Multiple Resource Value Assessment Report

SELKIRK NATURAL RESOURCE DISTRICT

July 2023

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Selkirk Natural Resource District & Forest Science, Planning and Practices Branch
Ministry of Forests

BRITISH COLUMBIA

FREP Forest & Range Evaluation Program

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CONTEXT FOR UNDERSTANDING THIS ASSESSMENT REPORT

All natural resource development will have an impact on ecosystem condition. The role of effectiveness evaluations is to assess the status and trends of British Columbia's natural resource values, whether policies or practices are meeting desired outcomes, and to identify related causal factors and opportunities for improvement. The site-level "impact ratings" presented here are based on assessments conducted within the working land base (e.g., areas where resource extraction takes place). The ecological contributions of parks, protected areas, and other conservancy areas are not covered in this report. Where possible, impact ratings reflect both resource development and the effects of natural impacts, such as those related to the mountain pine beetle infestation and fire or wind disturbances.

Effectiveness evaluations do not assess compliance with legal requirements. Instead, these evaluations assess the effects of development activities and natural influences on the condition of *Forest and Range Practices Act* (*FRPA*) values regardless of whether practices are in compliance with legislation. These evaluations are meant to help resource managers:

- assess whether resource development is achieving government's desired outcomes for the 11 FRPA values;
- provide transparency and accountability for the management of public resources;
- balance decision making in consideration of environmental, social, and economic factors; and
- guide ongoing improvement of resource management practices, policies, and legislation.

Multiple Resource Value Assessment (MRVA) reports reflect the results of monitoring carried out under the Forest and Range Evaluation Program (FREP). This is generally stand/site-level monitoring which is conducted on randomly selected forestry cutblocks or resource roads. As such, these evaluations provide a stewardship assessment of site-level resource development practices.

For those interested in obtaining more information about the methodology used to evaluate sites under a given protocol, please visit the FREP Monitoring Protocols Website link at: https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/integrated-resource-monitoring/forest-range-evaluation-program/frep-monitoring-protocols

All data collected has been placed on an internet SharePoint site and can be made available to interested users. Additionally, the FREP Dashboard is a relatively new mapping interface, publicly available, that presents FREP data for the following values: riparian, water quality, visual quality, cultural heritage resources and stand-level retention.

As a result of FREP sampling throughout the province, a large number of reports and extension notes have been written on a wide variety of values which resource managers must take into account during planning processes. These documents are a peer-reviewed, science-based, and statistically rigorous documentation of the results of monitoring and evaluations. In some cases, FREP reports are accompanied by report summaries, data sets and action plans.

Reports and extension notes are available at: https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/integrated-resource-monitoring/forest-range-evaluation-program/frep-reports-extension-notes.

RESOURCE VALUE ASSESSMENT CLASSIFICATIONS & MEANINGS

Monitoring results are summarized using four impact ratings: ***very low***, ***low***, ***medium***, ***high***.

- "***Very low***" and "***low***" impact ratings are considered consistent with the government's desired outcomes for the resource values within *FRPA*.
- "***Medium***" impact rating is considered borderline and the "***high***" rating is generally considered not meeting government's intended outcomes.

Site-level resource value trends are provided when there is sufficient data to compare sites impacted over time. Much of the information presented in this report is focused on the ecological state of the values and provides useful information to resource managers and professionals on the outcomes of plans and practices. For a description of the methodologies used in this report, see Appendices 2-6.

The presentation style is similar to that used in previous Multiple Resource Value Assessments[1]. For each resource value discussed in this report, there will be an "Impact Ratings" bar chart that indicates the effect of resource development on the resource value, ranging from "very low" to "high" impact. The "Summary" presents a description of the monitoring results. "Causal Factors" for the impact ratings may be discussed and would be derived from the field-based data where applicable. The "Opportunities for Improvement" are based on practices that resulted in the best outcomes and (or) expert knowledge.

The assessments in this report includes all data collected up to year 2021. For all the values below, except rangeland health, the assessments compare new versus old forestry practices (harvesting, road building) to gauge whether practices are improving over time. For all values except for rangeland health and cultural heritage resources, sites assessed are randomly selected from a cutblock list, with cutblocks being 1-3 years old. At least one growing season must have passed since harvesting to ensure that the effects from harvesting (if any) are expressed. Figure 1 shows the locations of FREP evaluations completed up to 2021.


Garrett Creek

- **Cultural Heritage**: Assessments are compared based on the new harvest era (cutblocks harvested between 2015-2019) versus older harvest era (2007-2014) and use data collected up to 2021. Sampling sites can have a minimum of 50% randomly selected sites and up to 50% targeted sites based on recently harvested cutblocks with known cultural heritage resource

[1] See https://www2.gov.bc.ca/gov/content?id=3404A95D195C48A5BAE6DA51462014A0. The methodology is described in FREP Technical Note No. 6 (https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/frep_technical_note_06.pdf).

(CHR) values. (The mixture of random versus selected sites is due to the need to incorporate requests from local First Nations and/or licensees).

- **Range**: Assessments of rangeland health do not compare results from different timeframes such as "new" versus "old" harvest eras. As livestock do not graze evenly across the land base, monitoring sites are not randomly selected and trending is not possible at this time. Results are compared for three different range areas of wetlands, streams, and upland. The data for range monitoring in the Selkirk Natural Resource District was collected from 2013 to 2021.
- **Riparian Condition**: Like CHR, the new harvest era data is compared to the older harvest era data using results from evaluations completed from 2006 to 2021. The old harvest era pertains to all evaluations on cutblocks harvested in or before 2014, while the new harvest area represents results from blocks logged in 2015 or later. Streams are assessed within the randomly selected cutblock, therefore we can directly compare the condition of streams in the modern versus old harvest era.
- **Stand-level Retention:** Like CHR and riparian, the new harvest era (cutblocks harvested between 2015-2019) is compared to the older harvest era (cutblocks harvested between 1998-2014).
- **Visual Quality:** Assessments for visual quality compare data collection year. The evaluations consist of "a landform" that includes randomly selected, recently harvested cutblocks. Sampling results obtained over the last five years (2017-2021) are compared all DSE sampling results before that time, from 2006-2016.
- **Water Quality**: Like visual quality, water quality data collected recently (2017 to 2021) is compared to all data collected prior to that time (2008-2016). This is assumed to reflect a comparison of old versus new forestry practices. The randomly selected cutblock is used as a starting point for site selection, with a focus on stream crossings installed on the in-block and access roads. Therefore, the roads themselves are not necessarily associated with a harvest year, and as such, data collection year is used as a basis for comparison.

Near Yahk in the ICHdm subzone: A 2018 clearcut with dispersed tree retention.

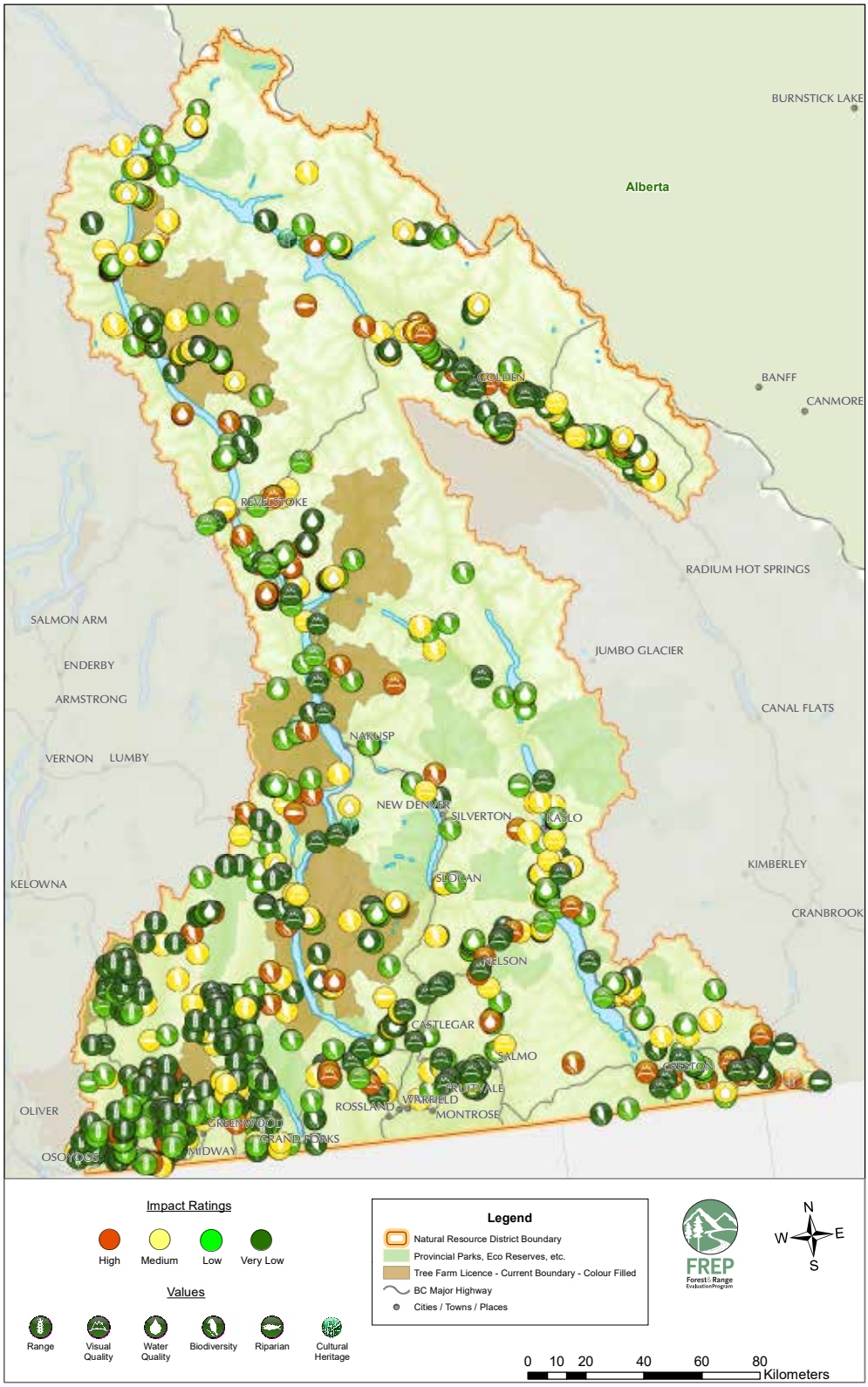


Figure 1. *Selkirk Natural Resource District, showing FREP sample locations.*

SELKIRK – ENVIRONMENTAL & STEWARDSHIP CONTEXT

GEOGRAPHY

The Selkirk District covers three physiographic areas: the Rocky Mountains, the Rocky Mountain Trench, and the Columbia Mountains which consist of the Purcell, Selkirk, and Monashee mountains. Also, there are two major river systems that encompass the District: the Columbia and the Kootenay. The total area of the District is 5,433,446 hectares and only 1,272,445 hectares are considered to be within the timber harvestable landbase (THLB).

CLIMATE

Three climatic regions (wet, moist, and dry) expressed as six biogeoclimatic zones: Ponderosa Pine (PP), Interior Douglas-fir (IDF), Montane Spruce (MS), Interior Cedar Hemlock (ICH), Englemann Spruce Subalpine fir (ESSF), and Interior Mountain-heather Alpine (IMA) are identified in the District. The wet and moist regions or "Interior Wet Belt" occurs in the north from Kinbasket Lake to the south in Creston. The dry regions occur in the rain shadows of the Coast and Columbia Mountains around the Kettle and Granby Rivers (Grand Forks) and the Rocky Mountain Trench (Golden). The climate supports a diverse range of tree species and wildlife: Douglas-fir, western larch, Engelmann spruce, subalpine fir, lodgepole pine, western redcedar and western hemlock and large mammal species include black and grizzly bear, moose, elk, mule deer, caribou, bighorn sheep and mountain goat.

HISTORY

For at least 10,000 years, Indigenous peoples have used this area as a seasonal place to gather plants, fish, and hunt. The First Nations who have asserted traditional territory in the District are:

- Ktunaxa Nation – Includes Ktunaxa Nation Council (KNC) at Cranbrook, and member communities, ʔAkisq̓nuk First Nation (Windermere), ʔaq'am (St. Mary's Indian Band) (Cranbrook), Yaqan Nukiy (Lower Kootenay Indian Band, Creston) and Yaq̓it ʔa·knuqƛi ʕit (Tobacco Plains Indian Band, Grasmere)
- Secwépemc Nation – includes Shuswap Nation Tribal Council (SNTC, Kamloops), and member bands Skw'lax te Secwepemu'lecw (LSLB, Chase), Neskonlith Indian Band (Chase), Adams Lake Indian Band (Chase), Splatsin First Nation (Enderby), Shuswap Band (Invermere) and Simpcw First Nation (Barriere)
- Okanagan Nation – includes Okanagan Nation Alliance (ONA, Westbank), Okanagan Indian Band (Vernon), Westbank First Nation (Kelowna), Penticton Indian Band (Penticton), Osoyoos Indian Band (Oliver), Lower Similkameen Indian Band (Keremeos) and Upper Nicola Band (Douglas Lake)
- Sinixt – includes the Confederate Tribes of the Colville Reservation (Nespelem, Washington, USA)

The Columbia River has played an important role in early European settlement to the area. In 1811, David Thompson mapped the entire river for westward expansion. The Gold Rush brought miners around 1864. Logging began around this time to supply the mining operations as well as for building railroad trestles and settlements. Before the Hugh Keenleyside and Revelstoke dams, paddle wheelers and steamboats provided transportation of goods and passengers from Castlegar to Revelstoke.

Today, six major centers: Nelson, Castlegar, Revelstoke, Trail, Creston, and Grand Forks, continue to thrive. Several smaller communities also exist and play an important role in the District.

Major Communities	Population
Nelson	11,106
Castlegar	8,338
Revelstoke	8,275
Trail	7,920
Creston	5,583
Rossland	4,140
Grand Forks	4,112
Golden	3,986
Fruitvale	1,958
Nakusp	1,589

DISTRICT OFFICES AND STAFF

The Selkirk Natural Resource District (DSE) was formed in 2010 from the amalgamation of the Arrow-Boundary (DAB), Columbia (DCO), and Kootenay Lake (DKL) Districts. A total of 48* employees currently reside in the following District Offices: Castlegar, Grand Forks, Nelson, and Revelstoke.

**Inclusive of Management, Client Service, Tenures, Range, Stewardship, Engineering, and Scaling*

COMMUNITY WATERSHEDS

Water is a primary and fundamental resource. Whether occurring as surface or groundwater, it is a crucial component of the ecosystems found in the area. A priority is to protect water quality and quantity for consumptive uses.

- Arrow watersheds – 47% THLB
- Boundary watersheds – 43% THLB
- Kootenay watersheds – 9% THLB
- Columbia watersheds – 1% THLB

Goodfellow Creek

RANGE

There are 41 different tenure holders with 50 Range Agreements, of which 47 are grazing and three are hay cutting.

- 18,471 annual unit months (AUMs) allocated for grazing and 112 tonnes allocated for hay cutting

Note: There is a lot of vacant range in the District so these numbers do not reflect the total production potential, just the portion that is licensed.

TOTAL FOREST ROADS

- Bridges and major culverts: 676
- Industrial use forest service roads: 2,975 kms
- District Manager responsible roads: 4,301 kms
- Road Permit Roads: 16,987 kms

NATIONAL & PROVINCIAL PARKS

- Mount Revelstoke National Park
- Yoho National Park
- Banff National Park
- Jasper National Park
- Kootenay National Park
- Glacier National Park
- Valhalla Provincial Park
- Granby Provincial Park
- Gladstone Provincial Park
- Goat Range Provincial Park
- Hamber Provincial Park
- Cummins Provincial Park
- Purcell Wilderness Conservancy
- Kokanee Glacier Provincial Park
- Lockhart Provincial Park
- Kianuko Provincial Park
- West Arm Provincial Park
- Goat Range Provincial Park
- Several smaller provincial parks, numerous recreation trails and campsites are scattered throughout the district

FOREST HEALTH

Bark beetles and defoliators active in the area that are considered significant include:

- Mountain pine beetle
- Douglas-fir beetle
- Spruce beetle
- Western balsam bark beetle
- Spruce budworm
- Western hemlock looper

Abiotic forest health issues that are considered significant include drought and fire.

MAJOR LICENSEES, MILLS & MANUFACTURING

- Atco Wood Products
- Balcaen Consolidated Contracting Ltd.
- BCTS
- Canadian Forest Products
- Cooper Creek Cedar
- Creston Valley Forest Corporation
- Downie Street Sawmills & Downie Timber
- Harrop-Procter Community Co-operative
- International Forest Products Ltd
- J.H. Huscroft
- Kalesnikoff Lumber
- Kaslo and District Community Forest Society
- Lower Kootenay Development Corporation
- Meadow Creek Cedar
- Mercer Celgar Pulp Ltd
- Nakusp & Area Community Forest Inc.
- Pacific Woodtech LVL Plant and Plywood Mill
- Revelstoke Community Forest Corporation
- Slocan Integral Forestry Cooperative
- Stella-Jones Inc.
- Tolko Industries Ltd.
- Vaagen Fibre Canada
- West Boundary Community Forest Inc.
- Wyndell Box and Lumber
- There are also several log home manufacturers and a few other specialty mills.

Mountain pine beetle

Table 1. *District timber supply areas and allowable annual cut (AAC)*

Mgmt. Unit	Area (ha)	CFLB (ha)	THLB (ha)	AAC (m^3)	BCTS AAC
TFL 3 – Interfor	79,111	58,997	27,587	80,000	5,900
TFL 8 – Interfor	77,189	71,911	53,713	158,400	0
TFL 23 – Interfor	551,471	261,701	144,632	450,000	0
TFL 55 – LP	97,706	55,103	16,007	83,000	0
TFL 56 – RCFC	119,353	23,233	21,987	90,000	11,480
TSA 01 – Arrow	1,285,631	501,246	186,466	426,413	157,587
TSA 02 – Boundary	659,000	406,433	272,286	670,142	259,764
TSA 07 – Golden	1,310,856	430,615	141,530	485,000	61,654
TSA 13 – Kootenay Lake	1,240,843	684,273	182,990	640,000	182,203
TSA 27 – Revelstoke	527,005	236,126	57,907	225,000	11,631
TSA 45 – Cascadia	175,549	unknown	48,817	139,161	139,161
Woodlot Licenses (77)	47,875	47,875	47,875	99,846	N/A
Total	**5,433,446***	**2,805,295**	**1,272,445**	**3,634,249**	**829,380**

*This number is not the summation of all units. Some areas overlap.

Glenogle

SELKIRK NATURAL RESOURCE DISTRICT – MONITORING IN BRIEF

This report summarizes monitoring conducted in the Selkirk Natural Resource District. MRVA reports allow decision makers to communicate expectations for improving resource management of public resources. This report includes a District Manager commentary on the key strengths and opportunities for improvement of natural resource management in the area.

