small infestations will be treated by hand pulling.
- Transport of seed will be minimized by removing burrs from clothing and equipment, and by checking the undercarriage of vehicles and removing weeds before leaving a weed infested area.
- The presence of invasive plants along the TCH corridor will be reported to responsible agencies. (East Kootenay Invasive Species Council 1-888-553-5472). New infestations will be reported to: http://www.for.gov.bc.ca/HRA/Plants/application.htm

Vegetation species of cultural significance such as Rocky Mountain Juniper will be retained where possible in the treatment areas.

TREATMENT AREA DESCRIPTION

Vacation Creek Treatment Area: 55.8 ha

C-1. AREA DESCRIPTION

ZONE, SUBZONE, VARIANT	SITE SERIES (RANGE)	MOIST/NUTR. GRID
MSdk	**04 (01)**	**3/C**

ELEVATION	ASPECT	SLOPE DATA	SLOPE		
			POSITION	LENGTH	UNIFORMITY
Min: 1100 Max: 1400 Avg.: 1250	South	Min. %: 10 Max. %: 40 Avg. %: 25	Mid-lower	Long	continuous

HUMUS FORM	ROOTING DEPTH	SOIL DEPTH TO RESTRICTING LAYER	SOIL TEXTURE	SOIL COARSE FRAGMENT	DRAINAGE
Mor			SiL	15-30%	Moderate

WATER COURSES	MECHANIZED STAND TENDING
Water No Gullies No	No

C-2. CURRENT STAND DESCRIPTION

Species Composition

SU	Spp.	%	Spp.	%	Spp.	%	Spp.	%	Spp.	%	Spp.	%	Layers 1,2 SPH	Layers 3,4 SPH	Site Index
A	Fd	37	At	30	Ep	19	Pl	7	Sx	3	Ct	3	589	1200	18

Stand Description:

- **A mixed species (conifer and deciduous) stand with a high degree of heterogeneity in terms of ages, distribution, stocking levels and species mixes.**
- **Coniferous species are leading in Douglas-fir with varying components of pine, spruce and balsam.**
- **The deciduous component is predominant aspen and birch with some scattered cottonwood on the benches where moisture gathers.**
- **The distribution varies from very open grass or brush/herb meadows with few scattered veteran or mature Douglas-fir or aspen stems to dense thickets of younger aspen and/or birch and birch coppices.**
- **The predominant stand type is somewhat open, 40-60 year old (10-40 cm DBH), mixed, Douglas-fir leading stand with aspen, spruce and birch components with an understory younger layer of similar mixed species composition.**
- **The brush and herb component is comprised on the following in general order of abundance:**
- **Sheperdia ca., Symphoricarpos al., Amelanchier al., Acer gl., Salix spp., ;**
- **Arctostaphylos uv., Aster co., Calamagrostis ru., Aralia nu.,**

C-3. FOREST HEALTH AND PROTECTION

FOREST HEALTH			AGENT OCCURRENCE				
SU	AGENT CODE	AGENT NAME	HOST SPECIES	TOTAL TREES AFFECTED (%)	TOTAL CONIFERS AFFECTED (%)	HOST TREES AFFECTED (%)	AREA (ha)

FOREST HEALTH STRATEGIES:

- **Minimal forest health concerns although patches of older dead pine (IBM) are scattered throughout and appear to have been subject to recent blowdown events.**

FIRE HAZARD ASSESSMENT & PROTECTION STRATEGIES

- **The forest is a mix of conifers and broadleaf tree species with 2-3 layers present throughout and generally open.**
- **Being on a south facing slope, multi-storied (fire ladder) and near a major transportation corridor (TCH) result in an elevated risk of fire although the open nature and broadleaf component, reduce the overall risk of an intense wildfire.**
- **The planned manual brushing treatment prescribed is a "high risk" activity and will not commence until the Fire Danger Rating falls below 3 (using the 3 closest Fire Weather stations as reference- Marion, Succour, Blaeberry).**

D. TARGET STAND CONDITIONS AND OBJECTIVES

STAND TREATMENT REGIME —

Cut 5-10% of the Layer 1 trees (conifer and deciduous);

Cut 10-20% of the Layer 2 trees (conifer and deciduous);

Cut 45-55% of the Layer 3 and 4 trees (conifer and deciduous);

Cut any dead or danger trees necessary to meet worker safety standard or where their removal will contribute to the stated objectives provided they are smaller than 30 cm DBH and do not exhibit Wildlife Tree characteristics or features, active nests or significant cavities.

