Hinton Wood Products
A division of West Fraser Mills Ltd.

Edson Forest Products
A division of West Fraser Mills Ltd.

Native Fish Species
Habitat Conservation Strategy

Version 1
October 29, 2014
Rick Bonar

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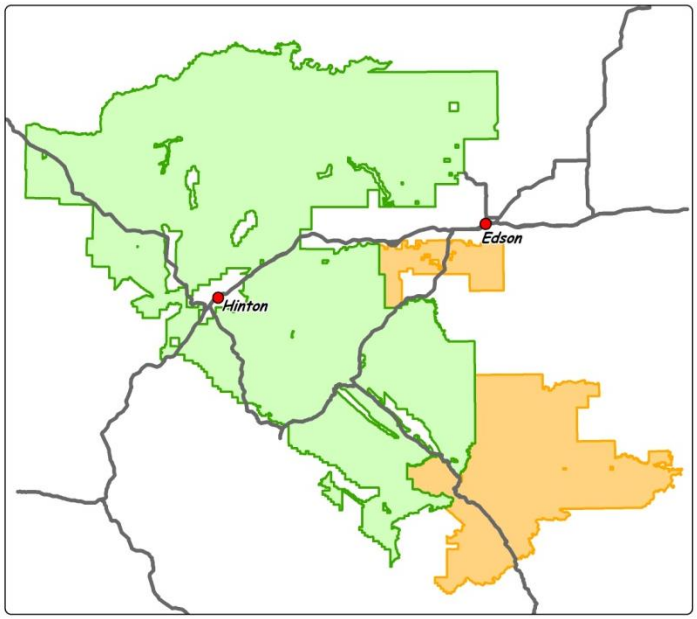
PREFACE

Hinton Wood Products and Edson Forest Products are Divisions of West Fraser Mills Ltd. Hinton Wood Products manages Forest Management Agreement 8800025 and Edson Forest Products manages Forest Management Agreement 9700032. The Forest Management Areas (FMA) associated with the Agreements border each other in west central Alberta. Each has a separate Forest Management Plan. A single Woodlands Department (hereafter, West Fraser) representing Hinton Wood Products and Edson Forest Products manages both FMA.

West Fraser is certified to the Sustainable Forestry Initiative[1] Standard, which requires signatories to have biodiversity conservation programs, especially for species at risk designated by relevant governments. The West Fraser Species at Risk (SAR) Guide (West Fraser 2014) describes species and ecological communities that are mandatory content to meet SFI requirements, plus additional species and communities that West Fraser includes as voluntary good practice. The SAR Guide is a document that provides identification and basic forest management direction for each species or community. The SAR Guide references a more detailed Species Conservation Strategy, which contains additional information about West Fraser habitat management to direct forest management and conservation.



Hinton Wood Products (green) and Edson Forest Products (yellow) Forest Management Areas.

West Fraser has one target related to Species Conservation Strategies:

1. Target #1 – Complete species conservation strategies for all species at risk (SARA and Alberta designations) within 6 months of designation, update strategies at least every 2 years and report on results of strategies annually.

Species conservation strategies are developed by West Fraser and reviewed, endorsed, and approved as a cooperative program between West Fraser and Alberta Environment and Sustainable Resource Development.

[1] http://www.sfiprogram.org/

SUMMARY

Three native fish species that are designated as species at risk inhabit aquatic ecosystems on the FMA: Arctic grayling (*Thymallus arcticus*), Athabasca rainbow trout (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*). A fourth species, pygmy whitefish (*Prosopium coulterii*), occurs in the Athabasca River drainage upstream of the FMA.

Alberta Wildlife Act designations for these species are as follows: The Alberta Arctic grayling (ARGR) population was designated as Special Concern[2] in 1996. The Alberta Athabasca rainbow trout (ARTR) population was designated as Threatened in 2014. The Alberta bull trout (BUTR) population was designated as Special Concern in 2002 and Threatened in 2014. Canada Species at Risk Act Schedule 1 designations for these species are as follows: ARGR no schedule, no status; BUTR Western Arctic Population was assessed as Special Concern by COSEWIC in 2012, no schedule, no status; ARTR were assessed as Endangered by COSEWIC in 2014, no schedule, no status.