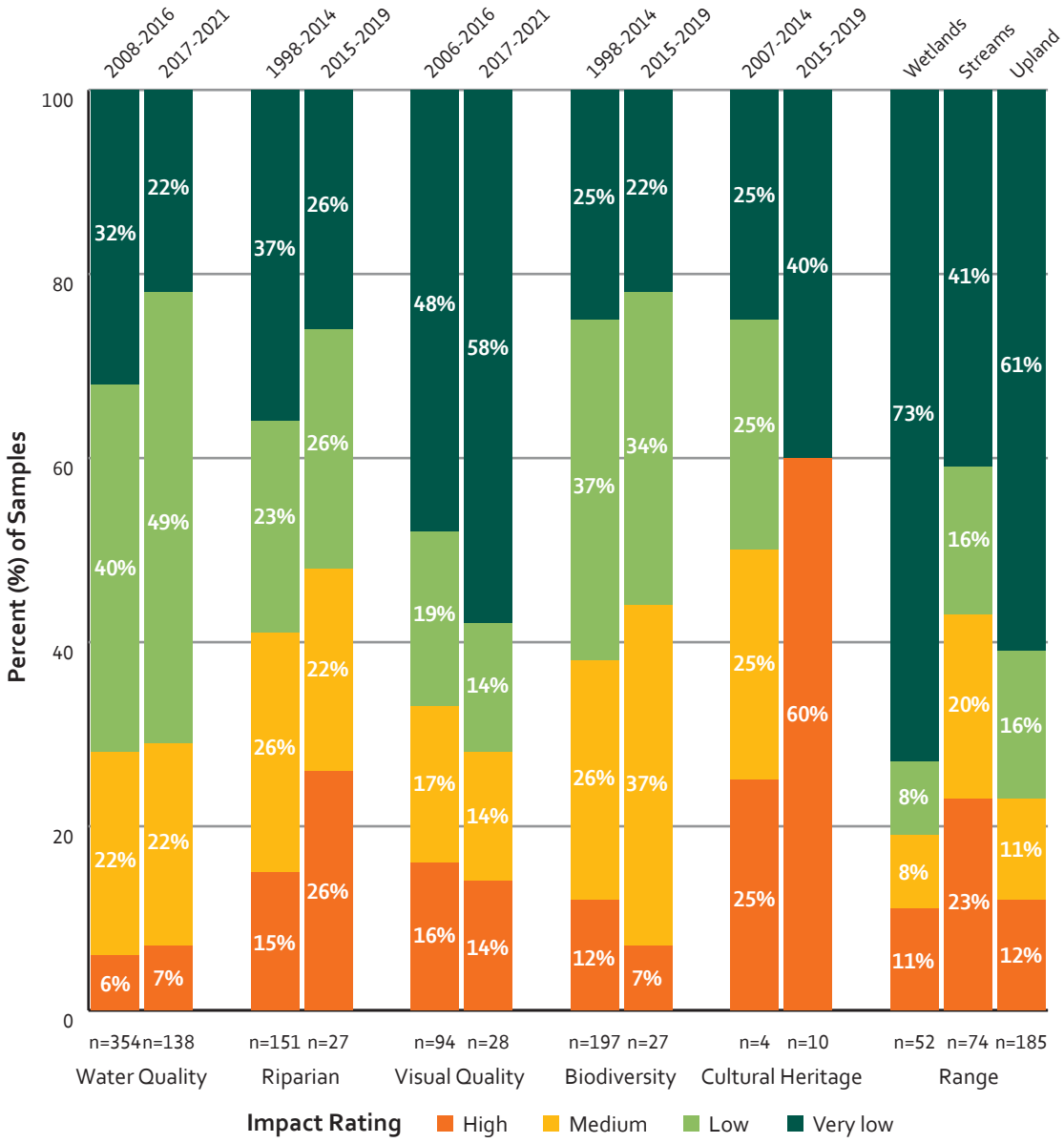


Figure 2. *Selkirk Natural Resource District site-level resource development "Impact Ratings" by resource value with trend. Trend is shown by comparing the % Impact Ratings by harvest era (Riparian and Cultural Heritage), evaluation year (Water Quality and Visual Quality), or by category (Rangeland Health). Sample size (n) is shown for each value and era.*

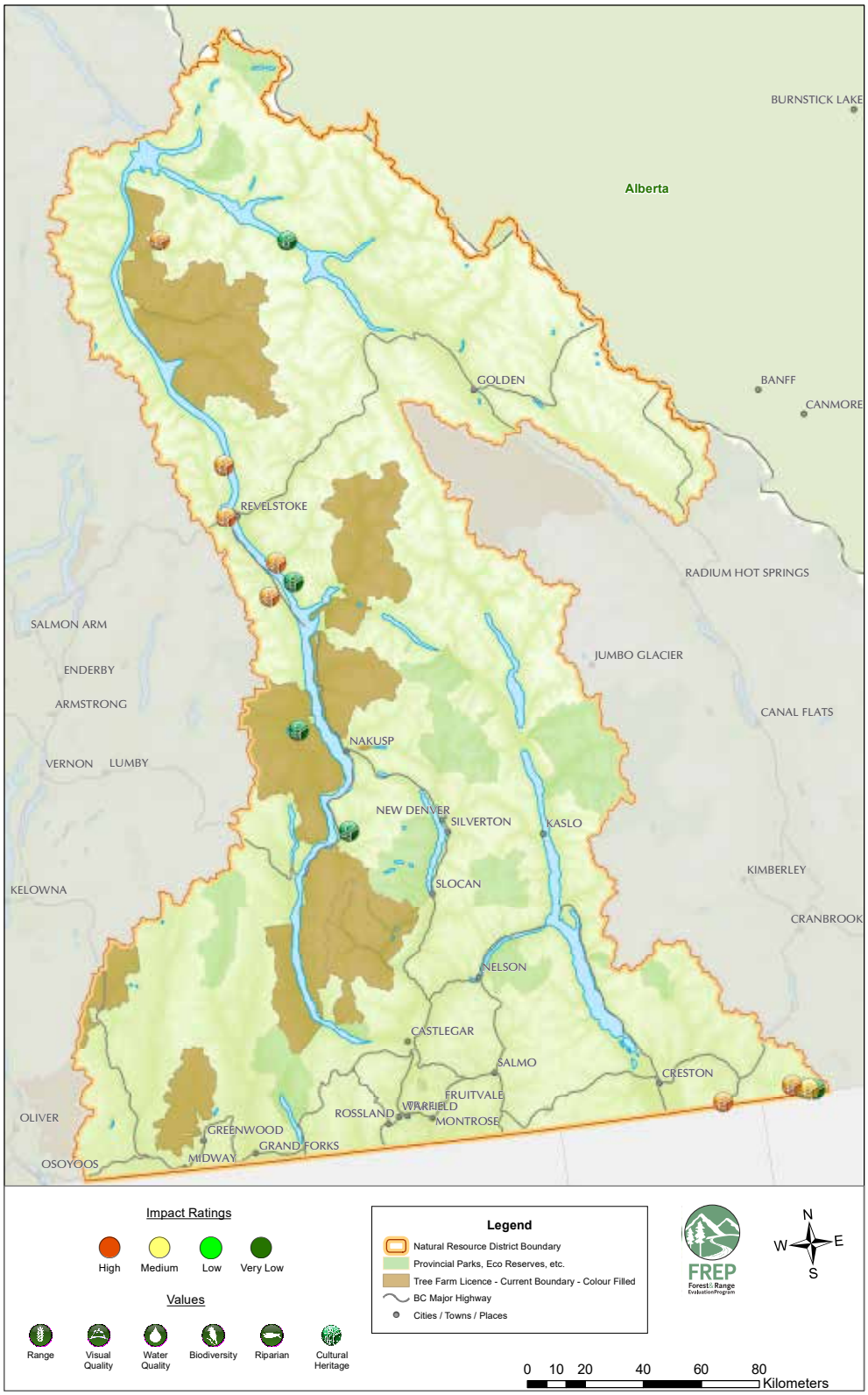


Figure 3. *Selkirk Natural Resource District, showing Cultural Heritage sample locations.*

KEY RESULTS BY RESOURCE VALUE AND OPPORTUNITIES FOR CONTINUED IMPROVEMENT

CULTURAL HERITAGE: RESOURCE DEVELOPMENT IMPACTS ON CULTURAL HERITAGE RESOURCES

The *Forest Act* definition of cultural heritage is "an object, a site or location of a traditional societal practice that is of historical, cultural, or archaeological significance to BC, a community, or an Indigenous people." Under *FRPA* the objective set by government for cultural heritage resources is to conserve, or, if necessary, protect cultural heritage resources that are

(a) the focus of a traditional use by an Indigenous people that is of continuing importance to that people, and

(b) not regulated under the *Heritage Conservation Act (HCA)*.

FREP assesses both CHR in (a) above, and Archaeological sites in (b).

FREP Priority Question for CHR to inform the *FRPA* Objective: Are cultural heritage resources being conserved and where necessary protected for First Nations cultural and traditional activities?

Cultural Heritage Resource sites are originally determined to be locations that are the focus of traditional use by Indigenous People, identified during pre-harvest heritage field reconnaissance assessments by Indigenous community representatives at the time of referral by Licensees (however this is not a requirement under FRPA). The potential for archaeological sites from Archaeological Overview Assessments is also a pre-harvest stage assessment, followed by an Archaeological Impact Assessment (AIA) completed by qualified professional archaeologists for high potential for archaeological sites.

A sample of the "known" CHR sites in harvested blocks are assessed under FREP. Data collected includes type of CHR feature, effective practices in managing CHR values, practices that were ineffective, any operational constraints that limited CHR management options on site, and suggestions for management strategies and/or practices that could have been used to reduce impacts on CHR.

See Appendix 2 for more information on the Cultural Heritage Resource Protocol.

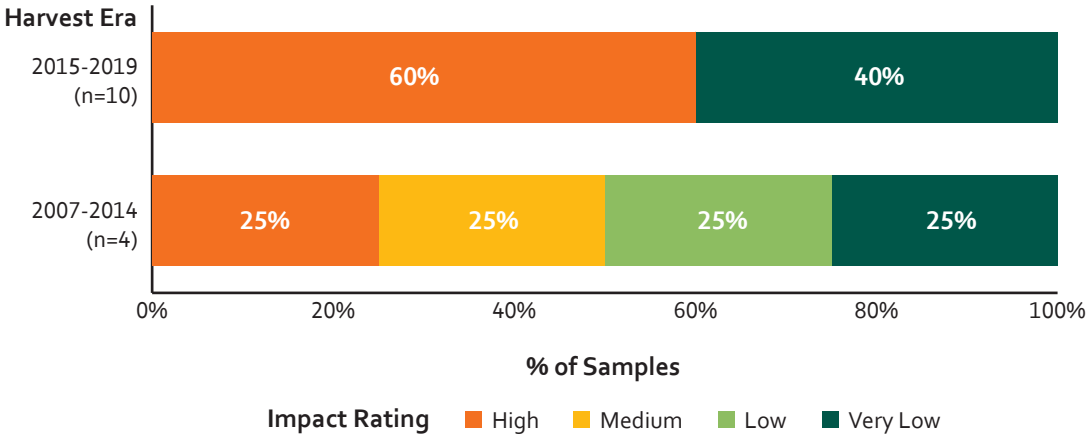


Figure 4. *Percent of samples evaluated for Cultural Heritage Resources, with high, medium, low or very low impact ratings for the two different harvest eras (2015-2019 vs. 2007-2014).*

Cultural Heritage Resource Value: Evaluation Question	Indicators	Resource Development Impact Rating Criteria	Very low Impact Rating	Low Impact Rating	Medium Impact Rating	High Impact Rating
Are cultural heritage resources being conserved and where necessary protected for First Nations cultural and traditional activities?	Evidence and extent of damage to features, operational limitations, management strategies, and type and extent of features.	Combined overall cutblock assessment results with consideration of individual feature assessment results.	Block rated very well and no features rated poor/very poor. Practices put in place are additional to the recommendations and/or CHR very well preserved for long term (rotation) traditional use, or conservation of the site.	Block rated well and ≥1 feature rated poor/very poor. The impact to CHR is minor as it is in abundance. Where harvest is deferred or temporary protection provided. ***OR*** A Site Alteration Permit with FN's consent allowed for CHR impact.	Block rated moderate and ≥1 feature rated poor/very poor. Recommendations followed but were ineffective or operational constraints limited options for CHR protection or recommendations not practicable, or were only partially implemented or practices were insensitive (spray paint used on Culturally Modified Trees (CMTs)).	Block rated poor/very poor. CHR partially intact. Or damage is reversible. Or serious impact to CHR where no longer intact for traditional use. Or irreversibly damaged or removed or destroyed to the extent that it cannot be found on site.

Data Source: Cultural heritage assessment data was collected by contractors and Ministry field staff in 2017 and 2020. Sampling sites can have a minimum of 50% randomly selected sites and up to 50% targeted sites (First Nations and/or licensees can identify candidate sites for sampling) based on recently harvested cut-blocks with known cultural heritage resource values. The blocks sampled in 2017 did not have any targeted blocks, and 100% were selected from the Random list; and for the blocks sampled in 2020, 89% were targeted and 11% were selected from the Random list of blocks. Data presented was collected from cut blocks harvested from 2007 to 2019.

SUMMARY

The total number of samples to date is 14, with 10 samples in the harvest era 2015-2019, and four in the harvest era 2007-2014. The data indicates, with low confidence due to small sample size, that the trend is towards greater risk of impact to CHR (60% at ***high*** risk of impact) in more recent harvesting compared to (25% at ***high*** risk of impact) in the older harvest era (Figure 4). The District will continue to sample cultural heritage resources post-harvest to be able to analyze the data with more confidence.

Analysis based on the small number of CHR samples (14 total samples), does not provide an accurate picture of the condition of CHR or the practices used, however a summary of the results is documented below.

Cultural Features Assessed: The CHR features on the assessed blocks were 40% pre-1846 archaeological sites of lithic scatter (flakes from stone tool making), 5% cultural trails, 10% ecological features of cultural significance (e.g. wildlife trees), 25% Areas of Potential for archaeology, 5% Culturally Modified Trees, and 15% traditional use places (large cultural cedar, and Pacific Yew).

CAUSAL FACTORS

Archaeological Sites pre-1846: At the CHR individual feature level, out of a total of eight (8) archaeological sites on the fourteen (14) blocks sampled, five (5) were intact and well managed, one (1) at borderline risk of future damage from windthrow, while two (2) had some level of damage. The damaged archaeological features were mostly affected by fallen rock from the road upslope, and tree planting within an archaeological site. The archaeological site that was planted had the following recommendations for the forester to choose one: avoid the archaeological site, or conserve in a rotational reserve (WTRA), or establish a Machine Free Zone, or winter harvest. The option chosen was harvest by hand falling and establish a Machine Free Zone, which was carried out as recommended. Avoiding tree planting of archaeological sites was not specified in the pre-harvest recommendations for this site but is a common practice to protect the subsurface lithic scatter from disturbance.

Of the two (2) archaeological sites identified with damage, none were irreversibly damaged; when a site is disturbed to the extent that an evaluation of the *in-situ* history and condition of the site cannot be determined, or a feature (such as a cultural trail) cannot be repaired or restored to a useable state. These two archaeological site findings were not considered significant to report to Compliance and Enforcement.

Areas of Potential: Of the individual features assessed, five (5) were Areas of Potential (AOP's) for archaeology, of which three (3) were very poorly maintained due to significant surface and sub-surface soil disturbance caused by a heavily used skid trail bisecting the AOP's. Reporting this damage to the licensee is the first course of action, as an AOP is not protected by the *Heritage Conservation Act* until a further survey and/or site evaluation confirms an archaeological site.

Cultural Heritage Sites post-1846: Of the individual features assessed, out of a total of seven (7) cultural heritage traditional use sites on the fourteen (14) blocks sampled, only two (2) were well maintained while the other five (5) were very poorly maintained.

- The Cultural Trail (a well-used ATV trail) was unusable after harvesting due to the trail being heavily rutted from use as a skid trail.
- A wildlife tree that was requested by a First Nation to be left on site was not found and presumed damaged during harvesting.
- Pacific yew that was requested by a First Nation to be left on site was not found and alleged to be damaged by harvesting practices.
- Large cultural cedar sites that are included in a provincial Large Cultural Cedar database GIS layer were not managed for during pre-harvest planning stages or harvesting.

EFFECTIVE PRACTICES

The effective management strategies and/or practices that were particularly effective in managing for CHR values included the following:

- Revising the block boundary to avoid an archaeological site and provide a windfirm buffer.
- Protecting an archaeological site within a WTRA with more than 30 m buffer.
- Stubbing (non-CMT's) to protect a site from windthrow.
- Harvesting using a feller-buncher within an Area of Potential for archaeology by establishing a machine free zone to prevent soil disturbance.

Example of hand felling and machine free zone to protect site of subsurface lithics, however, the site had tree planting that should have been avoided in an archaeological site to prevent disturbance.

OPPORTUNITIES FOR IMPROVEMENT

- Inform all stages in post-harvest silviculture activities of the CHR management strategies through inclusion in Site Plans (e.g., to avoid planting archaeological sites).
- Create larger (~30 m) windfirm buffer along boundary of archaeological sites.
- Protect pre- and post-1846 CHR within a rotational reserve if appropriate; otherwise consider adjusting block boundary so CHR is outside of block and mapped for future planning.
- Protect CHR from windfall and soil/slope erosion from road above by avoidance, including a setback from slope, and use of riprap.
- Complete Archaeological Impact Assessment shovel testing to determine archaeological sites and relocate the block boundary to avoid sites.

- Locate skid trails away from cultural trails or restore impacted trail beds post-harvest.
- Flag important traditional plant areas requiring conservation on the block to inform contractors of areas to avoid.
- Utilize Large Cultural Cedar database during pre-harvest planning to locate and manage large cedar for cultural uses.

DISTRICT MANAGER COMMENTARY

The FREP cultural heritage monitoring protocol is a relatively new addition to the FREP monitoring in this district, and there have been few assessments conducted to date. The small sample size does, however, show the importance of considering factors around archaeological sites and other cultural features that could impact these areas once harvesting or road building have been completed, even when reserves are created around important sites.

As with other values discussed in this report, layout crews must evaluate the potential impacts of windthrow, even if sites to be protected are located within retained areas where no harvesting will occur. It is very important to ensure archaeological sites are well mapped and all contractors and staff at all phases of forest development are aware of the location to ensure that the potential for accidental disturbance is eliminated.

Improved communication with First Nations during pre-harvest information sharing processes will help to identify cultural heritage features in the field and to improve strategies to ensure they are maintained.

Cultural features selected for evaluation may also be classified as archaeological sites. If the FREP evaluator suspects an infringement on an archaeological site during a CHR evaluation (or any field survey for that matter), then the first step will be to notify Compliance & Enforcement (C&E). However, if the cultural feature is not an archaeological site, then the district will immediately report the alleged infringement to the forest licensee. The licensee will be expected to work with the Indigenous community to mitigate any impacts and take steps to prevent a reoccurrence. If the Indigenous community is not satisfied with the outcome, the district or Indigenous community should then report the incident to C&E.

Valenciennes Fireweed and Burnt Timber

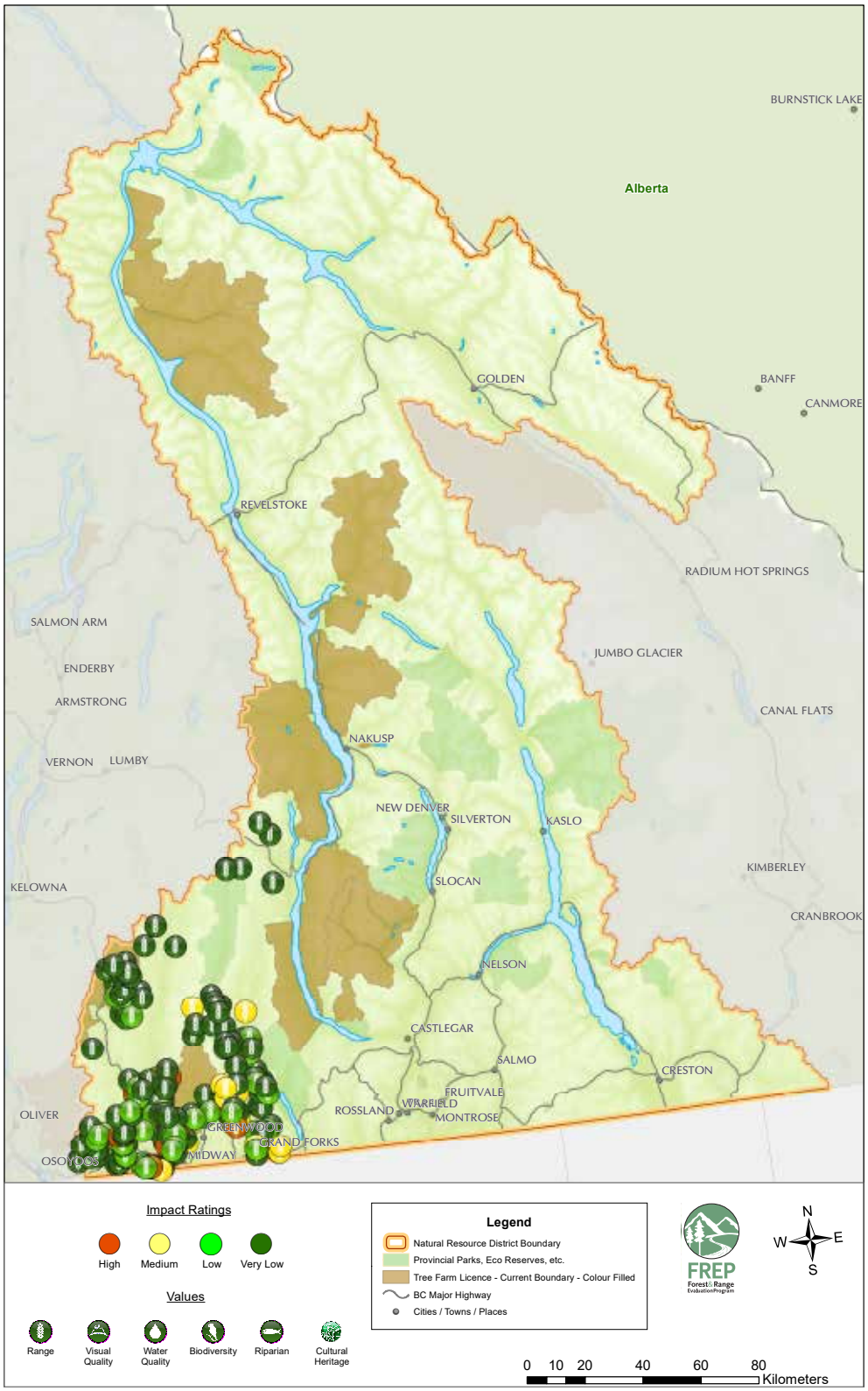


Figure 5. *Selkirk Natural Resource District, showing Rangeland Health sample locations.*

RANGE: RESOURCE IMPACTS ON RANGELAND HEALTH

Priority Question: Is the rangeland in British Columbia in properly functioning condition?