Selection criteria for crop trees (height, age, vigour, species preference, etc.):

Layer 1: Retain Conifers > Deciduous and Retain Fd > Sx > Pl >Bl

Douglas-fir and other L1 conifers with full crowns will be retained to provide snow interception and thermal cover. Groups and clumps of Douglas-fir trees will be left intact and Layer 1 trees will only be cut where removal will significantly improve opening size and value for forage production;

Layer 2: Retain Conifers > Deciduous and Retain Fd > Sx > Pl >Bl

Douglas-fir and other L2 conifers in clumps or groups with larger trees will be left intact where snow interception objectives are significant. L2 stems scattered in or around natural openings, will be targeted for cutting to meet forage production objectives.

Layer 3 and 4: Retain Conifers > Deciduous and Retain Fd > Sx > Pl >Bl

Douglas-fir and other conifers in this size class (less than 7 cm DBH), where found in the clumps or groups of larger trees will be left intact to meet long term objectives for snow interception and thermal cover. Throughout the rest of the TU, L3 and L4 stems will be targeted for cutting to create, enlarge or improve natural openings to meet forage production objectives.

Other Treatment Recommendations:

- **Avoid treating dense thickets of deciduous trees (At and Ep) especially large birch coppices. Treating of these stand types are not an effective use of resources and will create inordinate volumes of slash requiring abatement.**
- **Retain live and dead wildlife trees unless there is a risk to workers. If High value wildlife trees are identified during pre-work or by the danger tree faller, should have No Work zones established (ribboned) at a safe distance around them.**
- **Cut stems are to be piled for curing and burning and should be placed in the middle of openings greater than 7 meters from standing live trees.**
- **Suspended blowdown comprised of larger stems, should be limbed and bucked to lay flat on the ground and may be left to rot or incorporated into wildlife piles not intended for hazard abatement (burning).**
- **Focus on areas of good quality habitat where a minor amount of treatment can expand the area of the habitat significantly;**
- **Avoid treating very dense stand where a significant amount of treatment effort is required to make minor improvement to the habitat and where large slash volumes will result.**
- **Avoid treating dense conifer thickets with significant numbers of larger crowned (Fdi) that are already functioning or will in the future function as good quality snow interception and thermal cover.**

D-1. POST-TREATMENT STANDARDS

Layer	Species Composition	SPH (range)	SCHEDULE OF TREATMENTS (approx.)		
1, 2	Fd, At, Ep, Sx, Pl, Ct	500 (175 - 700)	Fall 2021	Winter 2022	Spring 2022
3, 4	At, Ep, Fd, Sx	600 (500 – 1500)	Manual cutting	Burn Piles	Grass seed

OTHER POST-TREATMENT STANDARDS: Describe any other post-treatment standards (type and rate of fertilizer, minimum live crown percent after pruning, maximum stump height after spacing, or other appropriate standards that apply to Forest Health, IRM, wildlife trees, etc.)

Stump Height: Layer 1 <30 cm; L2, L3 and L4 <10 cm and level;

STAND MANAGEMENT PRESCRIPTION: Selkirk Forest District **Date: February 25, 2022**

Disturbed areas such as access points and areas impacted by burn piles will be reseeded with a forage mix approved by a FLNROD range agrologist such as the mix listed below:

Grass Seed Mix	Quantity by Weight
Tall Wheatgrass	25%
Newhy Wheatgrass	15%
Slender Wheatgrass	10%
Polar Northern Wheatgrass	10%
Tall Fescue	10%
Hard Fescue	10%
Fults Alkali Grass	10%
Alfalfa	10%

D-2. SPECIAL AREAS - (TREATMENT PROPOSED)

N/A

D-3. RESERVE AREAS – (NO TREATMENT PROPOSED)

The Reserve area is the wide gully and water course labeled as Vacation Creek west of the treatment area.