The Arctic grayling was listed as Special Concern under the Alberta Wildlife Act in 1996 and a Management Plan was completed. A status report was completed and Arctic grayling was listed as Special Concern in 2006. In September 2014 the Alberta government designated ARTR as Threatened and approved an ARTR Recovery Plan. The first Alberta Bull Trout Management and Recovery Plan in 1994) recommended Special Concern status. A Status Report was prepared and Alberta bull trout were listed as Special Concern in 2002. The Status Report was updated and bull trout were designated as Threatened in September 2014. An Alberta bull trout Conservation and Management Plan 2012-2019 was completed in 2012 and the recent Wildlife Act designation will trigger development of an Alberta Bull Trout Recovery Plan.

All three species have declined due to habitat loss and alteration, overharvest, and introduction of non-native fish species that either compete or hybridize with native species. Most flowing waters on the FMA support one or more of the three species.

The main elements of West Fraser conservation plans for these species are:

- Remediate stream crossings to support unrestricted fish passage.
- Control sediment from roads and cutblocks to prevent entry into fish-bearing waters.
- Apply a new riparian management strategy to maintain ecological function of riparian areas and associated aquatic ecosystems over the long term.

West Fraser will work with the Alberta Government and others to conserve native fish species on the FMA. This document will be revised at regular intervals.

[2] The Alberta Wildlife Act does not currently contain a Special Concern category, so Special Concern designations are currently a policy decision.

INTRODUCTION

The native fish species assemblage in FMA aquatic ecosystems includes three species with at risk designation under the Alberta Species at Risk framework: Arctic grayling (ARGR: Special Concern), Athabasca rainbow trout (ARTR: Threatened) and bull trout (BUTR: Threatened). A fourth species, pygmy whitefish (PYWH: Threatened) occurs in the Athabasca River upstream from the FMA and therefore is not included in this HCS. Actions that benefit ARGR, ARTR, and BUTR should also benefit pygmy whitefish and other native fish species. These "cold water species" occur in similar habitats characterized by cold water, low sediment levels, relatively low productivity, small to large fluvial channels, and functioning aquatic and riparian ecosystems. All three species are sport fish that are sought by anglers.

The Arctic grayling (*Thymallus arcticus*) (Figure 1) is a circumpolar northern species that is found in the Athabasca River watershed on the FMA, and also in the Peace, Hay, and Belly River watersheds in Alberta. Alberta ARGR adults are usually 30-40 cm in length and 300-800 gm in weight. ARGR are usually found in larger streams and rivers in pools and reaches with lower gradients. Their diet is mainly invertebrates and they spawn in the spring.

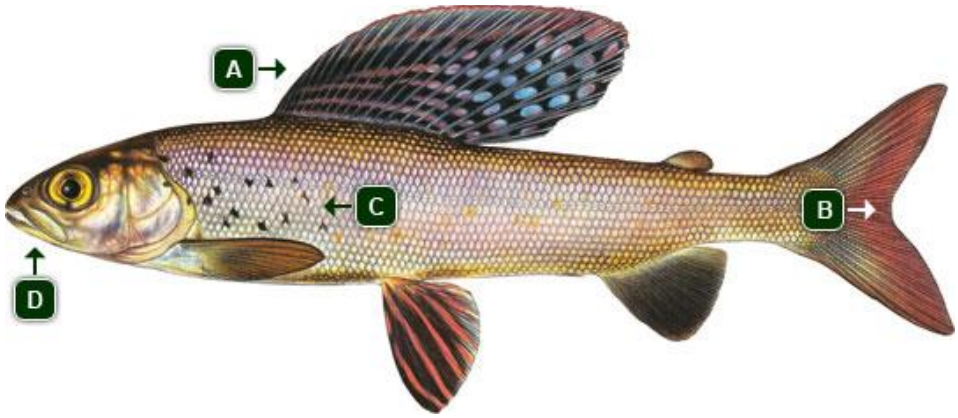


Figure 1 – *Arctic grayling, from Alberta Fishing Guide – A: large sail like dorsal fin. B: forked tail. C: may also have spots in the shape of an X or V. D: small narrow mouth with small teeth in both jaws.*

The Athabasca rainbow trout (ARTR: *Oncorhynchus mykiss*) (Figure 2) is the only native rainbow trout population in Alberta and occurs in the upper Athabasca River watershed. ARTR adults living in small headwater streams are usually 15-30 cm in length and 100-300 gm in weight. ARTR are visually indistinguishable from non-native rainbow trout (RNTR), which have been extensively stocked into ARTR range. Small fish with distinct parr marks (Figure 3) in headwater streams are likely to be ARTR, but genetic analysis is the only way to confirm. ARTR and RNTR hybridize so individuals with genetic mixtures occur. ARTR are mostly found in small fluvial headwater streams but they also occur in larger streams and rivers and ponds and lakes. ARTR in larger rivers such as the main stem Athabasca River can grow to 50-65 cm and, similar to RNTR, larger fish lack the distinctive parr marks that are retained by headwaters fish throughout their lives. Their diet is mainly invertebrates and they spawn in the spring.