The overall objectives for range management are to maintain healthy functioning riparian and upland systems, restore and maintain desired plant communities through proper management, ensure that there will be no net loss of native species, and allow safe levels of use.

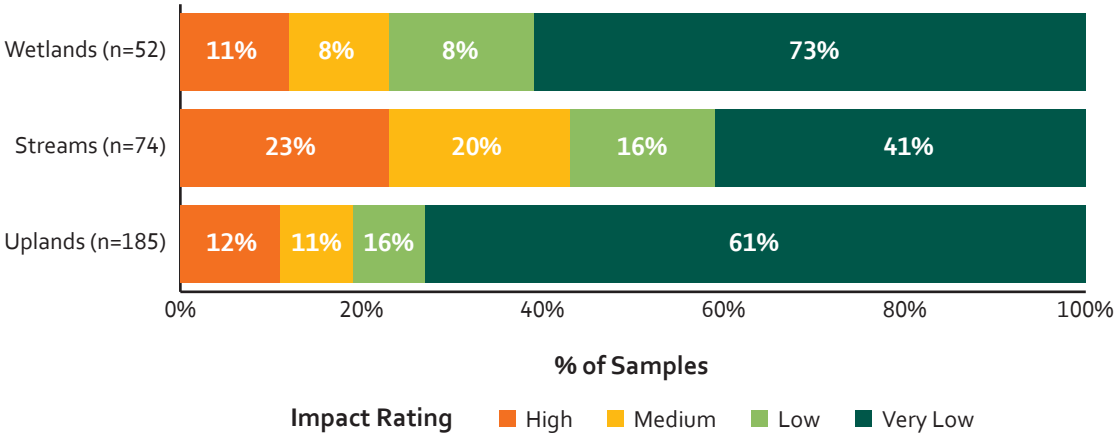


Figure 6. *Percentage of samples encountering high, medium, low or very low functioning condition.*

Rangeland Health Evaluation Question	Indicators	Resource Development Impact Rating Criteria	Very low Impact Rating	Low Impact Rating	Medium Impact Rating	High Impact Rating
Is the rangeland in British Columbia in properly functioning condition?	A number of specific wetland, stream and upland functions are evaluated under the broad categories of hydrology, biotic/ vegetation, nutrient inputs and water quality, stream channel function, and mineral cycle. Indicators are noted as present (=Yes), not present (=No) or not applicable (=N/A).	The % of Yes answers is used to place the wetland, stream or upland in one of 5 functioning condition categories: Properly functioning, slightly at risk, moderately at risk, highly at risk, and non-functional. To translate this scheme into the MRVA 4 categories, "highly at risk" and "non-functional" are combined into the High Impact category.	>= 80% Yes answers = properly functioning condition	61-7% of Yes answers = slightly at risk	41-60% of Yes answers = Moderately at risk	40% or less Yes answers = Highly at risk

Data Source: Ministry of Forests Range program staff monitor and report on the health of rangelands using the Rangeland Health Field Guide *(2007)*. Monitoring is done on land under Crown grazing tenures that is considered of primary use for grazing, to determine the impact of livestock grazing on uplands, wetlands and streams. The data for range monitoring in the Selkirk Natural Resource District was collected from 2013 to 2021. Annually, range program staff monitor uplands, wetlands and streams on Crown range. Because livestock do not graze evenly across the land base, monitoring sites are not randomly selected. Site selection is based on livestock use, tenure and operational plan renewals, complaints, and problem areas where land-based investments such as water developments and fences can be installed to improve range condition. For this reason, comparisons and trends are not easily obtained from this data set.

SUMMARY

A total of 311 range samples have been completed since 2013. Results are depicted for the wetlands, streams and uplands sampled in the Selkirk Natural Resource District (Figure 6), and were determined as experiencing ***high***, ***medium***, ***low*** or ***very low*** livestock grazing impact (Table 2).

Table 2. *2013-2021 Rangeland Health monitoring function score and associated FREP impact rating*

	Proper Functioning Condition (PFC)	Slightly at Risk	Moderately at Risk	Highly at Risk	Non-Functional
MRVA Rating:	Very Low	Low	Medium	High	
Wetlands (52)	38 (73%)	4 (8%)	4 (8%)	1 (2%)	5 (9%)
Streams (74)	30 (41%)	12 (16%)	15 (20%)	13 (18%)	4 (5%)
Uplands (185)	113 (61%)	31 (16%)	20 (11%)	16 (8%)	5 (4%)

CAUSAL FACTORS

Logging, silviculture practices, roads, culverts, ditches, and livestock grazing and management practices are the primary causes of altering the dynamics of the system on Crown range. Silviculture practices that cause non-functioning conditions may include poor obstacle planting which lead to increased damage by livestock when grazing in newly planted cutblocks. Also, treatments such as trenching can create pathways for livestock. Often, the effect of one poor land management practice facilitates or enables other practices that put ecosystems further at risk. For example, timber harvesting openings and practices create transitional grazing areas for livestock but also encourage livestock access to and use of riparian ecosystems in small streams, lakes and wetlands not protected in legislation (FPPR, S.47, 48 & 49). The presence of water and forage make riparian areas vulnerable to overgrazing and soil compaction, thus altering their productivity and ability to safely store and release water.

RECOMMENDED BEST PRACTICES

Natural range barriers are landscape features that provide a psychological or physical barrier to livestock, thereby controlling livestock movement. Natural range barriers stop or impede livestock movement to and from an adjacent area. They may include rivers, rock faces, shrub thickets, and standing or downed timber. Maintenance of natural range barriers on sensitive features such as wetlands and creeks includes practices that minimize negative effects of livestock use and will help protect multiple resource values including water quality and the aquatic ecosystem. Maintaining a riparian buffer of trees on small streams (S4 – S6) or implementing debris barriers at the time of harvest has been shown to maintain higher vegetative cover to trap sediments and filter nutrients. Debris barriers also reduce trampling of soils and utilization. The benefits of this treatment are protection of water quality and increased

groundwater recharge allowing for safe storage and release later in the season to maintain streamflow and temperature. A reserve of tall trees and shrubs and reduced utilization also helps to stabilize streambanks and provide the benefit of shade on stream temperature and aquatic organisms.[2]

Meaningful referral processes and communication between forestry licensees and range agreement holders can help mitigate many of these issues. Ingrowth/encroachment, recreation activities, wildlife and fires along with poorly located or poorly maintained range developments are also secondary contributors to altering ecosystem health. Managing for cumulative effects and protecting sensitive riparian areas while maintaining healthy uplands is important in maintaining healthy ecosystems.

Healthy wetland riparian area. (Photo credit: Clayton Bradley)

[2] Bradley, C.A, Akin-Fajiye, M, Gardner, W.C, Fraser, L.H, 2022, Debris Barriers Reduce the Effects of Livestock Grazing Along Streams After Timber Harvest. Rangeland Ecology and Management. 81, 1-8.

Non-functional stream (Ingram Creek). There is a road on one side of this stream and a fence on the other making it very difficult to manage. (Photo credit: Clayton Bradley)

Healthy (PFC) wetland and sedge meadow. Poorly maintained range infrastructure can become a hazard to wildlife, livestock and people and should be removed if not going to be maintained. (Photo credit: Clayton Bradley).

Filled in cattleguard can lead to livestock being in non-compliance with the grazing schedule in the range use plan and can affect rangeland health in adjacent pastures. Cattleguard cleaning is the responsibility of the Ministry on forest service roads and the licensee on road permit roads.

DISTRICT MANAGER COMMENTARY

I am encouraged to see the relatively high percentages of "***very low***" ratings in the uplands, streams, and wetlands samples. However, attention should be focused on the causal factors that contributed toward the "***medium***" and "***high***" ratings which are associated with uplands, streams, and wetlands that are considered at risk or non-functioning.

Range developments can be used to address range and livestock management issues on Crown range. Between 2014 and 2022, the Range program through the Ministry of Forests' Land Based Investment Strategy has funded 6 projects in the Selkirk Natural Resource District valued at over $140,000.00. Most of the projects were to protect riparian values through exclusion fencing, control range rotations, reduce grazing pressure, and improve off-stream watering.

Timber harvesting activities create transitional grazing opportunities and are essential in some habitat types to support forage requirements for *Range Act* agreements. Rangeland health monitoring has shown that the cumulative effects of timber harvesting and livestock use can expose riparian areas to overgrazing, increased sedimentation and soil compaction. As a result, communication between forest licensees and range agreement holders is essential for coordinating the protection of sensitive areas to promote healthy ecosystems, by using natural range barriers, building range developments, and using other practices to minimize livestock movement and use in these areas.

I encourage district staff and range licensees to continue to work together to ensure tenures are adequately stocked and Range Use Plans meet the principles of range management including distribution of livestock, appropriate utilization, sufficient rest for plants to recover and proper time and timing of use over the agreement area. It is important that livestock are not lingering and overgrazing sensitive areas. Riparian areas can be preferred areas for livestock to use considering access to water, forage and shade. Overuse of these areas can result in degraded stream channels and reduced water quality. Forest licensees can help reduce grazing effects by increasing tree retention near sensitive streams and communicating harvesting activities. Range Agreement holders can do their part by regularly checking on their livestock and using available tools such as herding and providing salt and mineral supplements in areas away from sensitive areas. Livestock should be moved when utilization levels are reached.

Bear tracks

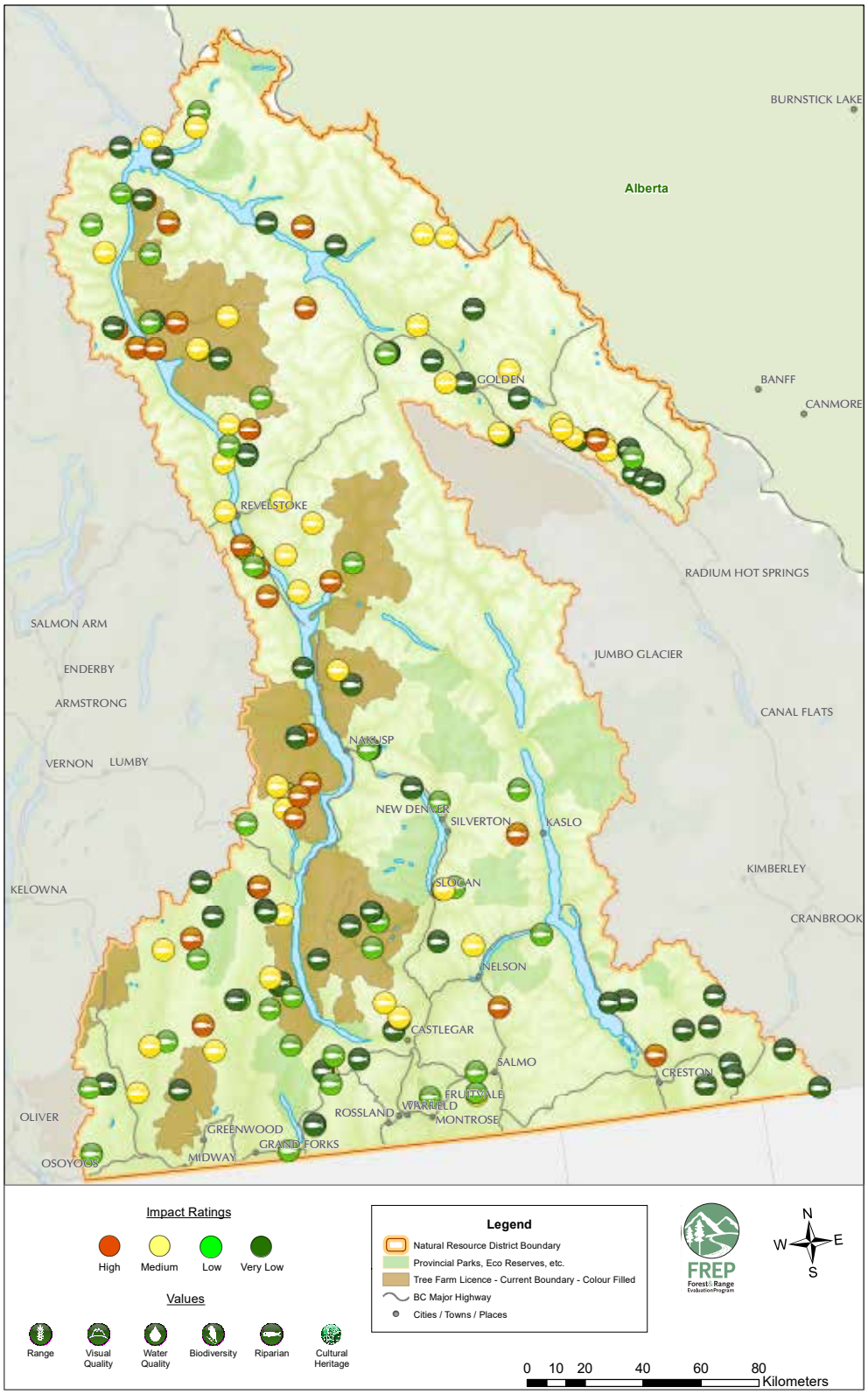


Figure 7. *Selkirk Natural Resource District, showing Riparian sample locations.*

RIPARIAN: RESOURCE DEVELOPMENT IMPACTS ON STREAM FUNCTION

Priority Question: Are riparian forestry and range practices effective in maintaining the structural integrity and functions of stream ecosystems and other aquatic resource features over both short and long terms?

Riparian indicators such as moss abundance, invertebrate diversity, and fish cover attributes are assessed to determine the "health" or "functioning condition" of the stream. Point indicators are measured at six sites along the stream, while continuous indicators are recorded between the sites along the stream reach.

Note that additional information to consider regarding issues of concern and recommendations is available in Appendix 3.

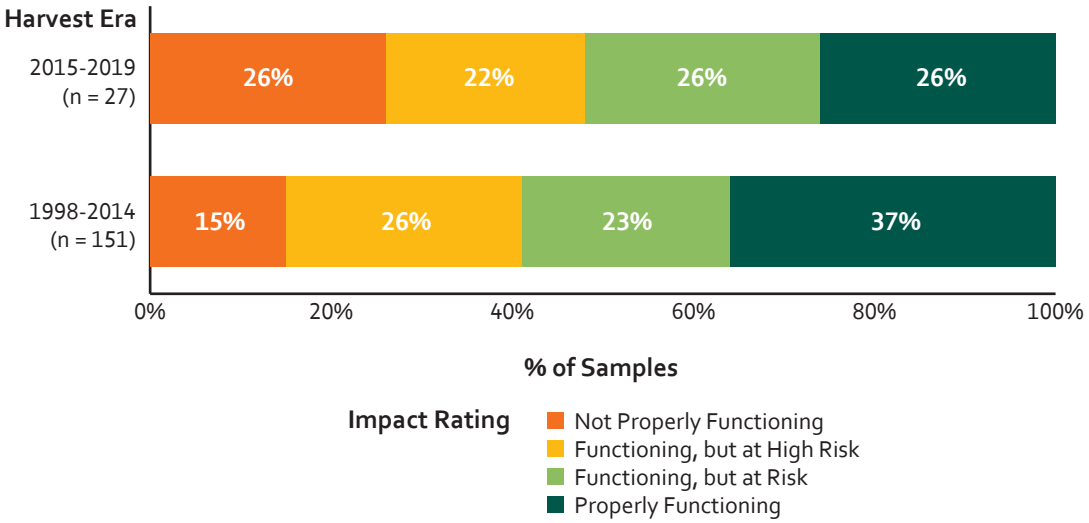


Figure 8. *Percentage of sites in high, moderate, low and very low impact categories by harvest era.*

Riparian Resource Value: Evaluation Question	Indicators	Resource Development Impact Rating Criteria	Very low Impact Rating	Low Impact Rating	Medium Impact Rating	High Impact Rating
Are riparian forestry and range practices effective in maintaining the proper functioning of riparian areas?	Fifteen key questions (e.g., intact channel banks, fine sediments, riparian vegetation)	Number of "no" answers on assessment questions of channel and riparian conditions.	0–2	3–4	5–6	> 6

Data Source: The assessment data was collected by Ministry staff using the FREP riparian evaluation protocol. The sample population consists of randomly-selected cutblocks with streams in or adjacent to block boundaries. The guidance for site selection is to wait until 1-2 years after harvest to ensure effects such as sediment mobilization and windthrow have had a chance to manifest. Therefore, while this district summary represents data collected to 2021, the streams are associated with blocks harvested up to and including 2019. The total random sample size in this analysis was 178, with 27 sites represented in the more recent harvest era.

SUMMARY

Streams sampled at 14 out of the 27 randomly selected recently-harvested blocks (logged 2015-2019 inclusive) were in ***properly functioning condition*** *or* ***functioning, but at risk***, indicating they were left in a state similar to that in an undisturbed watershed. Together, this proportion (52%) of sites in the top two categories was lower compared to the older harvesting era (60%). The proportion of sites in the ***properly functioning condition*** category was also lower for the recently-harvested streams (26%) compared to the previous harvest era (37%) with slightly more sites in the ***functioning, but at risk*** category (Figure 8). All of the recently-harvested sites that were assessed as ***not properly functioning*** were represented by S6 streams (Table 3), which are defined as non-fish bearing and less than 3 m in channel width. The non-fish bearing status, size, and lack of required reserves for S6 streams means they are often subjected to more disturbance than other stream classes. However, many S6 streams are an important contributer to fish habitat, and/or are home to regionally important wildlife or species at risk, and so should be managed with consideration to those values. The proportion of small streams in the recently-harvested sample size was 70%, which is slightly higher than the older harvest era (66%), suggesting that improved practices around these streams will likely result in a better overall outcome.

Table 3. *Condition of recently-harvested sites by stream class*

Class	Properly Functioning	Functioning, but at Risk	Functioning, but at High Risk	Not Properly Functioning	Total
S3	2	1	0	0	**3**
S5	2	1	2	0	**5**
S6	3	5	4	7	**19**
Total	**7**	**7**	**6**	**7**	**27**

Caddisflies

CAUSAL FACTORS

Logging was the most common causal factor linked to the negative responses to the indicator questions at the recently-harvested sites (Table 4). These negative responses are indicative of impacts to a stream and riparian area and the number of them out of a total 15 questions determines the functioning condition outcome for a sample reach. Negative responses caused by natural events, roads, animals and upstream factors were also recorded at these sites, but less frequently.

Table 4. *Causal factors of impacts at recently-harvested sites*

Factor	% of recorded impacts
Logging	46%
Natural events	35%
Roads	15%
Other, including Upstream factors	4%

There wasn't a strong upward or downward trend in the average number of logging-related causes of impaired indicators when considering the entire range of harvest years (Figure 9). However, there was a strong increase from 2004 to 2010, followed by a strong decline since 2010 (Pearson's r = 0.82; -0.72) indicating riparian management has gotten progressively better over the past 10 years. The higher values seen in the 2018 harvest year represents an average of just two sites, of which one had been heavily impacted by a road crossing in addition to recent logging activities.

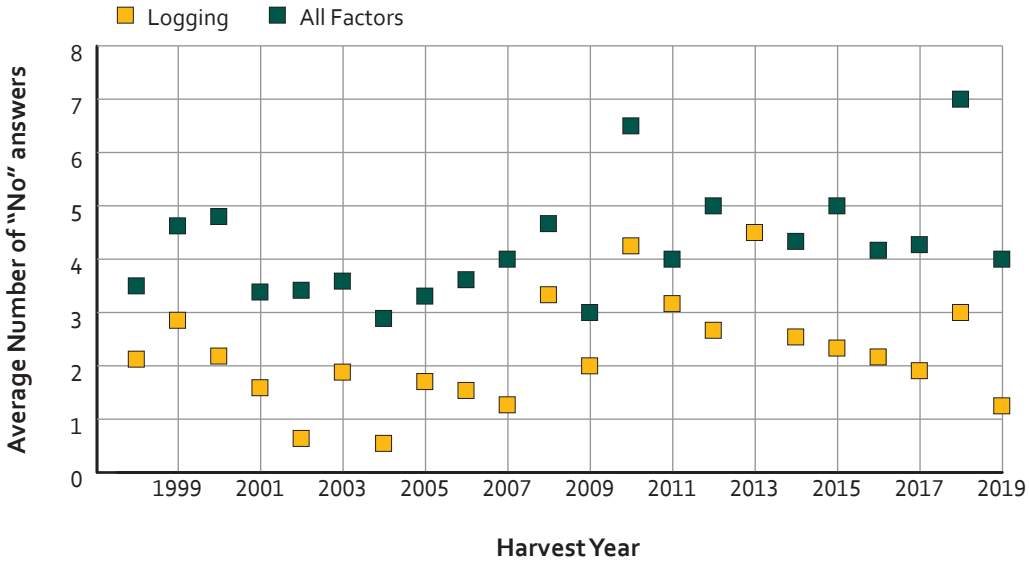


Figure 9. *Average number of "no" answers attributed to logging and to all causal factors.*

The top specific logging-related factors observed at recently-harvested sites include low retention, falling and yarding, windthrow, and debris blockages (Table 5) within or adjacent to streams. The most common natural event was flooding, followed by high background sediment levels, fire, and wind. Sixteen years of FREP data has shown that logging and natural events are not always mutually exclusive, which is why it is important to include natural events in reporting. For example, a combination of low retention and wind can lead to excessive blowdown, especially if the health of the timber has been impaired by disease or insects. The exposed soil of unpaved roads, cutblocks, landings and root wads from windthrow in areas containing high background levels of fine sediment can increase erosion and transfer sediment to streams. Soil compaction from harvesting, roads and other development decreases infiltration capacity, thereby increasing the potential for surface water run off. Although this data only represents harvested sites and the degree of magnification over and above what is natural cannot be quantified, it is important to recognize the increased risk that is associated with combinations of logging and natural factors, especially in areas that might already be in a sensitive state.