E-3. ADMINISTRATION

PRESCRIPTION PREPARED BY (RPF SIGNATURE AND SEAL):

Brian Amies, RPF

RPF NAME *(Printed)*

DATE: February 25, 2022 RPF NO.: 2854

PRESCRIPTION ATTACHMENTS:

- ❑ ADDITIONAL SMP COMMENTS
- ❑ SMP MAP(S)
- ❑ FIELD DATA CARDS
- ❑ TERRAIN STABILITY FIELD ASSESSMENT
- ❑ FOREST HEALTH/PEST INCIDENCE ASSESSMENT
- ❑ ECONOMIC ANALYSIS
- ❑ OTHER: SPECIFY: Treatment Map

PRESCRIPTION APPROVED BY:

District Manager's Signature

District Manager's Name (Printed)

Date:

Original approval date (if amended):

Appendix B – Columbia Shuswap Invasive Species Society Summary of Invasive and Noxious Weeds in The Project Area

Invasive Plant Inventory in Kicking Horse Canyon, Golden BC

Kicking Horse Canyon Ungulate Winter Range Enhancement Project

Prepared by Columbia Shuswap Invasive Species Society

OCTOBER 2021

Columbia Shuswap Invasive Species Society
Kicking Horse Canyon Ungulate Winter Range Enhancement Project

Scope

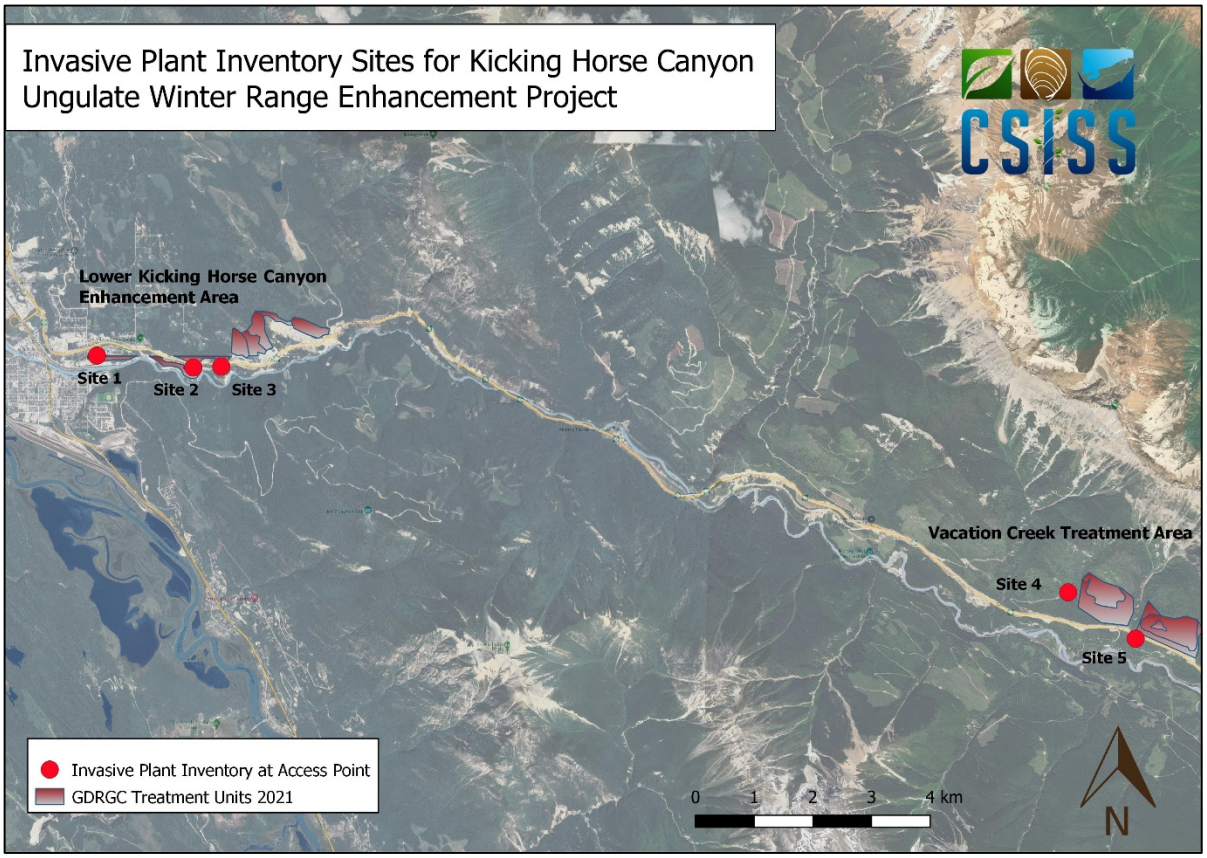
The Columbia Shuswap Invasive Species Society (CSISS), acting as a qualified contractor on behalf of the Kicking Horse Canyon Ungulate Winter Range Enhancement Project (KHC UWR Project) completed an invasive plant inventory and developed a mitigation plan to prevent further spread of invasive plants into the project footprint for the KHC UWR Project areas near Golden, BC.