Table 5. *Top specific factors observed to contribute to impacts at recently-harvested sites*

Causal factor	% of all causal factors
Logging	Low Retention (19%)
	Falling and Yarding (15%)
	Windthrow (4%)
	Debris Blockages (4%)
Natural events	Floods (13%)
	High background sediment levels (6%)
	Fire (4%)
	Wind (4%)
Roads	Erosion from running surface and cut/fill slopes (13%)

12 Mile S6 Stream

SUGGESTED BEST PRACTICES

1. Retain treed retention when possible in the riparian management zone (RMZ) of small streams, especially around perennial reaches that make significant contributions to downstream fish habitats. This retention will regulate water temperatures, provide nutrients/invertebrates to downstream reaches, supply sediment-trapping large woody debris (LWD), and buffer the stream from increases in overland flow while maintaining bank stability.
2. Windfirm or increase buffer widths of windthrow-prone timber to minimize blowdown near the streambank.
3. Establish yarding corridors at independently stable areas of the stream when falling and yarding away cannot be achieved.
4. Apply strategies related to timing and method of harvest to minimize compaction and exposure of bare ground in the riparian area, especially in areas naturally high in fine sediment. Train new equipment operators in working carefully around streams.
5. Recognize the risk of erosion in areas that are naturally high in fine sediments. Plan, maintain, and deactivate roads to minimize the transport of sediments to stream channels.

DISTRICT MANAGER COMMENTARY

I am disappointed to see an increase in the percentage of streams in the ***high-risk*** category and sites that were ***not properly functioning***. These results show that improvements need to be made to management of riparian areas.

The results indicate that streams classified as non-fish bearing and outside of community watersheds (S5 and S6) have a higher proportion in poor condition. Because this is a province-wide issue, a greater emphasis has been placed on educating forest practitioners. Since 2017, a number of reports and information has been made available for forest practitioners. This includes reports made by the FREP program as well as seminars and presentations by Forest Professionals BC (FPBC, formerly known as ABCFP). Some of these are listed in Appendix 3.

Also starting in 2017, many forest stewardship plans expired in the district and have been replaced by new and updated documents. District staff are working with forest licensees to improve the requirements for riparian management adjacent to small streams within the FSP documents. Examples include: commitments to remove slash and harvested debris from stream channels, 5m machine free zones along the edge of streams where reserves are not required, improved standards for grass seeding on disturbed areas, and greater emphasis on retaining trees and vegetation along streams where reserves are not required.

The potential impacts of windthrow following harvesting is an important consideration that requires greater attention during the planning and layout of cutblocks and riparian management zones. Therefore, it is important to consider the location, size and shape of retained areas in relation to topography, tree species composition, soil moisture and other factors that could contribute to the windfirmness of the site. Trees that blow down may also attract beetles and lead to their spread in the area.

Potential impacts from climate change and concerns expressed by First Nations are additional reasons why continuous improvement of riparian management practices needs to take place. First Nations are more frequently commenting on the importance of streams to their Aboriginal rights during consultation processes with the Ministry of Forests and forest licensees. Climate change factors also suggest the need to ensure streams and their riparian areas are healthy and functioning post harvest so that they are more resilient to changes in temperature, water levels and windthrow events.

Given the increased awareness, education and importance that the Ministry, First Nations and the FPBC has placed on riparian management as well as the more stringent requirements in FSP's, I anticipate that future FREP results will show a decrease in the percentage of streams that have been assessed as ***not properly functioning*** or at ***high risk*** of not properly functioning.

Examples of Properly Functioning VS Not Properly Functioning Condition.

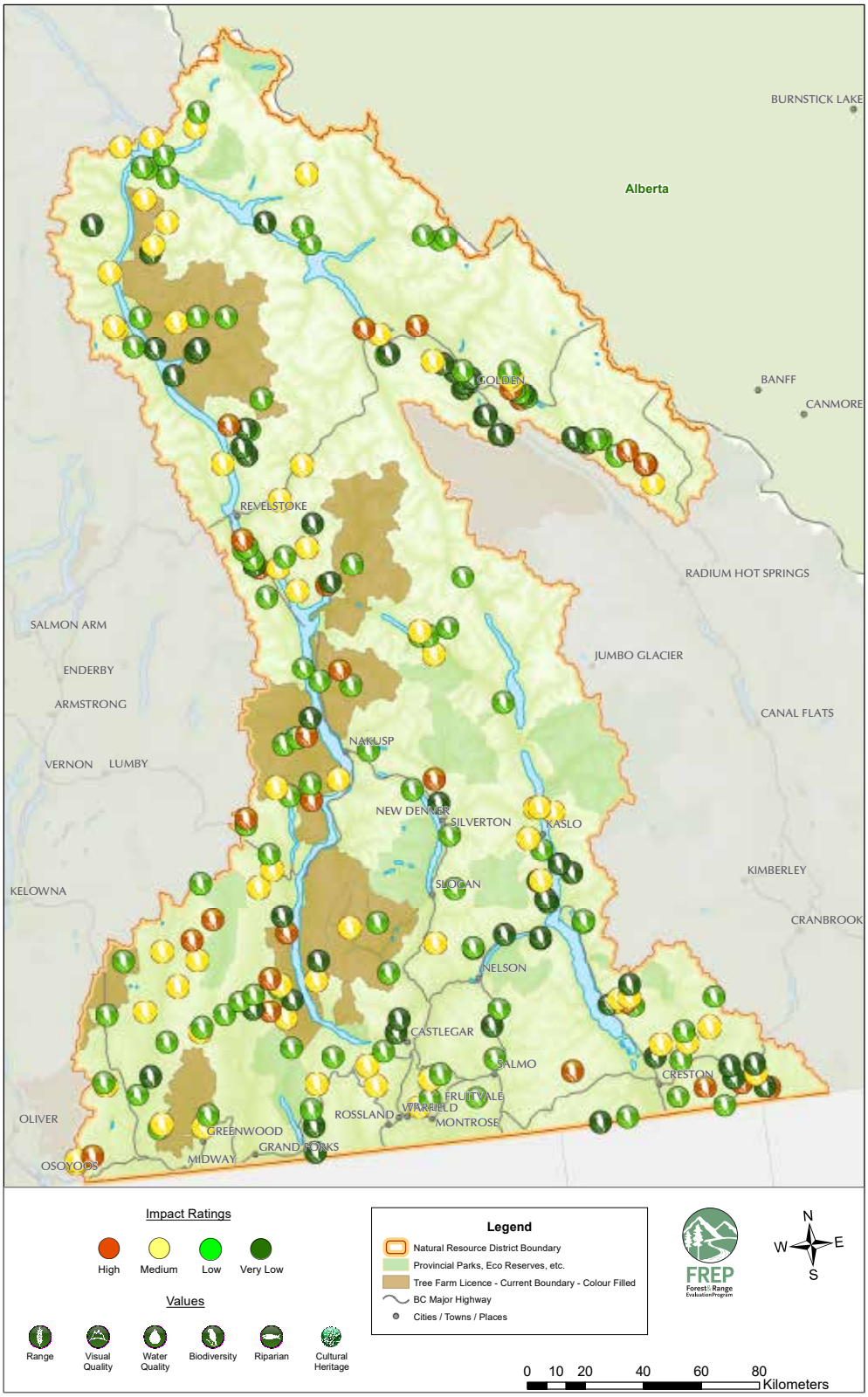
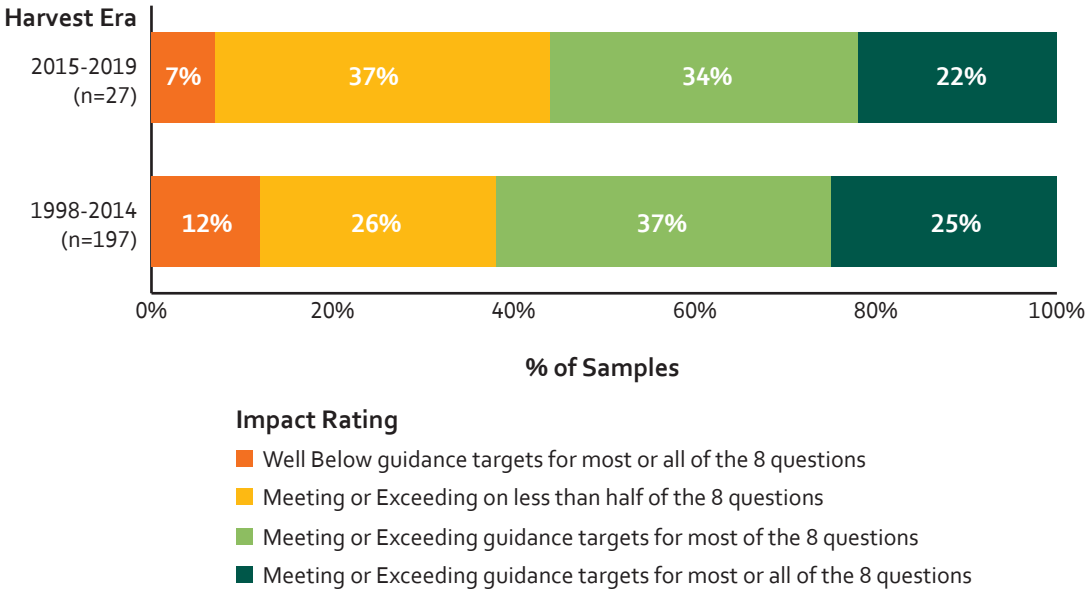


Figure 10. *Selkirk Natural Resource District, showing Stand-Level Retention sample locations.*

STAND-LEVEL RETENTION (SLR): RESOURCE DEVELOPMENT IMPACTS ON STAND-LEVEL BIODIVERSITY

Priority Question: Is stand-level retention providing the range of habitat with the structural attributes understood as necessary for maintaining the species dependent on wildlife trees and coarse woody debris (CWD)?

The SLR assessment collects data on several biodiversity indicators that are used to answer eight questions that evaluate whether practices are ***Exceeding***, ***Meeting***, ***Below*** or ***Well Below*** guidance targets for the indicators. The more practices are meeting guidance targets, the more likely that retention practices will be maintaining stand-level biodiversity and wildlife habitat. The indicators include landscape condition around the cutblock, retention amount, maximum distance between retention and adjacent forest, percent forest influence, windthrow, large wildlife trees, and coarse woody debris volume and number of large diameter CWD pieces. See Appendix 4 for more information on the Stand-Level Retention Assessment.




Cirque Creek

Stand-Level Retention Evaluation Question	Indicators	Resource Development Impact Rating Criteria	Very low Impact Rating	Low Impact Rating	Medium Impact Rating	High Impact Rating
Is stand-level retention providing the range of habitat and attributes understood as necessary for maintaining species dependent on wildlife trees and coarse woody debris?	Retention amount (percent total wildlife tree retention) considering landscape context and patch size, maximum distance (metres) between retention or adjacent forest, percent forest influence, average and maximum percent windthrow, quantity of wildlife trees, volume and number of large pieces of coarse woody debris.	Overall rating of how 'Likely' the cutblock achieves the FREP question, based on results of 8 questions that evaluate whether practices are Exceeding, Meeting, Below or Well Below guidance targets for indicators related to each question.	Very Likely – practices are **Meeting** or **Exceeding** guidance targets for most or all 8 questions.	Likely – practices are **Meeting** or **Exceeding** guidance targets for most of the 8 questions.	Somewhat Likely – practices are **Meeting** or **Exceeding** on less than half of the 8 questions.	Unlikely to Very Unlikely – practices are **Below** or **Well Below** guidance targets for most or all of the 8 questions.

Data Source: Assessments were conducted by trained personnel from 2006-2021 using the FREP SLR monitoring protocol[3] to evaluate whether retention of wildlife tree patches and riparian reserves is achieving the desired levels and types of structures to maintain species diversity. The sample population consists of randomly selected cutblocks harvested from 1998 to 2019. The guidance for site selection is to wait until 1-3 years after harvest to ensure effects such as windthrow have had a chance to manifest. Therefore, while this summary represents data collected up to 2021, the cutblocks include those harvested up to and including 2019. A total of 224 SLR samples have been collected in the Selkirk Natural Resource District, of which 27 represent recently harvested blocks (2015-2019) and 197 in the 1998-2014 period.

SUMMARY

Each cutblock in this analysis was assigned an impact rating based on how well retention practices are likely to maintain stand-level biodiversity and wildlife habitat. Impact ratings are based on results of eight questions that evaluate whether practices are ***Exceeding***, ***Meeting***, ***Below*** or ***Well Below*** guidance targets for indicators related to each question.

RESULTS

Impact ratings were compared between the recent harvest era (2015-2019) to the older era (1998-2014) (Figure 11). For the recent harvest era (2015-2019), the impact ratings are generally improving, with fewer blocks rated ***High*** Impact. The number of cutblocks in the recent harvest era that are in the ***Low*** and ***Very Low*** impact categories has declined slightly, with more in the ***Moderate*** Impact category.

Results for all eight questions for all samples illustrate where retention practices across sampled cutblocks were most often ***Meeting*** or ***Exceeding*** guidance targets, or where improvements may be required as retention levels are ***Below*** or ***Well Below*** guidance targets (Figure 12). Sampled cutblocks that are ***Below*** or ***Well Below*** guidance targets occur more often for Question 1 (total stand-level retention amount considering landscape context), Question 2

[3] Formerly called the Stand-Level Biodiversity (SLBD) Protocol. Data collection standards have remained the same allowing comparisons between the revised and older protocols.

total retention and patch size, Question 3 (micro-environment and forest influence), Question 5 (standing wildlife trees), and Question 8 (large CWD pieces).

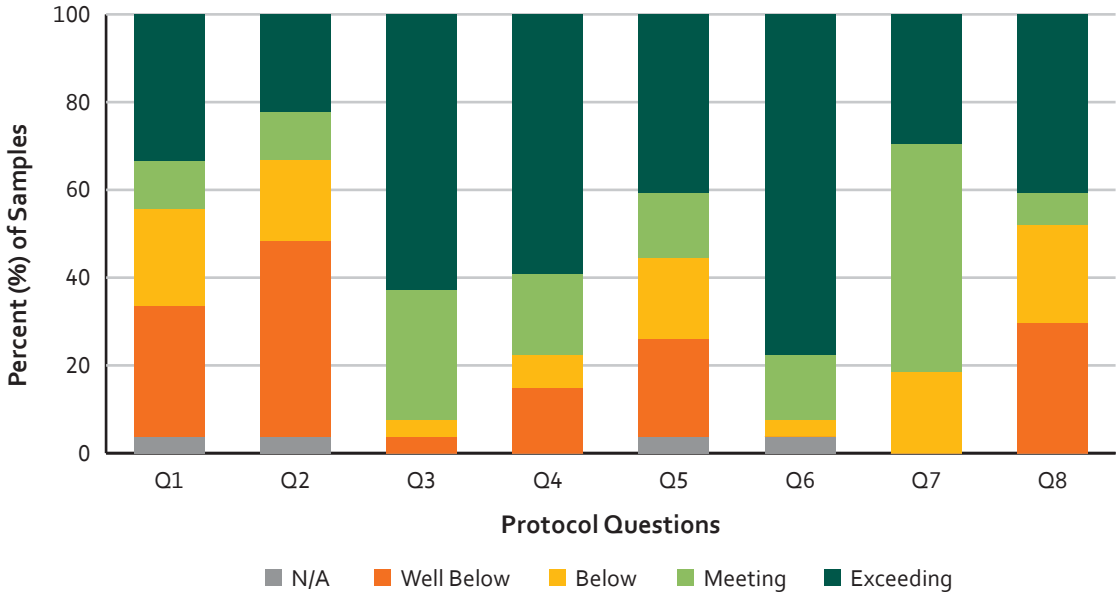


Figure 12. *Results showing whether retention practices are Well Below, Below, Meeting or Exceeding guidance targets for all 8 questions. Questions with a "NA" rating do not have wildlife trees associated with the block to be evaluated.*

Retention Amount (Questions # 1 and 2)

Question #1: Is the amount of stand-level retention adequate considering the landscape context?

Question 1 considers retention amount compared to guidance targets based on natural disturbance regime and landscape context. In general, recommended retention varies with the amount of the landscape available for harvest and the amount of that area that is already disturbed. However, retention amounts of 10-15% or more are recommended where >50% of the landscape is available for timber harvest and of that, >50% of that is young forest (<40 years old).

Question #2: Patch size – Is the amount of stand-level retention adequate considering the size of the harvested patch?

Question 2 considers patch size and measures total retention amount compared to guidance targets that considers the size of the patch that the cutblock is associated with, natural disturbance regime and landscape context. In general, recommended retention amounts should increase with larger patches and in more highly disturbed landscapes. Retention of 10-15% is recommended for patches >50 hectares, and recommended levels increase for larger patches, and more highly disturbed landscapes.

For Questions 1 and 2, a greater proportion of cutblocks in the new harvest era (2015-2019) were ***Below*** or ***Well Below*** guidance targets for total retention compared to the historic era (Fig. 13A). The data shows more cutblocks in the recent harvest era are located in highly disturbed landscapes (***Moderate*** to ***High*** landscape context rating) where increased retention is recommended to offset the landscape-level reductions in mature and old forest habitats (Fig. 13B). Cutblocks in the new harvest era show a general increase in retention levels and fewer cutblocks that have no retention[4] (Fig. 13C).

[4] The minimum legal default is 3.5% retention for cutblocks and 7% retention is achieved at the cutting permit (CP) level. There are circumstances allowing flexibility for reduced wildlife tree retention in individual cutblocks (See Wildlife Tree Retention Guidance here)

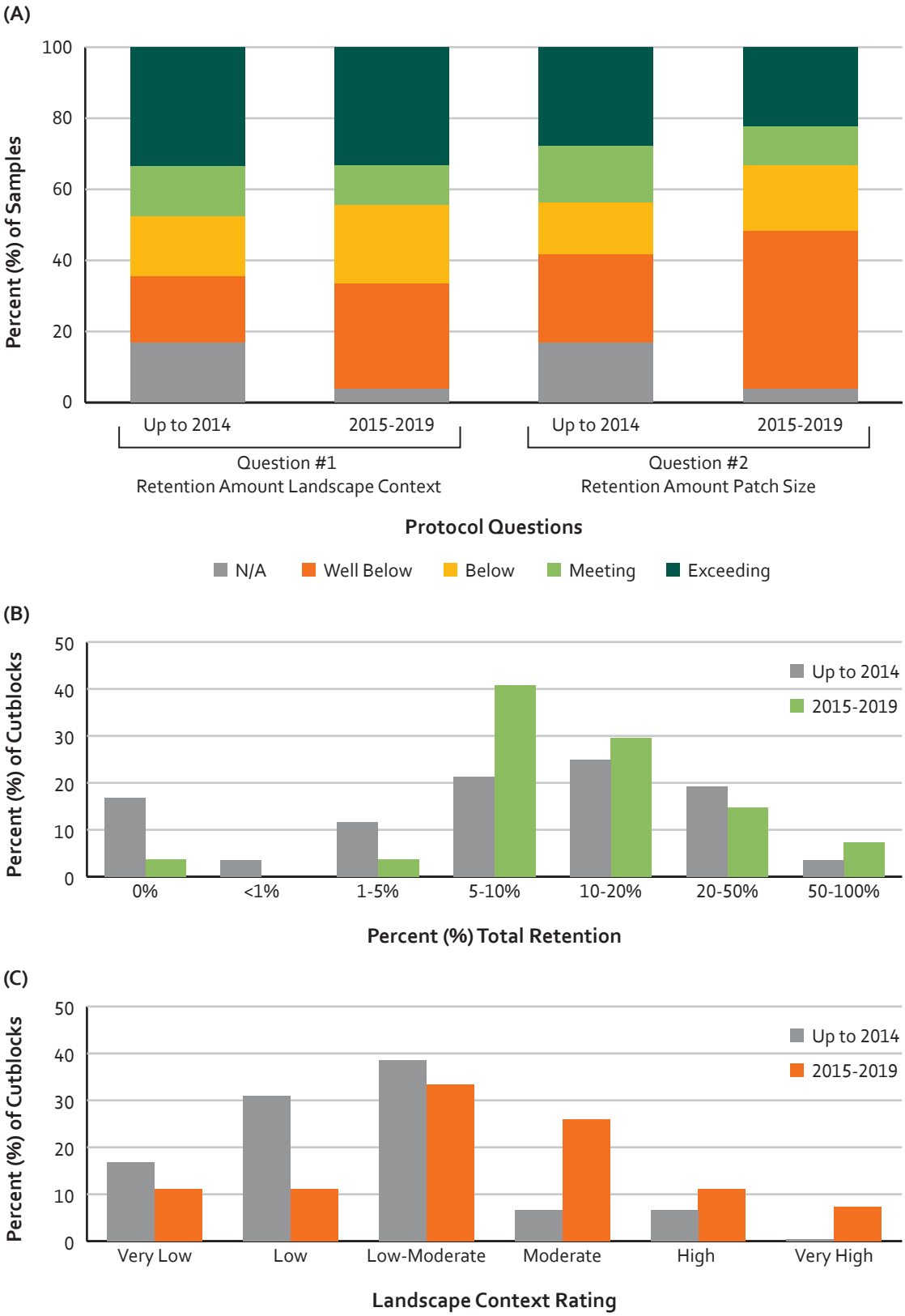


Figure 13. *Comparison of results for sampled cutblocks from historic (1998-2014) and recent (2015-2019) eras for how well sampled cutblocks are meeting guidance targets for questions 1 and 2 (A), the landscape context rating at the time cutblocks were harvested (B) and total percent retention (C). Cutblocks in (A) with a "NA" rating have no wildlife tree retention associated with the sample.*

Connectivity and Forest Influence (Questions # 3 and 4)

Question #3: Is the amount and spatial location of stand-level retention adequate to help maintain landscape-level connectivity?

Question 3 considers landscape connectivity and evaluates the maximum distance in metres between tree retention within the block as wildlife trees patches or dispersed retention and/or trees adjacent to the cutblock. The maximum distance indicator considers the landscape context, requiring a shorter maximum distance where more of a landscape is disturbed and has more area available for timber harvesting.

Question #4: Does wildlife tree retention and block shape contribute to a range of microenvironments and structural complexity within the block?

Question 4 considers forest influence and evaluates the total percent gross area of a cutblock that has forest cover as wildlife tree patch or dispersed retention and/or area of the net area to be reforested (NAR) that is within 25 metres of forest within or adjacent to the cutblock. As an interim target, 40% of the gross area of the block is recommended to be under forest influence.

Both forest influence and connectivity are affected by cutblock size, shape, forest adjacent to the cutblock and the amount and dispersion of retained trees in the cutblock.

For Questions 3 and 4, a higher proportion of cutblocks sampled in the recent harvest era were ***Meeting*** or ***Exceeding*** guidance targets (Fig. 14A). Data from sampled cutblocks between the two harvest eras suggests more blocks in the recent era have a shorter maximum distance (Fig. 14B). Data from sampled cutblocks between the two harvest eras suggests more blocks in the recent era have a greater proportion of their gross block area that has forest influence (Fig. 14C).

LaForme wildlife tree retention area

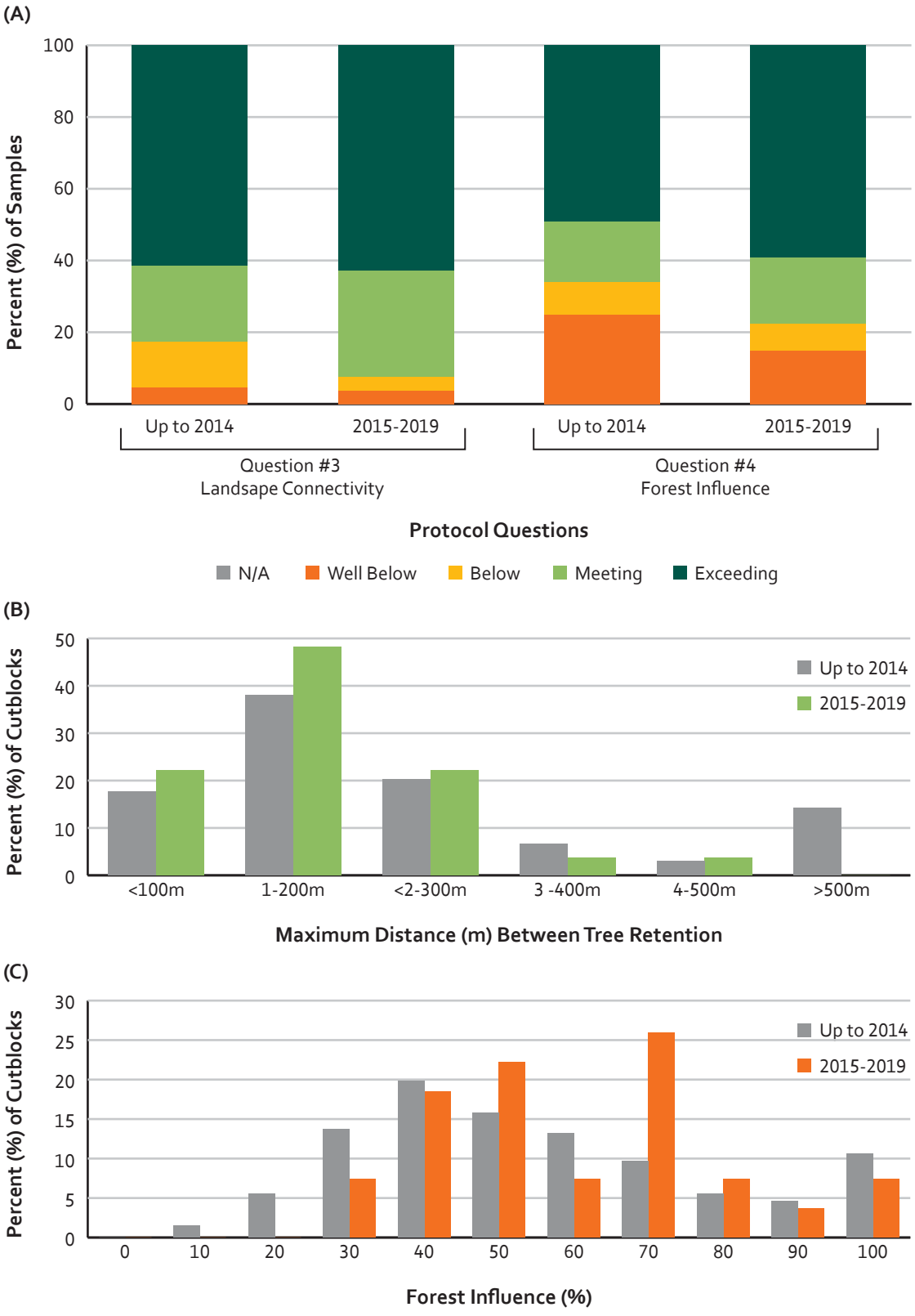


Figure 14. *Comparison of results for sampled cutblocks from historic (1998-2014) and recent (2015-2019) eras for how well sampled cutblocks are meeting guidance targets for questions 3 and 4 (A), the maximum distance between wildlife tree retention within and outside the cutblock (B), and the percent of gross block area that has forest influence measured as covered by trees or within one tree length (25 metres) of trees (C).*

Wildlife Trees and Windthrow (Questions # 5 and 6)

Question #5: Will standing live and dead trees provide habitat refugia and structural complexity in the regenerating stand now and into the future?

Question 5 considers standing wildlife tree retention and evaluates the density (stems/ha) of large (>30cm dbh[5]) standing trees, large snags and soft snags measured in Wildlife Tree Retention Areas (WTRAs) and dispersed wildlife trees in the NAR. The density of retained trees is compared to average conditions for that ecosystem with guidance recommending retention include a higher density of large trees. Target densities for total trees >30cm dbh range from as low as 50-100 stems/ha in dry IDF, MS ecosystems to 125-250 stems/ha in wetter and more productive ecosystems like the ICH and CWH.

Question #6: Do stand-level retention practices retain wildlife trees to conserve important habitat features, and minimize windthrow effects?

Question 6 considers windthrow and evaluates the amount of windthrow assessed across all wildlife tree retention areas and the maximum amount in any one WTRA. Interim targets for windthrow in the protocol are <10% on average between all WTRAs and no more than 30% in a single WTRA.

A higher proportion of cutblocks sampled in the recent harvest era were ***Meeting*** or ***Exceeding*** guidance targets on Questions 5 and 6 (Fig. 15A). Data from the sampled cutblocks suggest a higher density of large trees are being retained, and fewer sampled cutblocks that have no large trees (Fig. 15B). Across sampled cutblocks, the average percent windthrow has decreased in the recent harvest era with almost 60% of cutblocks having an average of <1% windthrow (Fig. 15C).

Wildlife tree retention area in harvested cutblock near Ymir

[5] diameter breast height

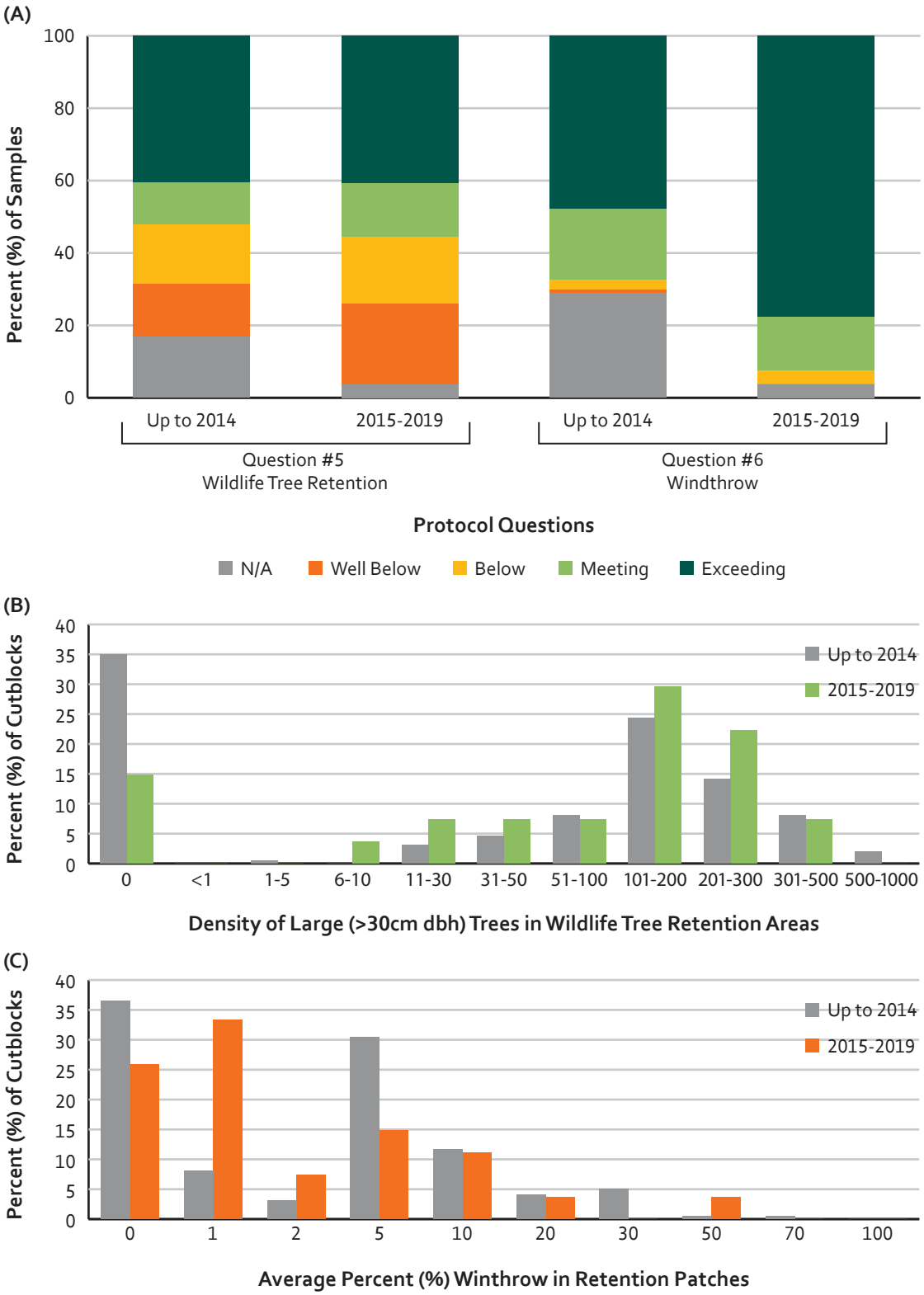


Figure 15. *Comparison of results for sampled cutblocks from historic (1998-2014) and recent (2015-2019) eras for how well sampled cutblocks are meeting guidance targets for questions 5 and 6 (A), the density of large (>30cm dbh) wildlife trees retained in WTRAs or in the NAR (B), and the average percent windthrow of wildlife trees in the cutblock (C). Cutblocks assigned an "NA" rating have no wildlife tree retention (Question 5) or retention in WTRAs to be assessed for windthrow (Question 6).*

Coarse Woody Debris (Questions # 7 and 8)

Question #7 –Does the amount and dispersion of CWD provide habitat refugia and structural complexity in the regenerating stand now and in the future?

Question 7 considers coarse woody debris volume and evaluates the amount of CWD left following harvest relative to benchmarks for the ecosystem, and the amount of the cutblock with forest influence that will contribute future CWD. Target CWD can range as low as 30m^3/ha in dry forest ecosystems where wildfire fuel hazard reduction is a priority to 150m^3/ha or more in more productive ecosystems where wildlife habitat is a management objective.

Question #8 - Does the size and condition of CWD provide habitat refugia and structural complexity in the regenerating stand now and in the future?

Question 8 considers the number of large (>20cm diameter and >10m length) CWD pieces/ha and compares the number of large CWD pieces to benchmarks for that ecosystem. Recommended targets for large CWD pieces range from 10 pieces/ha in dry forest ecosystems to 20- 25+ pieces/ha in wetter more productive ecosystems.

A higher proportion of cutblocks sampled in the recent harvest era were ***Meeting*** or ***Exceeding*** guidance targets for CWD volume in the NAR, but fewer cutblocks are ***Meeting*** or ***Exceeding*** targets for large CWD pieces in the NAR (Fig. 16A). Data from sampled cutblocks suggests slightly higher, on average, CWD amounts in the recent harvest era (Fig. 16B). Data from sampled cutblocks suggests a lower number of large CWD pieces/ha, and more blocks with no large CWD pieces measured in the net area to be reforested (Fig. 16C).

Coarse woody debris in the net area to be reforested, in a cutblock near the Paulson summit

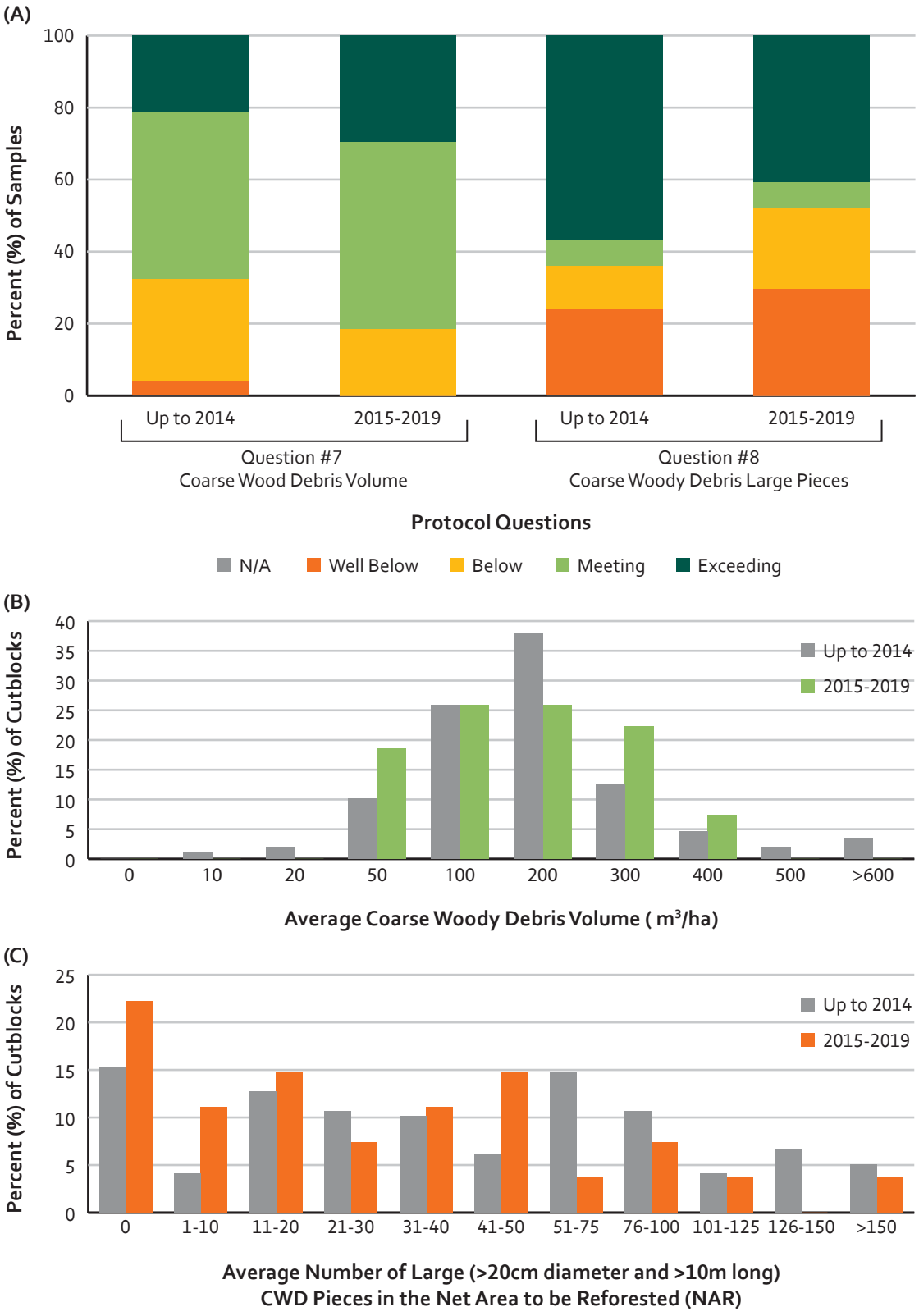


Figure 16. *Comparison of results for sampled cutblocks from historic (1998-2014) and recent (2015-2019) eras for how well sampled cutblocks are meeting guidance targets for questions 7 and 8 (A), the average amount (metres³/ha) of CWD in wildlife tree patches or in the NAR (B), and the number of large (>20cm diameter and >10m length) CWD pieces/ha in the NAR (C).*

SUGGESTED BEST PRACTICES

Retention Amounts – When planning stand-level retention levels, consider the broader landscape context (the extent of the landscape that is highly disturbed) and the larger 'patch' that may be created when new cutblocks are created adjacent to other young (<30year old blocks). In heavily disturbed landscapes or where a newly planned cutblock will join with adjacent blocks to create a large 'patch', increase retention levels consistent with existing guidance (see the Biodiversity Guidebook, Chief Forester and Southern Interior Region retention guidance). Increased stand-level retention can help offset reductions in mature or old forest in highly disturbed landscapes, and can help meet other objectives (e.g., wildlife habitat, visuals, hydrology).

Forest Microenvironment and Connectivity – Maintain wildlife tree retention areas (WTRAs) and dispersed retention throughout cutblocks and modify the block shape to reduce the distance between tree cover within and adjacent to the cutblock. Increased forest influence and less distance between retained trees promotes a range of microenvironments in the stand, facilitates dispersal of organisms into the regenerating block and promotes landscape connectivity.

Wildlife Tree Retention – Continue to include important ecological anchors (e.g., large wildlife trees, snags, deciduous trees) within wildlife tree retention areas when available. Focus retention on large trees and snags as these stand structures take the longest time to recruit in managed landscapes with shortened rotation cycles.

Windthrow – Consider soil types and conditions, topography, tree species and other information sources to understand windthrow potential and modify harvest and retention practices where required to minimize windthrow risk. Some levels of windthrow are acceptable and even desirable to recruit downed wood structures, but the objective should be to ensure wildlife trees persist through the rotation to become larger trees, snags and eventually downed wood.

Coarse Woody Debris – Coarse woody debris levels can vary between cutblocks in order to achieve local management objectives such as increased downed wood for furbearer habitat (e.g., Fisher; *Pekania pennanti*), or reduced downed wood to mitigate fuel loading in high wildfire risk areas (e.g., WUI: Wildland Urban Interface). However, maintain minimal levels specific to the ecosystem and management objective, leave more large CWD pieces in the net area to be reforested, and elevate logs in piles and windrows to maintain important habitats and allow CWD to persist longer into the regenerating stand.