Purpose

The project's close proximity to the Trans Canada Highway (TCH) presents an elevated risk of spreading invasive plants from access points along the TCH into the project footprint. The goals were to identify areas that present an elevated risk of spreading invasive plants from access points into the treatment area and to develop a mitigation plan to prevent further spread of invasive plants into the project footprint.

Summary of Work Completed

CSISS completed a comprehensive inventory of invasive alien plants at 5 access points along the TCH highway in the Lower Kicking Horse Canyon Enhancement Area and the Vacation Creek Treatment area. All invasive plant inventory data was entered into the provincial Invasive Alien Plant Program (IAPP) database.



Map 1. Invasive Plant Inventory Sites for Kicking Horse Canyon Ungulate Winter Range Enhancement Project.

Table 1. Kicking Horse Canyon Ungulate Winter Range Enhancement Project Invasive Plant Inventory

Date	Site [1]	Species	Total Area (m^2)	Distribution Code	Density Code	Comments
August 31st 2021	1	*Spotted Knapweed	200	6	1	
		Burdock	20	4	1	
		Mullein	10	5	1	
		Western Goat's Beard	35	5	2	
August 31st 2021	2	*Scentless Chamomile	10	2	1	
		*Spotted Knapweed	300	6	2	
		Canada Thistle	10	2	1	
		Perennial Sow Thistle	100	6	2	
		Mullein	10	4	1	
		Burdock	75	6	2	
		Chicory	10	4	2	
August 31st 2021	3	*Spotted Knapweed	8	2	1	
		Oxeye Daisy	10	2	1	
		Burdock	5	2	1	
		Perennial Sow Thistle	10	2	1	
		Mullein	5	5	2	
		Chicory	10	2	1	
		Western Goat's Beard	5	2	1	
August 31st 2021	4	Canada Thistle	5	2	1	
August 31st 2021	5	Perennial Sow Thistle	200	6	2	
		Chicory	25	4	2	
		Oxeye Daisy	25	4	2	
		Canada Thistle	200	6	2	

*Indicates category 2, Eradication or Annual Control Species, see Golden IPMA Priority Plant list below.

Invasive Species Best Management Practices

To prevent new incursions and to reduce further spread of invasive species, all equipment entering the project area should be free of soil and vegetation. Vehicles and equipment used in staging and project areas should be inspected and cleaned before entering an invasive free area, and before leaving an infested site. Disturbed areas should be reseeded as soon as possible following disturbance with a seed mix that is free of invasive species.

Conclusion and Recommendations

Follow best management practices as described above to prevent new incursions and further spread of invasive plants in project areas. Treatment of plant species in category 1 and 2, as well as category 3 species outside their containment lines (as determined by the "Golden IPMA Priority Plant List" included below) is recommended. Monitoring of project area after disturbance to ensure no new incursions are

[1] Please note that at this time we are in the process of adding the sites to the Provincial IAPP database, and we can provide you with updated site identification numbers by November 30, 2021.

found and continued monitoring for invasive plants for 1-3 years following completion of the project is recommended.

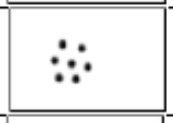
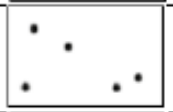
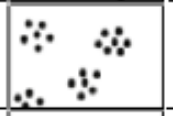
Golden IPMA Priority Plant List