DISTRICT MANAGER COMMENTARY

It is important to ensure licensees locate WTRAs in those portions of the stand that include ecological anchors and are representative of the tree species and size of the harvested stand. The Wildlife Habitat Features in the Kootenay Boundary Region Order was established in 2018 and provides further legal protection for specific wildlife habitat features. Licensee staff and contractors who are responsible for cutblock layout must be familiar with these features and ensure their protection by locating them either within WTRA's or outside of cutblocks.

Figure 11 shows consistent results between harvest eras. However, the deeper analysis presented above shows that we are seeing more blocks below the guidance targets in highly disturbed landscapes. Current guidance suggests increased retention is warranted, because it is in these highly disturbed landscapes where large young patches begin to form and where increased retention can provide the most benefit. Specific retention practices include:

1) Increased retention around riparian areas – particularly Active Fluvial Units (AFUs) outside the set riparian reserve zones. This will improve outcomes for biodiversity and promote bank stability to assist with hydrologic processes. Outside of AFUs, increase the width of retention around streams – particularly larger streams (>1.5-3m wide) and create retention networks to other reserves (e.g. WTRAs) to facilitate landscape connectivity. Where large-scale disturbances such as wildfire or severe insect attack occur, leave patches of partially disturbed and undisturbed forest along the riparian corridor. This will facilitate connectivity, complexity and inputs of large woody debris.
2) Focus retention on mature and older forests within 'under-represented' ecosystems to promote ecosystem representation. If predictive ecosystem mapping or terrestrial ecosystem mapping is available, use it to identify site series groups (wet, mesic, dry). Ensure that a proportion of all ecosystems have mature and old forest retained on them within and outside the harvested area. Try to incorporate retention of these sites into the broader set of retained areas (riparian reserve network) as part of ecosystem networks.
3) Create larger retention patches within and outside harvested areas by connecting patches of mature/old trees with undisturbed younger forest, or patches of partially disturbed forest. This will provide better interior forest conditions.
4) Where logging occurs in highly disturbed landscapes, increasing retention of small aggregates (<1ha) and dispersed green-tree retention along with WTRAs throughout the logged areas will facilitate recovery in the regenerating stand.
5) Layout staff should evaluate the windfirmness of areas that are planned to be retained.
6) Locate retention in areas that are unlikely to be disturbed by future road or block developments so that they can remain intact until the regenerating stand has developed similar stand attributes.

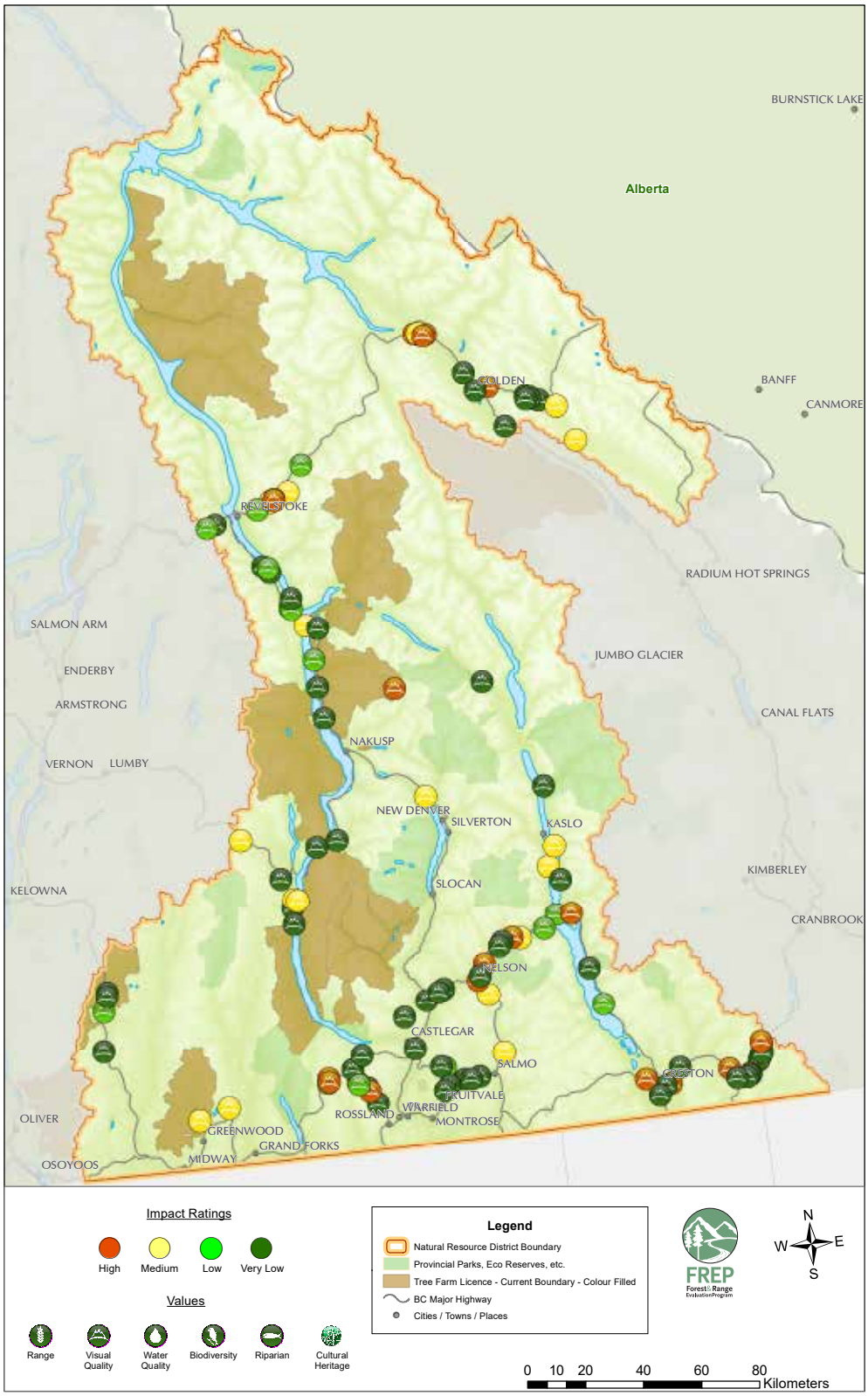


Figure 17. *Selkirk Natural Resource District, showing Visual Quality sample locations.*

VISUAL QUALITY: ARE VISUAL QUALITY OBJECTIVES (VQOS) BEING ACHIEVED ON LANDFORMS?

Priority Question: Are established visual quality objectives being achieved?

A VQO defines the extent of alteration that is deemed acceptable in a given viewscape. The VQOs are established to reflect the public's desired level of visual quality based on the physical characteristics and social concern for an area. There are five levels of management prescribed: Preservation, Retention, Partial Retention, Modification and Maximum Modification. Preservation allows very little visual impact while Maximum Modification allows for considerable visual impact.

Note that additional information on the Visual Quality Effectiveness Evaluation (VQEE) is provided in Appendix 5.

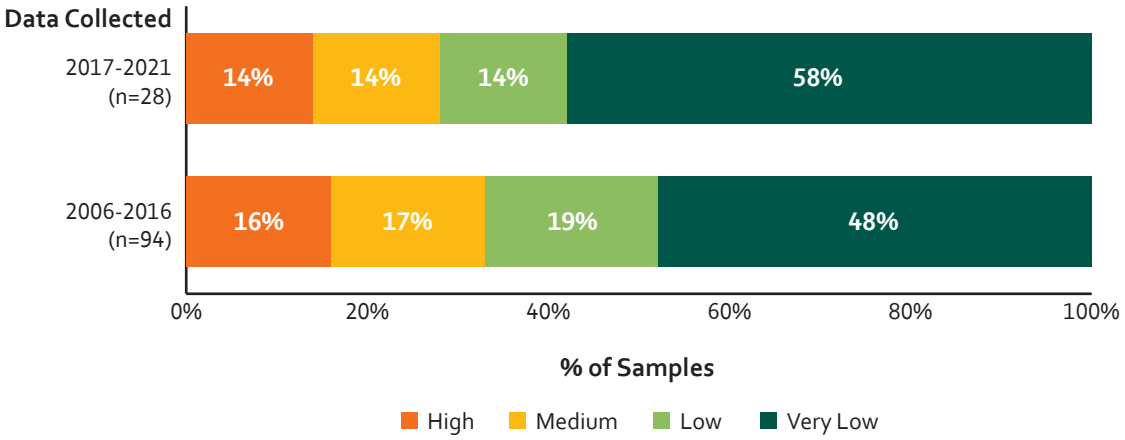


Figure 18. *Percentage of landforms in each effectiveness evaluation rating category by evaluation era.*

Visual Quality Resource Value: Evaluation Question	Indicators	Resource Development Impact Rating Criteria	Very low Impact Rating	Low Impact Rating	Medium Impact Rating	High Impact Rating
How are we managing views in scenic areas and achieving visual quality objectives?	Visual evaluation of block, design of block, percent of landform altered, impact of roads, tree retention and view point importance	Basic visual quality class (determined using the VQC definitions) is compared with the Adjusted VQC (derived using percent alteration measurements and adjustment factors) to determine if VQO is achieved.	VQO achieved, and % alteration low or mid-range	VQO achieved, but % alteration for one or both close to alteration limit	Only one method indicates VQO achieved	Both methods indicate VQO not achieved

Data Source: Effectiveness evaluations were conducted by trained personnel from 2006 to 2021 using the FREP visual quality monitoring protocol to evaluate the extent to which legally established VQOs in designated scenic areas are being achieved. The sample population consists of landforms (distinct three-dimensional topographic features defined in perspective view) that include randomly selected, recently harvested cutblocks. Sampling results obtained over the last five years (2017-2021) are compared with earlier sampling results (2006-2016) (Figure 18).

SUMMARY – EARLIER SAMPLING PERIOD (2006 - 2016)

A total of 94 samples were collected in the Selkirk District during the 2006 to 2016 period.

Table 6. *Percentage of recently evaluated landforms by visual quality objective and effectiveness evaluation (EE) rating category (2006-2016)*

Visual Quality Objective	EE Rating Category					
	Clearly Not Met	Not Met	Borderline	Met	Well Met	Grand Total
Maximum Modification			2		1	3
Modification			3	6	18	27
Partial Retention	5	4	9	10	22	50
Retention	1	5	2	2	4	14
Total	6	9	16	18	45	94
% Total	**6%**	**10%**	**17%**	**19%**	**48%**	**100%**

Overall, 67% of the evaluated landforms achieved *(**met or well met**)* the VQO, 16% of landforms did not achieve the objective *(**not met/clearly not met**)*, and 17% were inconclusive *(**borderline**)* (Table 6). Of the 64 Retention and Partial Retention (more restrictive VQOs) samples, 59% achieved the VQO, 23% did not achieve the objective, and 17% were borderline. Success in achieving the more restrictive VQOs was significantly lower than the overall success rate.

The ***initial percent alteration*** metric is an indicator of the visual quality class (VQC) that has been achieved based only on the scale of the alteration(s) relative to the landform.

Table 7. Scale of alteration assessment results *(2006-2016)*

Scale (Initial % Alteration)	No. of Samples	% of Samples
Within Limits	74	79%
Borderline	6	6%
Exceeding Limits	14	15%
Total	**94**	**100%**

Scale (initial percent alteration) exceeded the upper limit of the range for the established VQO for 15% of the landforms sampled while 79% fell within the limits (Table 7).

The ***quality of design*** of harvested openings is a key factor in assessing the achievement of VQOs. It is a measure of how well openings blend with the natural landscape.

Table 8. Design assessment results (2006-2016)

Design Quality	No. of Samples	% of Samples
Good	47	50%
Neutral	12	13%
Poor	35	37%
Total	**94**	**100%**

Design quality was rated poor for 37% of the landforms sampled, while 50% of landforms sampled were rated as having good design (Table 8).

The ***visibility of roads*** can add significantly to overall visual impact, most often appearing as an unnatural linear element in the view.

Table 9. Road visibility assessment results (2006-2016)

Road Visibility	No. of Samples	% of Samples
None	60	64%
Subordinate	23	25%
Significant	7	7%
Dominant	4	4%
Total	**94**	**100%**

Road visibility was significant or dominant in 11% of sampled landforms, while 7% had significant visibility and 64% of sampled landforms had no visible roads (Table 9).

The ***retention of trees***, both dispersed and aggregated, can be highly effective in reducing the visual impact of openings.

Table 10. Tree Retention assessment results (2006-2016)

Tree Retention	No. of Samples	% of Samples
Good	22	23%
Moderate	13	14%
None	59	63%
Total	**94**	**100%**

There was no internal tree retention on 63% of landforms assessed, while 37% had significant amounts of tree retention (Table 10).

SUMMARY – RECENT SAMPLING PERIOD (2017 – 2021)

A total of 28 samples were collected in the Selkirk District during the 2017 to 2021 period.

Table 11. *Percentage of recently evaluated landforms by visual quality objective and effectiveness evaluation (EE) rating category (2017-2021)*

Visual Quality Objective	EE Rating Category					
	Clearly Not Met	Not Met	Borderline	Met	Well Met	Grand Total
Maximum Modification						0
Modification					3	3
Partial Retention	1	3	4	4	13	25
Retention						0
Total	1	3	4	4	16	28
% Total	**4%**	**10%**	**14%**	**14%**	**58%**	**100%**

Overall, 72% of the evaluated landforms achieved *(**met or well met**)* the VQO, 14% of landforms did not achieve the objective *(**not met/clearly not met**)*, and 14% were inconclusive *(**borderline**)* (Table 11). Of the 25 Retention and Partial Retention (more restrictive VQOs) samples, 68% achieved the VQO, 16% did not achieve the objective, and 16% were borderline. Because most of the samples (25 of 28) were Partial Retention, success in achieving the more restrictive VQOs was very close to the overall success rate.

The ***initial percent alteration*** metric is an indicator of the visual quality class (VQC) that has been achieved based only on the scale of the alteration(s) relative to the landform.

Use of tree screening and topography to achieve Partial Retention (PR) EVQO.

Table 12. *Scale of alteration assessment results (2017-2021)*

Scale (Initial % Alteration)	No. of Samples	% of Samples
Within Limits	22	78%
Borderline	1	4%
Exceeding Limits	5	18%
Total	**28**	**100%**

Scale (initial percent alteration) exceeded the upper limit of the range for the established VQO for 18% of the landforms sampled, while 78% fell within the limits (Table 12).

The ***quality of design*** of harvested openings is a key factor in assessing the achievement of VQOs. It is a measure of how well openings blend with the natural landscape.

Table 13. Design assessment results (2017-2021)

Design Quality	No. of Samples	%of Samples
Good	10	36%
Neutral	8	28%
Poor	10	36%
Total	**28**	**100%**

Design quality was rated poor for 36% of the landforms sampled, and equally 36% of landforms sampled were rated as having good design (Table 13).

The ***visibility of roads*** can add significantly to overall visual impact, most often appearing as unnatural linear elements in the view.

Table 14. Road visibility assessment results (2017-2021)

Road Visibility	No. of Samples	% of Samples
None	21	75%
Subordinate	7	25%
Significant	0	0%
Dominant	0	0%
Total	**28**	**100%**

Road visibility was not significant or dominant (0%) in any of the sampled landforms. It was subordinate in 25% of sampled landforms, while 75% of sampled landforms had no visible roads (Table 14).

The ***retention of trees*** within an opening, both dispersed and aggregated, can be highly effective in reducing the visual impact of openings.

Table 15. Tree Retention assessment results (2017-2021)

Tree Retention	No. of Samples	%of Samples
Good	1	4%
Moderate	6	21%
None	21	75%
Total	**28**	**100%**

There was no internal tree retention on 75% of landforms assessed, while 25% had significant amounts (Moderate or Good ratings) of tree retention (Table 15).

COMPARISON OF SAMPLING PERIODS

The recent (2017-2021) sampling period has less than one-third as many samples as the earlier (2006-2016) period, so any trends identified and conclusions drawn should be viewed tentatively. Below are some observations:

- Overall success in achieving VQOs improved from 67% to 72% between assessment periods, although further sampling may help to clarify this trend.
- Success in achieving the more restrictive VQOs (Retention and Partial Retention) improved (from 59% to 68%), although further sampling may help to clarify this trend.
- Scale of alteration (% alteration) stayed within VQO limits by about the same amount (78% and 79%) in each assessment period.
- Application of design principles to achieve good design dropped significantly from 50% to 36% from the older to newer sampling era.
- Amount of visible roads decreased in the newer sampling era, with no samples showing significant or dominant road visibility in the recent assessment period as compared to 11% in the earlier period.
- Use of internal tree retention dropped significantly from 37% to 25% from older to newer sampling era.
- It appears that the achievement of VQOs is showing incremental improvement over time. Of concern is the decrease in both the percentage of well-designed openings and the use of internal tree retention. These are both key practices that can reduce visual impacts and contribute to achieving VQOs.

COMPARISON OF SELKIRK DISTRICT WITH PROVINCIAL AVERAGE

A comparison was also made between Selkirk District's newer sampling period results and the Provincial average results for the same period – 2017 to 2021 (Figure 19). The District's results are very similar to the Provincial average results:

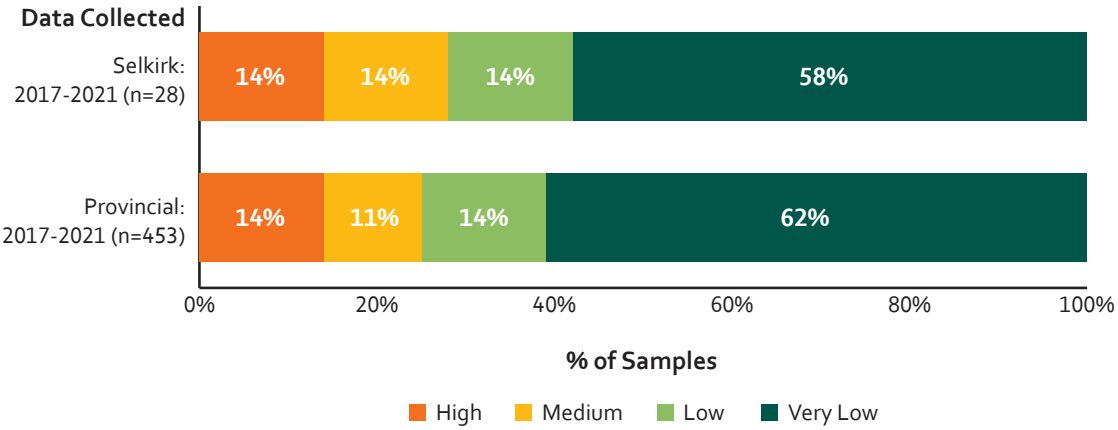


Figure 19. *Comparison of Selkirk District's newer sampling period results to the Provincial average for the same period – 2017 to 2021.*

- Provincially, overall success in achieving VQOs (***low*** and ***very low*** impact rating on the bar graph above) is 76%, while the District's success in achieving VQOs is slightly lower at 72%.
- The percentage of samples that did not achieve VQOs (***high*** impact rating on the bar graph above) was the same at 14% for both the Province and the District.

Table 16. *Design assessment results for Selkirk District vs Provincial average (2017-2021)*

Design Quality	Selkirk % (2017 – 2021)	Provincial Average % (2017 – 2021)
Good	36%	32%
Neutral	28%	36%
Poor	36%	32%
Total	**100%**	**100%**

- Provincially, 32% of samples were rated as having good design, while 36% of District samples were rated as having good design (Table 16).
- However, a slightly higher percentage of District samples were rated as having poor design (36%) compared to the Provincial average (32%).

SUGGESTED PRACTICES TO IMPROVE VISUAL MANAGEMENT RESULTS

Based on the data analysis and observations, the following recommendations are made to encourage improved visual practices and results.

1. Communicate with forest professionals within the District that while achievement of VQOs is showing an upward trend, there is still room for innovation and improvement in visual management practices.
2. Encourage greater understanding and implementation of visual design principles and practices, to improve visual quality and VQO achievement. A new visual impact assessment handbook has been developed and replaces the Visual Impact Assessment Guidebook released in 2001 under the Forest Practices Code of British Columbia Act (Forest Practices Code).
3. Encourage greater use of internal tree retention, where possible, to improve visual quality and VQO achievement.
4. Continue to follow scale of alteration guidance in achieving VQOs and continue to be aware of the visibility of roads and other site disturbances.

DISTRICT MANAGER COMMENTARY

Keeping in mind that the recent period has one-third fewer samples than the older period, licensees need to improve their diligence and effort spent during the layout and design of cutblocks in areas with Visual Quality Objectives. The use of improved technologies and techniques for conducting visual impact assessments can play an important role in modeling what prescriptions will look like following harvesting and the final outcomes.

Improvements have been made within forest stewardship plans and some licensees have increased consultation with stakeholders and the public where roads and cutblocks will impact the visual landscape.

The Ministry of Forests has also conducted several seminars in the district within the past few years. These were facilitated by provincial visual experts and were well attended by licensees and their contractors.

I expect all of these factors to continue in the future and a positive trend to be seen in future assessment results.

Example of Well Met VQO achievement in a Partial Retention (PR) EVQO.

Example of Clearly Not Met VQO achievement in a PR EVQO.

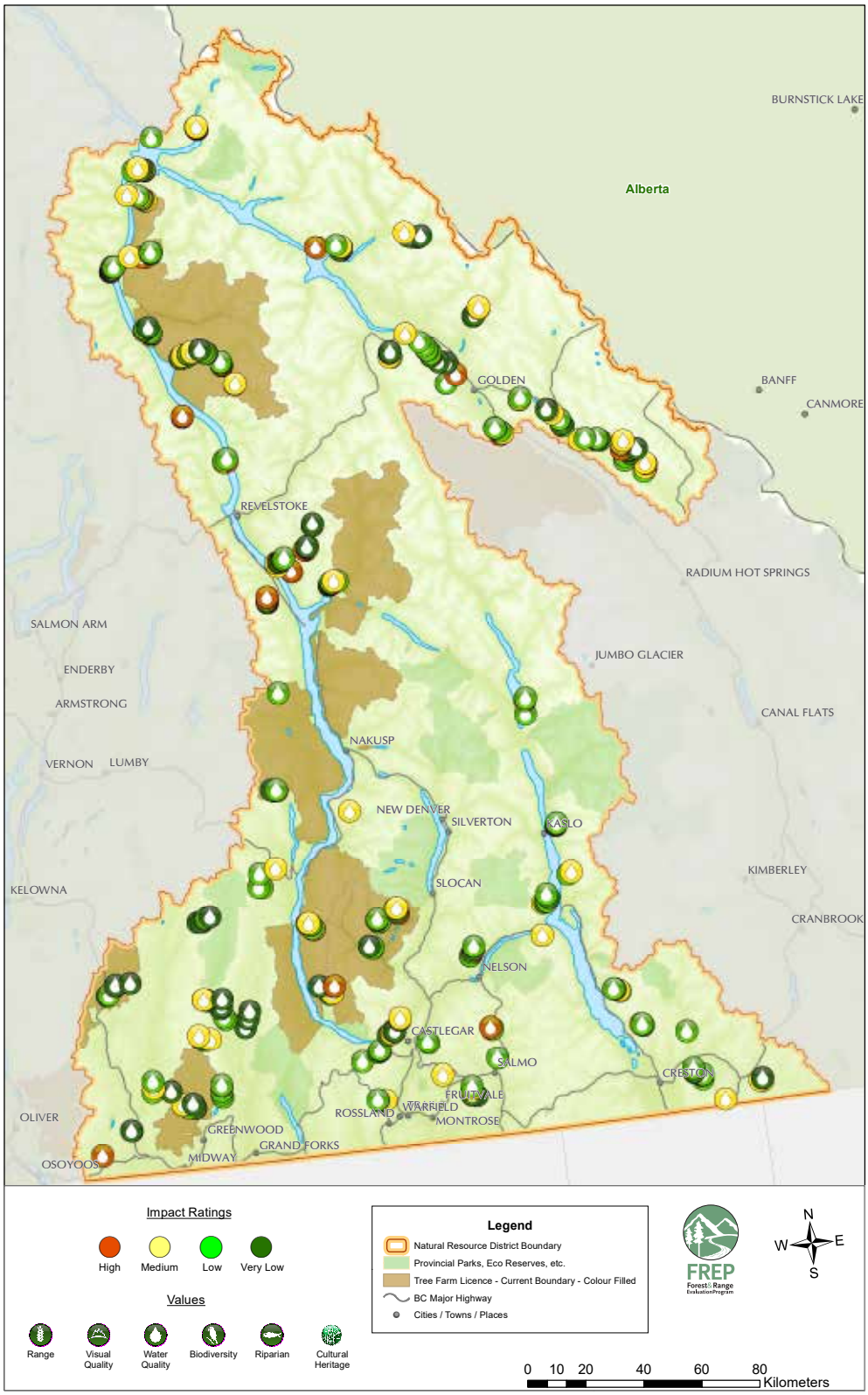


Figure 20. *Selkirk Natural Resource District, showing Water Quality sample locations.*

WATER QUALITY: RESOURCE DEVELOPMENT IMPACTS ON WATER QUALITY

Priority Question: Are the *Forest and Range Practices Act* policies effective in protecting water quality?

The Water Quality Effectiveness Evaluation (WQEE) was developed to assess the amount of fine sediment generated from forest and range related site disturbances and the effect on water quality. At each site, attributes such as connectivity, exposed soil, and the amount of erodible material present, are used to assess potential water quality degradation. A total fine sediment volume calculation is made to determine if the site fits into a "Very Low", "Low", "Moderate", "High, "or "Very High" impact class. The classes rate the severity of water quality impact that a site may have on a watershed. Note: the following information has been summarized by the MRVA impact rating: ***Very low***, ***low***, ***medium***, and ***high***.

Additional information to consider regarding issues of concern and recommendations is available in Appendix 6.

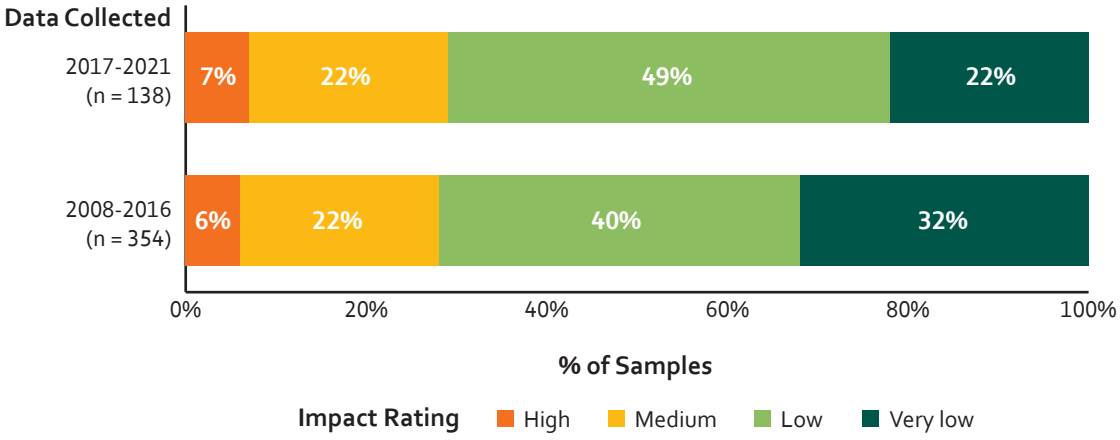


Figure 21. *Percentage of sites in high, moderate, low, and very low impact categories by evaluation era.*

Water Quality Resource Value: Evaluation Question	Indicators	Resource Development Impact Rating Criteria	Very low Impact Rating	Low Impact Rating	Medium Impact Rating	High Impact Rating
Are forest practices effective in protecting water quality?	Fine sediment potential	Fine sediment (m^3) due to expected surface erosion or past mass wasting	< 0.1	< 1	1–5	> 5

Data Source: The 492 sites evaluated for water quality assessments in the Selkirk Natural Resource District were collected by Ministry staff using the Forest and Range Evaluation Program water quality monitoring protocol. All data was collected between 2008 and 2021. The sampling transects for water quality evaluations originate at randomly selected, recently harvested openings and follow the route that logging trucks would travel to bring wood from the cutblock to the mill or dry sort. Stream crossings and areas where roads parallel streams are targeted for sampling and are considered "sites". Volumes of fine sediment delivered to streams are estimated for each site which is then assigned a water quality impact rating ranging from 'Very Low' to 'High'.

The samples provide a cross section of the types and magnitudes of disturbances to water quality one might expect from disturbances associated with an industrial gravel road. Individual licensees were not targeted and the sites along any given transect may or may not be managed by the company that harvested the block. Licensees typically have no authority over non forestry uses of road and much of the traffic may be generated by recreation users, mining exploration or other industries. Consequently, although a licensee may hold a road permit, care must be used in assigning responsibilities to specific water quality impacts.

DISTRICT WATER QUALITY RATINGS

Out of the 492 sites evaluated, 354 were evaluated in 2008-2016, and 138 were evaluated in 2017-2021. In 2008-2016, 32% of sites were rated '***Very Low***', 40% were rated '***Low***', 22% were rated '***Medium***', and 6% were rated '***High***'. In 2017-2021, 22% of sites were rated '***Very Low***', 49% were rated '***Low***', 22% were rated '***Medium***', and 7% were rated '***High***' (Figure 21). The nature of water quality sampling, and the dispersal of samples within the district, prevent the statistical analysis of trends over time.

RECOMMENDATIONS TO REDUCE WATER QUALITY IMPACT FOR EVALUATED SITES

Opportunities for improvement of sediment management are related to all stages of a road's life: its location, design, construction, maintenance and/or road deactivation. Upon reviewing the Selkirk District's database for 2008-2021, five management recommendations addressed two-thirds of the sediment generating issues (Table 17).

Table 17. *Type of management issues impacting water quality from provincial data base (WQEE, 2022)*

Road life phase	% of total recommendations	Recommendation for improvement
Design	20%	Plan for sufficient number of strategically place culverts to avoid excess drainage water concentration
Construction	13%	Armour seed or spread-out logging debris over disturbed area to protect soil
Construction	11%	Construct sediment basins capable of handling coarse sediment
Maintenance	9%	Reduce or prevent traffic during very wet weather or just after spring thaw
Deactivation	9%	Install strategically placed cross ditches, water bars and ditch blocks

The single most noted recommendation, "plan for sufficient number of culverts" identifies the importance of managing water from the road's surface and the interception of groundwater associated with the road prism. Contingent with this recommendation is: a) the requirement to direct the captured ditch water into the understorey where it can filter back into the soil to become groundwater again, b) maintain short ditchlines so that the accumulated ditch water does not increase in volume and as a result develop "erosive power" and cause additional issues and c) have ditchlines not ending (or emptying) at creeks. Ditchlines ending at a creek are not a solution as they transport sediment laden water directly to a creek, facilitate increased peakflows, and increase stream erosion.

Road ruts channeling water and eroding the road surface.

The second most mentioned recommendation given at 33 sites was associated with heavy use of roads during wet weather or during spring thaw. Where possible, more careful timing of hauling could have substantially reduced sedimentation at these times.

The third most mentioned concern found at 31 sites was associated with the use of low-quality road fill in the original construction of the road. Low quality fill can include: 1) rocks with lower hardness that fracture and produce fines that are more easily transported to a stream crossing, 2) rocks that have high fine sediment (fines) content/composition such as silt stone, some sandstones, shale, etc. or 3) pit run materials that contain a high percentage of fine sands, silts, or clays. Long haul distances from better quality road base sources may have made improvements to road fill issues.

DISTRICT MANAGER COMMENTARY

The water quality results highlight the importance of incorporating fine sediment management into all phases of a road's life (location, design, construction, maintenance, and deactivation). As per the results in Table 17, two-thirds of the recommendations to manage fine sediment generation occur within four life stages of a road's life. These results point towards the understanding that the management of fine sediment generation is everyone's responsibility, including planning foresters, surveyors, engineers, operational staff, and heavy equipment operators involved with road construction, maintenance, and deactivation. This understanding, can only be accomplished via:

- Better communication between planning and operational staff within government and the forest licensee. This includes the transfer of FREP water quality results to licensees of ***moderate*** and ***high*** sites immediately after their assessment;
- Increased and improved training and knowledge management, such as the grader operator course, and the identification of the importance of fine sediment and water management to road planners and layout crews;
- Institutionalized district and licensee monitoring to ensure sediment and erosion control practices are working.

To implement the above recommendations, I would expect that any newly designed roads consider increasing strategically placed culverts, protecting disturbed soil and constructing sediment basins. For existing roads, reduce traffic in wet weather or freshet and place strategic cross ditches and water bars.

Garrett Creek

Sediment accumulation on bridge deck over a fish bearing stream

APPENDIX 1 – Comparative FREP Results by Resource Value for Other Areas

Table A1.1 below compares the Selkirk Natural Resource District to the North, South and Coast areas and the province as a whole. Note that due to the nature of sampling, and the dispersal of samples within each district, caution should be exercised when making comparisons. Rangeland health data could not be compared due to summary data not being available.

Table A1.1. *FREP monitoring results of Low and Very Low Impact Ratings, up to 2021, by resource value for the North, South, and Coast Areas and the province as a whole compared to the Selkirk Natural Resource District*

Resource Value	Effectiveness of Practices in Achieving Resource Stewardship Objectives: **% Very Low + Low resource development impact rating (sample size of Very Low and Low in brackets)**				
	Selkirk Natural Resource District	Ministry of Forests Operations Areas			
		North	South	Coast	Province
Riparian – all data to 2021	**60% (104)**	**74% (635)**	**71% (800)**	**62% (546)**	**67% (1937)**
2015-2019 harvest year	52% (14)	87% (115)	74% (159)	66% (133)	74% (404)
1998-2014 harvest year	60% (90)	72% (520)	70% (641)	60% (413)	68% (1574)
Water Quality – all data to 2021	**72 % (353)**	**62% (1186)**	**72% (2676)**	**77% (3011)**	**71% (6800)**
2017-2021 samples	71% (98)	65% (415)	71% (968)	76% (817)	73%(2250)
2008–2016 samples	72% (255)	60% (771)	72% (1703)	78% (2194)	71% (4600)
Stand-level Retention – all data to 2021	**61% (137)**	**53% (436)**	**56% (656)**	**80% (753)**	**63% (1845)**
2015-2019 harvest year	56% (15)	51% (27)	49% (69)	86% (86)	62% (182)
1998-2014 harvest year	62% (122)	54% (409)	56% (587)	79% (667)	63% (1663)
Visual Quality – all data to 2021	**68% (83)**	**73% (248)**	**65% (321)**	**76% (490)**	**71% (1059)**
2017-2021 samples	72% (20)	82% (95)	66% (105)	79% (141)	75% (341)
2006-2016 samples	67% (63)	68% (153)	64% (216)	75% (349)	70% (718)
Cultural Heritage – all data to 2021	**43% (6)**	**69% (276)**	**76% (176)**	**70% (179)**	**71% (635)**
2015-2019 harvest year	40% (4)	70% (115)	77% (98)	69% (94)	71% (631)
2007-2014 harvest year	50% (2)	68% (161)	74% (78)	72% (85)	72% (307)

APPENDIX 2 – Additional Information on the Cultural Heritage Resources Assessment

PROTOCOL INFORMATION

The complete protocol can be found at the following website:
https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/integrated-resource-monitoring/forest-range-evaluation-program/frep-monitoring-protocols/cultural-heritage

GOAL OF CULTURAL HERITAGE RESOURCE (CHR) VALUE MONITORING

CHR stewardship monitoring is undertaken on forest and range tenures to help answer the following questions:

1. How are known CHRs actively managed and what strategies are used?
2. How has conservation or protection maintained the site integrity and (or) value?
3. Are results on the ground consistent with First Nations' expectations?
4. Do site planning documents contain information about CHR management?
5. Are results on the ground consistent with site planning and site alteration permit commitments or requirements?
6. Is/was site damage due to unavoidable operational factors?
7. What management practices are resulting in adequately protecting, managing and/or conserving CHR values?
8. What management options may have improved CHR management on the site?
9. In what format, and how readily available, is CHR information?

PRIORITIES FOR CULTURAL HERITAGE RESOURCE MONITORING

The monitoring procedures outlined in this protocol only assess the post-harvest management effectiveness of known and site-specific CHR sites or features. For this protocol, "known" sites are those recorded or identified by a First Nation, and of which forest managers and decision makers should therefore be aware.

In collaboration with our First Nations partners, the CHR team identified seven general categories of CHRs on which to focus:

- Culturally modified trees (CMTs)
- Cultural trails
- Traditional, ceremonial, and spiritual use sites or areas
- Cultural plants
- Ecological features with cultural significance
- Archaeological resources (e.g. pre-1846 CMTs, cultural depressions, lithics, etc.)
- Monumental cedar

CURRENT STRATEGIES FOR CULTURAL HERITAGE RESOURCE MANAGEMENT

Conserving, and where necessary protecting, CHRs involves preventing the loss of, or minimizing damage to, sites or features. To achieve this, forest managers frequently use one or more of the following approaches to manage site-specific CHRs:

- Modify the cutblock boundary to avoid the feature ("site avoidance")
- Retain a buffer around the site or feature
- Retain the feature with no buffer where safe to do so ("log around"; e.g., leave a CMT standing with no buffer)
- Modify tree crowns or stands
- Conserve the feature in a temporary retention area or permanent reserve
- Stub CMT above scar
- Stubbing all trees in and around a CHR area/feature
- Record the location and (or) date the feature with subsequent conservation or protection of the feature
- Record the location and (or) date the feature before forestry activities proceed
- Alter silvicultural practices (e.g., selective harvesting to maintain understorey plant communities)
- Undertake detailed or systematic archaeological data recovery or preservation through record
- Monitor for additional archaeological site information during forestry activities

ADDITIONAL INFORMATION

FREP Report #18 – A Review of Forest Stewardship Plan Results and Strategies for the Cultural Heritage Resource Value. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/frep_report_18.pdf?fileName=frep_report_18.pdf

FREP Report #22 – Evaluating Forest Management Planning and Implementation under the Forest and Range Practices Act: FREP Cultural Heritage Resource Process Evaluation Pilot Project. https://www.for.gov.bc.ca/ftp/HFP/external/!publish/FREP/reports/FREP_Report_22.pdf

FREP Extension Note # 6: Perspectives from the Cultural Heritage Resource Value Monitoring Pilot Project. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/frep-extension-note-06.pdf?fileName=frep-extension-note-06.pdf

Extension Note # 11: Cultural Heritage Monitoring: Results, Perspectives and Opportunities for Improvement. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/frep-extension-note-11.pdf?fileName=frep-extension-note-11.pdf

FRPA Administrative Bulletin 1 – Forest Stewardship Planning First Nations Information Sharing https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/integrated-resource-bulletins/frpa-admin-no-1-fn-info-sharing-jun-9-2005.pdf

Proponents guide to consulting with FN. https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/consulting-with-first-nations

British Columbia Archaeological Resource Management Handbook for Foresters. https://www.for.gov.bc.ca/ftp/archaeology/external/!publish/web/handbook_for_foresters.pdf

APPENDIX 3 – Additional Information on the Riparian Assessment

PROTOCOL INFORMATION

The complete protocol can be found at the following website:
https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/full_riparianprotocol_2020-117pp.pdf

The properly functioning condition of a stream and its riparian area is the ability to:

- withstand normal peak flood events without experiencing accelerated soil loss, channel movement or bank movement
- filter runoff
- store and safely release water
- maintain connectivity so that fish habitat is not lost or isolated
- maintain an adequate root network and supply of large woody debris (LWD)
- provides shade and reduces microclimate change

The above definition is expanded here to include the need for fish habitat in streams and riparian areas to be fully connected so that fish habitat is not lost or isolated as a result of management activities. The ability of the riparian habitat to maintain an adequate root network or LWD supply, and to provide shade and reduce bank microclimate change, is also included in the definition of properly functioning condition. This is in keeping with recommended best management practices for logging beside different stream types in the Riparian Management Area Guidebook (Province of B.C. 1995).

Functioning condition of each stream reach is determined by 15 questions about the characteristics of healthy streams and their riparian habitats. Each question is based upon indicator statements that are specific to the features being assessed. Indicator statements require a yes or no response. Each question has equal weighting. Some attributes may naturally be more important or sensitive than others. These differences in importance have been taken into account by varying the thresholds for each indicator or changing the number of indicators that need to be met to obtain a 'Yes' answer to a main question. Attributes that are naturally quite variable, such as the amount of eroding bank present, have a relatively high threshold. Other attributes with low variability or are naturally rare, such as the amount of bare ground present, have a lower threshold (Riparian Protocol 2020).

INDICATOR QUESTIONS

1. Is the channel bed undisturbed?
2. Are the channel banks intact?
3. Are channel LWD processes intact?
4. Is the channel morphology intact?
5. Are all aspects of the aquatic habitat sufficiently connected to allow for normal, unimpeded movements of fish, organic debris, and sediments?
6. Does the stream support a good diversity of fish cover attributes?
7. Does the amount of moss present on the substrates indicate a stable and productive system?
8. Has the introduction of fine sediments been minimized?
9. Does the stream support a diversity of aquatic invertebrates?
10. Has the vegetation retained in the RMA been sufficiently protected from windthrow?
11. Has the amount of bare erodible ground or soil compaction in the riparian area been minimized?
12. Has sufficient vegetation been retained to maintain an adequate root network or LWD supply?
13. Has sufficient vegetation been retained to provide shade and reduce bank microclimate change?
14. Have the number of disturbance-increaser plants, noxious weeds and/or invasive plant species present been limited to a satisfactory level?
15. Is the riparian vegetation within the first 10m from the edge of the stream generally characteristic of what the healthy unmanaged riparian plant community would normally be along the reach?