REGIONAL EDRR - High risk invasive plant species not currently known within the Columbia Shuswap Regional District boundary or brand new incursions that are extremely limited in extent (less than 10 very small sites) within the Columbia Shuswap Regional District boundary. Management objective is eradication.		
- Bighead knapweed - Buffalobur - Bur chervil - Colt's foot - Common bugloss - Field scabious - Garlic mustard - Giant hogweed	- Giant knotweed - Gorse - Greater knapweed - Himalayan knotweed - Hoary Cress - Japanese butterbur - Longspine sandbur - Nodding thistle	- North Africa grass - Plumeless thistle - Puncturevine - Short-fringed knapweed - Tansy Ragwort - Wild chervil - Wild parsnip - Wood sage
ERADICATION or ANNUAL CONTROL – Species are known in the IPMA but with limited distribution and/or significant potential to spread. Management objective is to control sites annually.		
- Baby's breath - Blueweed - Bohemian knotweed - Common Tansy - Cypress spurge - Diffuse knapweed (BC)	- Hoary alyssum - Japanese knotweed - Knapweed spp. (BC) - Leafy spurge (BC) - Meadow knapweed (BC)	- Poison hemlock - Policeman's helmet - Scentless chamomile (BC) - Spotted knapweed (BC) - Teasel
CONTAINMENT – Species are abundant (with no expectation of eradication) in certain portions of the IPMA but have not yet infested all potential habitats. Containment is the management objective. Treat all sites outside of containment lines.		
Contain to gardens: - Butterfly bush - Common periwinkle - English holly	- English ivy - Garden yellow loosestrife - Goutweed - Mountain bluet	- Russian olive - Salt cedar/ Tamarisk - Siberian elm
ESTABLISHED (BIOCONTROL OR SITE-SPECIFIC APPROACH) – Widespread species beyond landscape-level control and/or have relatively low impact. May have biocontrol (BC) available. Treat based on land management objectives.		
- Annual sow thistle - Bull thistle (BC) - Burdock - Canada thistle (BC) - Caraway - Chicory - Common comfrey	- Curled dock - Dalmatian toadflax (BC) - Hound's tongue (BC) - Meadow buttercup - Oxeye daisy - Perennial sow thistle	- Purple loosestrife (BC) - Sow thistle spp. - Western goat's beard - Wormwood - Yellow hawkweed spp. - Yellow toadflax (BC)
INSUFFICIENT INFORMATION – Insufficient information for these species on their distribution, impacts, potential for spread and/or feasibility of control. Further information is required.		
- Bachelor's button - Black knapweed (BC) - Black locust - Brown knapweed - Carpet burweed - Creeping buttercup - Curly leaf pondweed - Dame's rocket - Eurasian water milfoil - Eyebright - Field bindweed - Flat peavine - Fragrant water lily	- Greater celandine - Green foxtail - Hairy cat's ear - Hedge false bindweed - Himalayan blackberry - Kochia - Lady's thumb - Marsh plume thistle - Meadow goat's beard - Night-flowering catchfly - Nightshade - Orange hawkweed - Queen Anne's Lace	- Rush skeletonweed (BC) - Russian knapweed - Russian thistle - Scotch broom - Scotch thistle - Spurge laurel - St. John's Wort (BC) - Sulphur cinquefoil - Sweet fennel - Wild four o'clock - Yellow archangel - Yellow flag iris

BC – biocontrol

Some commonly used codes in IAPP:

Distribution Code

Code	Reference	Description
1		Rare individual, a single occurrence
2		Few sporadically occurring individuals
3		Single patch or clump of a species
4		Several sporadically occurring individuals
5		A few patches or clumps of a species
6		Several well-spaced patches or clumps of a species
7		Continuous uniform occurrence of well-spaced individuals
8		Continuous occurrence of a species with a few gaps in the distribution
9		Continuous dense occurrence of a species

Density Code

Code	Reference	Description
1	Low	≤ 1 plant/m^2
2	Medium	2-5 plants/m^2
3	High	6-10 plants/m^2
4	Dense	> 10 plants/m^2

Jurisdiction Codes

MFR	Ministry of Forests and Range
AH	Alaska Highway
HYDR	BC Hydro
BCR	BC Rail
BCTC	British Columbia Transmission Corp.
BNSF	Burlington Northern Santa Fe
CNR	CN Rail
CPR	CP Rail
DND	Department of National Defense
GL	Grazing Lease
FN	First Nations Reserves
MN	Mining Companies
MOT	Ministry of Transportation and Infrastructure
MOE	Ministry of Environment - *except Provincial Parks*
MOP	Municipality owned land
PIPE	Oil and Gas Companies
PNG	Pacific Northern Gas
PCAN	Parks Canada
P	Private Land
PP	Provincial Parks
MRD	Regional District owned land
TEL	Telus
TER	Terasen Gas Inc.
TRP	TransCanada Pipelines
WE	Westcoast Energy Inc.