SUMMARY OF THE ASSESSMENT

- 0–2 No answers – Virtually all stream and riparian experts would agree the stream is healthy and in properly functioning condition
- 3–4 No answers – Functioning but at risk. Most, but not all stream and riparian experts would agree the stream is functioning properly
- 5–6 No answers – Functioning but at high risk. Most, but not all stream and riparian experts would agree the stream is not in properly functioning condition
- 7 or more No answers – Virtually all stream and riparian experts would agree the stream is not functioning properly

KEY CAUSAL FACTORS

The following information provides details on some of the key causal factors that influence how a stream functions following harvesting:

1. Retention of stream side vegetation

Maintaining adequate streamside vegetation has a positive influence on most, if not all, factors evaluated by this protocol. This is the most effective method to ensuring streams function post-harvest. Trees and vegetation play an important role by maintaining stream bank stability, providing shade and reducing changes to the microclimate. They introduce coarse woody debris and organic material into the stream gradually overtime. This vegetation also forms a barrier which reduces the likelihood of cattle and harvesting debris from entering the stream and limits the operation of equipment. Maintenance of >10m of streamside vegetation has been shown to greatly increase the likelihood of a stream maintaining functionality following harvesting.

The effects of this are most noticeable on S5 and S6 streams where a riparian reserve zone is not required in regulation and there are limited requirements to maintain vegetation in the riparian management zone.

2. Windthrow

When windthrow in riparian areas is extensive, there is a good chance that the integrity of the stream and stream bank environment is also compromised. The benefits provided by the retained trees, as described in the previous paragraphs are minimized or eliminated when windthrow takes place. If retained trees blow down, then it is likely that key wildlife attributes will also be disrupted. When trees are adjacent to the stream, sedimentation can be directly added to streams from root wads and there can be impacts to stream bank stability.

3. Harvest Debris in the Stream Channel

Material that is introduced into a stream during harvesting activities has a number of negative impacts on the stream channel and morphology. These may include: inhibiting the flow of water which may lead to a buildup of sediments or vegetative material that would naturally be carried through the system, redirecting of the stream outside of its natural channel, and posing a barrier to the movement of aquatic life and degradation of their habitat.

Management strategies to reduce debris in the channel include but are not limited to: yarding and skidding away from stream, establishing a machine free zone, maintaining vegetation within riparian management zones to act as a buffer, and physically removing any unstable, introduced debris following harvesting.

4. Machine Disturbance

Machinery that operates adjacent to streams can have negative impacts on stream functioning in a number of ways. These include disturbance to stream banks resulting in the potential to increase sediment and debris into the stream which can have negative impacts on fish, aquatic habitat and water users. It can also result in soil compaction or disturbance, and the potential introduction of invasive plants.

Establishing a machine free zone >5m where equipment is not operated in close proximity to the stream bank is the most effective strategy for reducing impacts on stream functionality.

5. Roads

Road surfaces and cut-and-fill slopes are examples of bare erodible ground. Bare erodible ground is exposed soil or erodible mineral deposits that water can wash into the adjacent stream. Where a road or cut-and-fill slope is hydrologically connected to a riparian area, sediments can be transported to a stream over a long distance.

Hydrological linkage is estimated based on the ability of the water to carry sediments into the stream. It is not just a measure of whether water by itself will enter the stream. Evidence of hydrological linkage can usually be observed in the form or ruts, rills or eroding tracks down the road to a spot at the crossing where water spills directly off the edge of the road into the stream or into a ditch that is clearly connected to the stream. Minimizing bare erodible ground and eliminating the hydrologic connectivity will prevent fine sediments from being introduced into streams.

The best method to minimize impacts on water quality is to ensure that best management practices for road layout, construction, maintenance and deactivation are followed and that roads are risk rated and inspected at appropriate intervals. There are a multitude of websites and documents with information available on these topics. Consider the Ministry engineering website found at: https://www2.gov.bc.ca/gov/content/industry/natural-resource-use/resource-roads/engineering-publications-permits/engineering-manual

Consider factors such as existing upstream crossings and soil erodibility when making decisions for road placement near streams. Evaluate and improve existing crossings when obtaining tenure for old roads to ensure structures are functioning and appropriate for logging traffic and potential increases in discharge resulting from new harvest activity.

6. Natural Events

Natural events such as landslides, windthrown trees, floods and debris torrents caused by snow melt or excessive rainfall can have detrimental impacts on any of the factors assessed in this protocol. A stream's natural process of erosion also leads to sediment and debris being introduced which can have negative effects. Impacts from natural factors may lead one or more no answers for the 15 main assessment questions and by themselves will not usually result in a high-risk or not properly functioning condition but may do so if combined with those attributed to harvesting or roads.

Review watershed maps and other information before planning a block near a stream to identify any sensitive landscape features (e.g., alluvial fans), upstream factors (e.g., logging, landslides), or downstream priorities (e.g. water licenses, fish, or sensitive species) that may affect decision making. Develop a flow chart with the above categories and potential riparian prescriptions for each.

Walk the ground as a group of functional teams (harvesting, silviculture, etc.) to account for all site-specific factors, and prescribe practices that will be effective for both logging and post-logging activities. Consider soils, windthrow hazard, terrain, and timber type when writing prescriptions.

Provide equipment operators with geo-referenced e-maps for iPads or other mobile devices to help locate streams and fisheries-sensitive areas. Tie ribbons at the stream centreline and/or at the edge of riparian buffers. Fallers can leave high stumps in riparian areas to help others identify streams.

ADDITIONAL INFORMATION

FREP Extension Note #41 (PDF): Best Riparian Management Practices Leading to Good Outcomes for Small Streams. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/extension-notes/frep_extension_note_41.pdf

FREP Extension Note #40 (PDF): The Condition of Small Streams After Harvesting: A Summary of FREP Data From 2006-2015. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/extension-notes/frep_extension_note_40.pdf

FREP Extension Note #39 (PDF): Post-harvest Condition of Stream Channels, Fish Habitats, and Adjacent Riparian Areas: Resource Stewardship Monitoring to Evaluate the Effectiveness of Riparian Management 2005-2014. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/extension-notes/frep_extension_note_39.pdf

FREP Extension Note #38 (PDF): The Importance of Small Streams in British Columbia. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/extension-notes/frep-extnt38-smallstreams.pdf

FREP Report #27 (PDF, 3MB): State of Stream Channels, Fish Habitats, and their Adjacent Riparian Areas: Resource Stewardship Monitoring to Evaluate the Effectiveness of Riparian Management, 2005–2008. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/frep_report_27.pdf?fileName=frep_report_27.pdf

APPENDIX 4 – Additional Information on the Stand-Level Retention (SLR) Assessment

In 2020, the FREP Stand-level Retention Protocol was introduced to replace the original Stand-Level Biodiversity (SLBD) Protocol, but has not yet been published.

The new SLR protocol still utilizes the same site selection, sampling procedure and field data collection as the original SLBD protocol. This allows for direct comparisons between cutblocks sampled prior to (dating back to blocks harvested as early as 1997) and after development of the new SLR protocol.

However, the new SLR protocol includes several important new components that are intended to improve how the data can be used to evaluate stand-level retention practices, including:

1. The use of GIS-based indicators to evaluate whether the amount of retention in the cutblock is adequate considering the landscape context, whether the sampled cutblock is part of a larger patch (adjacent forest <30 years that forms a large aggregate opening), and how block shape and retention within the block affects connectivity and forest influence within the cutblock.

2. The development of eight key questions that relate to different categories of stand-level retention including: 1) retention amount and design considering landscape context, 2) wildlife tree retention practices, and 3) coarse woody debris retention practices. To answer these questions the protocol compares collected data for both GIS-based indicators and field data against pre-defined targets based on existing management guidance and ecological principles. This comparison is used to determine if practices are ***Well Below***, ***Below***, ***Meeting***, or ***Exceeding*** the targets for each question.

3. A final rating for the cutblock that evaluates how likely (*Very Unlikely, Likely, Somewhat Likely, Likely, or Very Likely*) the cutblock will achieve the priority FREP question "Is stand-level retention providing the range of habitat with the attributes understood as necessary for maintaining the species dependent on wildlife trees and CWD?". This evaluation is based on the number of questions that are ***Meeting*** or ***Exceeding*** targets, with the outcomes being more likely when more questions are ***Meeting*** or ***Exceeding*** targets.

Currently, the new SLR protocol has not yet been posted to the FREP website but is anticipated by May/June 2023. However, the original SLB protocol is still on the website and provides useful insight on field data collection.

PROTOCOL INFORMATION

The original SLB protocol can be found at the following website: https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/integrated-resource-monitoring/forest-range-evaluation-program/frep-monitoring-protocols/biodiversity

The SLR assessment measures several GIS-based indicators to help answer the priority question. The indicators used to assess stand-level retention include:

- biogeoclimatic Ecosystem Classification (BEC) Group – groupings of biogeoclimatic subzone variants that represent similar climatic and natural disturbance conditions;
- natural disturbance type (NDT);
- percent timber harvesting land base (% of total forest area);
- percent area harvest (% of forest area harvested <40 years old);
- percent burn (% of forest area in Moderate-High burn severity class due to wildfires) – areas harvested pre or post wildfire are counted as harvested;
- percent insects (% of forest area cumulatively affected by insects to 2015) – includes Medium to High Severity insect attack for mountain pine beetle (IBM) and spruce beetle (IBS);
- percent total disturbance (% of forest area cumulatively affected by forest harvest, wildfire and insect attack)
- percent forest influence of the gross area of the cutblock that is covered by a WTRA and/or within 25 m of within stand retention or adjacent forest (>40 years old);
- maximum distance across the cutblock (meters);
- patch size in hectares; and
- patch size class (<50, 50-250, 250-1000, 1000+ hectares).

The SLR assessment collects field data on several biodiversity indicators to help answer the priority question. The indicators used to assess stand-level retention include:

- tree species and size (height and diameter)
- ecological attributes used to anchor retention
- the amount of trees that are wildlife tree classes 1 and 2 (live trees), and 3+ (standing dead trees)
- the presence of invasive plants
- the amount and type (size, species and decay class) of coarse woody debris
- the amount of windthrow
- harvesting constraints

These key field-based indicators are used to derive specific metrics that are summarized for each stratum sampled in the cutblock, or averaged for the cutblock as a whole, including: the density (stems/ha) of large diameter live trees and large snags > 30cm dbh, the average and total amount of windthrow in WTRAs, total CWD volume, and large CWD pieces > 20cm dbh and > 10m in length.

STRATUM TYPES

There are a total of 10 different stratum types that can be used to help stratify a block opening. The 10 strata are defined by FREP as:

- Patch riparian (PR) – Treed retention left within a riparian management area. Use riparian designation regardless of retention being classified as a WTP on site map
- Patch wildlife (PW) – Treed retention left outside of the riparian management area (RMA) and designated as a wildlife tree patch
- Patch other (PO) – Tree retention left outside of RMA for purposes other than PR, PW, and anticipated to remain for the full rotation
- Patch temporary (PT) – Treed retention that will likely be harvested before rotation end (e.g., indication on map that this is a temporary deferred area)
- Patch unidentified (PU) – Retention found in the field but not mapped. No indication on map regarding patch purpose and patch not in a RMA
- Dispersed riparian (DR) – Dispersed trees left within a RMA. Use riparian designation regardless of other coding from map
- Dispersed wildlife (DW) – Dispersed trees left outside of RMA and designated as wildlife trees
- Dispersed other (DO) – Dispersed trees left outside of RMA for purposes other than DR, DW, and anticipated to remain for the full rotation
- Dispersed temporary (DT) – Dispersed trees that will likely be harvested before rotation end (e.g., indication on map that trees are left as part of a commercial thin or shelterwood)
- Clearcut (CC) – Zero retention in stratum

ADDITIONAL INFORMATION

FREP Report #29: Southern Interior Forest Region: Analysis of Stand-Level Biodiversity Sampling Results In Six Predominant Biogeoclimatic Subzones. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/frep_report_29.pdf?fileName=frep_report_29.pdf

FREP Report #10: Stand-level Biodiversity Monitoring in 44 Large Cutblocks in the Central Interior of British Columbia. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/frep_report_10.pdf?fileName=frep_report_10.pdf

FREP Report #7: State of Cutblocks: Resource Stewardship Monitoring for Stand-level Biodiversity 2005. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/frep_report_07.pdf?fileName=frep_report_07.pdf

FREP Extension Note #8: Coarse Woody Debris Backgrounder. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/frep_extension_note_08.pdf

Wildlife Tree & Course Woody Debris Guidance & Policies. https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/wildlife/wildlife-habitats/wildlife-tree-committee/wildlife-tree-guidance-policies

Guidance on Landscape- and Stand-level Structural Retention in Large-Scale Mountain Pine Beetle Salvage Operations. https://www.for.gov.bc.ca/hfd/library/documents/bib95960.pdf

Forest Practices Board Special Report. Biodiversity Conservation during Salvage Logging in the Central Interior of BC. https://www.bcfpb.ca/wp-content/uploads/2016/04/SR35-Salvage-Logging.pdf

B.C. Ministry of Forests.1995. Biodiversity Guidebook. https://www.for.gov.bc.ca/ftp/hfp/external/!publish/FPC%20archive/old%20web%20site%20contents/fpc/fpcguide/biodiv/biotoc.htm

B.C. Ministry of Forests and Range. 2006. Wildlife Tree Retention: Management Guidance. https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/conservation-habitat-management/wildlife-conservation/wildlife-tree-committee/wt-guidance-05-2006.pdf

B.C. Ministry of Forests and Range. 2005. Preliminary assessment of the effectiveness of wildlife tree retention on cutblocks harvested between 1999 and 2001 under the Forest Practices Code. Victoria, BC. https://www.crownpub.bc.ca/Product/Details/7655005372_S

B.C. Ministry of Forests and Range. 2008. Sampling intensity for stand-level biodiversity surveys. B.C. Min. Forest Practices Branch, Victoria, B.C. FREP Report No. 015. https://www.for.gov.bc.ca/hfd/library/frep/FREP_Report_15.pdf

Harris, B. 2001. Observations on the use of stubs by wild birds: A 10-year update. BC Journal of Ecosystems and Management 1(1):19–23. https://jem-online.org/index.php/jem/article/view/212

APPENDIX 5 – Additional Information on the Visual Quality Assessment

PROTOCOL INFORMATION

The complete protocol can be found at the following website:
https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/integrated-resource-monitoring/forest-range-evaluation-program/frep-monitoring-protocols/visual-quality

The main focus of these procedures is on measuring viewing conditions for clearcut, patch-retention and partial cut alterations in mid-distance view, i.e., 1–8 km from the viewpoint, which account for the majority of current alterations in scenic areas in British Columbia.

Visual quality effectiveness is generally evaluated at the landscape level and may involve multiple cutblocks, viewpoints and licensees. Examples of evaluation areas: a long stretch of highway corridor, an entire valley, a lakeshore, a coastal inlet or channel.

The evaluation must be conducted at all important viewpoints. New and older alterations not yet greened-up in the subject landscape must be included in the evaluation. Alterations are considered "greened-up" when the public would perceive what they see to be a regenerating forest and when the new forest cover is sufficiently tall to obscure stumps, logging debris and bare ground.

Each view must be assessed according to whether it meets:

1. the basic visual quality class (VQC) definition and
2. the percent perspective landform alteration criteria which include consideration of the quality of visual landscape design.

The final Effectiveness Evaluation rating combines the result of the above two independent measures. The achieved VQC under the basic definition is compared with the VQC determined using perspective measurement and adjustment for the scene attributes. The final rating for each landform is determined by reconciling any differences between the two assessments from each viewpoint in a brief written rationale.

A field form (Appendix 1, VIA Handbook) has been developed that practitioners can use for planning and evaluation purposes.

DOCUMENTS AND WEBSITES TO CONSIDER

Guidance for Forest Professionals Practicing in Visual Resource Management. (This document is located in the FPBC website under member/practicing in B.C./practice guidelines https://www.fpbc.ca/practice-resources/standards-practice-guidelines/practice-standards-forest-resource-activities/)

FRPA General Bulletin #9: Managing Visual Resources. https://www.fpbc.ca/practice-resources/standards-practice-guidelines/practice-standards-forest-resource-activities/

FREP Extension Note #32 (PDF): The Effectiveness of Managing Visual Quality under the Forest and Range Practices Act. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/frep-extension-note-32.pdf?fileName=frep-extension-note-32.pdf

FREP Extension Note #13 (PDF): The Effectiveness of Managing Visual Resources under the Forest Practices Code. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/frep-extension-note-13.pdf?fileName=frep-extension-note-13.pdf

Managing Change in British Columbia's Scenic Landscapes. https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/visual-resource-management

A First Look at Visually Effective Green-up in British Columbia. https://www.for.gov.bc.ca/hfd/pubs/Docs/Mr/Rec008.htm

APPENDIX 6 – Additional Information on the Water Quality Assessment

PROTOCOL INFORMATION

The complete protocol can be found at the following website: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/water-quality-protocol.pdf

This FREP protocol estimates fine sediment delivered to streams from mass failures and surface erosion. Virtually all sediment generated by forest activities comes from easy-to-identify point sources. Such sources or sites occur wherever roads, harvesting or livestock disturbed terrain come in close hydrological proximity with natural drainages.

Forestry or livestock disturbed sites are delineated by their disturbed drainage contributing areas. These are called "mini-catchments". A mini-catchment encompasses the whole area of disturbance associated with any sample site that drains towards a recognized water body. It might include a portion of forest road drained by a particular culvert, cutbank faces along the road and the pathway of any concentrated water as it flows off a disturbed site toward an adjacent stream. It does not include surfaces where the forest floor, logged or not, is largely undisturbed.

When forestry related disturbances generate fine sediment that is then transported to a stream, turbidity pulses occur which degrade water quality. Any process that transports fine sediment is also capable of carrying any other pollutants that might be on site. Although the evaluation methodology focuses on fine sediment generating turbidity, it also acts as an indicator for other potential contaminants.

CAUSAL FACTORS AND CONTINUOUS IMPROVEMENT

The selection of appropriate management options needs to be considered during the initial layout and design of a road through to construction, maintenance and deactivation. Actions taken to reduce the available exposed ground and to prevent sediment from entering streams during each of these phases, will strongly influence how much water quality degradation will occur.

The best method to minimize impacts on water quality is to ensure that best management practices for road layout, construction, maintenance and deactivation are followed and that roads are risk rated and inspected at appropriate intervals.

There are a multitude of websites and documents with information available on these topics. One such site is the Ministry of Forests engineering website found at: https://www2.gov.bc.ca/gov/content/industry/natural-resource-use/resource-roads/engineering-publications-permits

Any of the following management actions will decrease the potential for fine sediments to be generated and delivered to a stream:

1. **Reduce the amount of bare erodible ground that is exposed and available to be eroded by precipitation and vehicle traffic by minimizing soil disturbance. Some examples are:**
   - Use narrow roads that follow natural breaks to minimize the road width and size of cut and fill slopes
   - Ensure windfirm boundaries along riparian leave strips to minimize blow down and the resulting exposure of mineral soil
   - Use existing roads where possible
2. **Reduce the potential for exposed ground to be eroded. Some examples are:**
   - Ensure prompt grass seeding and re-vegetation of cut and fill slopes and other disturbed areas
   - Spread logging debris on disturbed areas where possible
   - Avoid grader berms which prevent precipitation from dissipating off the road surface and can lead to channeling and increased transportation of sediments along the road surface
   - Armour culvert outlets and areas where there is concentrated surface flow that might reach a stream
   - Use quality road fill where possible
   - Minimize road usage and log hauling during excessively wet conditions
   - Ensure appropriately placed and maintained culverts and cross drainage
   - Ensure properly functioning ditch lines
3. **Reduce the hydrologic connectivity from sediment sources to streams and riparian areas. Some examples are:**
   - Minimize the amount of stream crossings where possible
   - Minimize the amount of road that is located immediately adjacent to streams
   - Ensure appropriately placed and maintained culverts and cross drainage
   - Ensure properly functioning ditch lines
   - Avoid grader berms which can trap water on road surfaces and cause it to travel large distances
   - Design bridge decks higher than the road grade and avoid long approaches to prevent water on the road surface from transporting sediment onto the bridge deck and into the stream

ADDITIONAL INFORMATION

FREP Extension Note #42: Evaluating the Presence and Impact of Acid Drainage from Industrial Roads in British Columbia (2018): https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/extension-notes/frep_extension_note_42.pdf

FREP Extension Note #29 (PDF): Water Quality Effectiveness Evaluation Results (2008-2012): Results and Opportunities for Continued Improvement https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/frep-extension-note-29.pdf?fileName=frep-extension-note-29.pdf

FREP Extension Note #28 (PDF, 1.1MB): Temporary Access Structures: Considerations for Site Plans and Post Harvest Assessments. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/frep-extension-note-28.pdf?fileName=frep-extension-note-28.pdf

A Climate Change Vulnerability Assessment Approach for Resource Roads. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/resource-roads/archived/fpi_partington_bradley_vulnerability_approach_tr2020-08.pdf

Ministry of Forests Engineering Manual
https://www2.gov.bc.ca/gov/content/industry/natural-resource-use/resource-roads/engineering-publications-permits/engineering-manual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