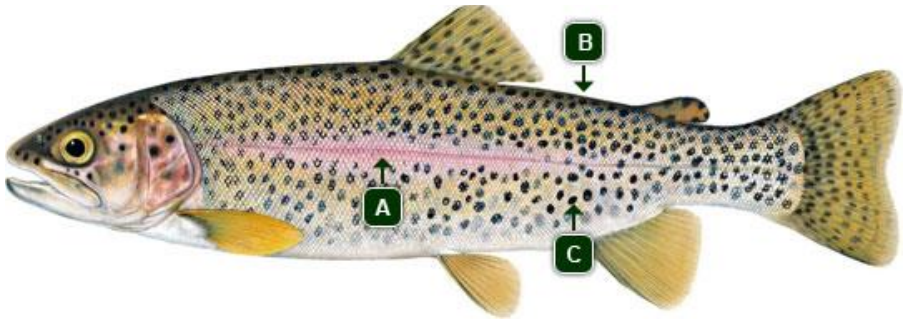


Figure 2 – *Rainbow trout, from Alberta Fishing Guide – A: reddish stripe along the side. B: darker on top. C: black spots.*

Figure 3 – *Mature Athabasca rainbow trout from Wampus Creek, stream resident form typical of the Upper Foothills Natural Subregion of Alberta. Note prominent parr marks (bluish spots). From ARTR Recovery Plan.*

The bull trout (BUTR: *Salvelinus confluentus*) (Figure 4) is found in the upper reaches of the Alberta Eastern Slopes including all FMA watersheds. BUTR are not trout, rather they are part of the char family and adults can reach 30-80 cm in length and up to 10 kg in weight. BUTR inhabit smaller headwaters streams, larger rivers, and lakes. Some fish migrate from larger waterbodies into smaller streams to spawn while others remain in the smaller streams throughout their lives. Smaller BUTR eat mainly invertebrates while larger fish often eat mainly fish. BUTR spawn in the fall, usually at sites with groundwater upwelling which promotes better egg and fry survival in winter conditions.

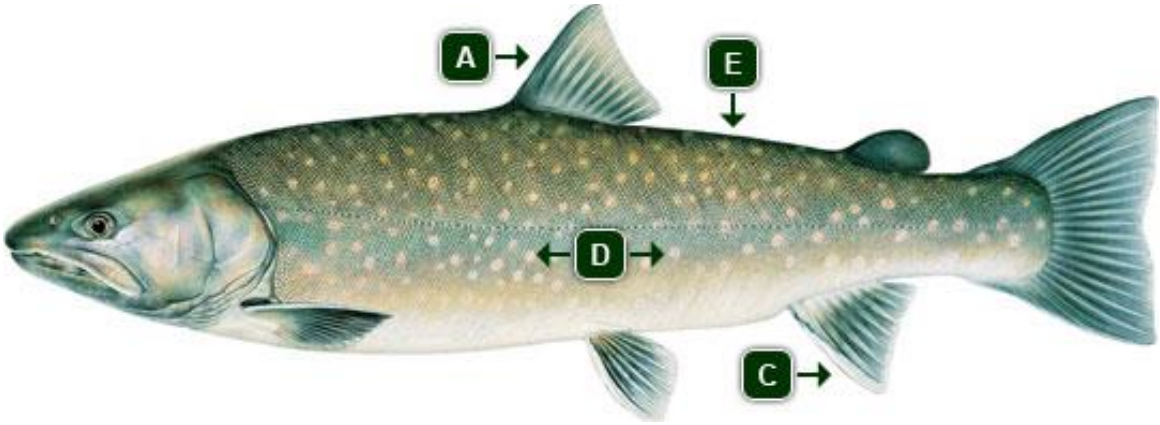


Figure 4 – *Bull trout, from Alberta Fishing Guide – A: no black spots on dorsal fin (all other Alberta trout and char species have black spots). B: large head and mouth. C: fins have white leading edges. D: pale yellow or cream colored spots. E: dark/olive green*

These three fish species occur in similar habitats, face generally the same limiting factors, and will benefit from similar conservation actions. For this reason West Fraser combined the Habitat Conservation Strategies that would normally be created for each species into a single HCS. This document describes the habitat conservation strategy for native fish species on the FMA.

Figure 5 – *North America distribution of Arctic grayling (left), bull trout (centre) and rainbow trout (right) from http://www.roughfish.com*

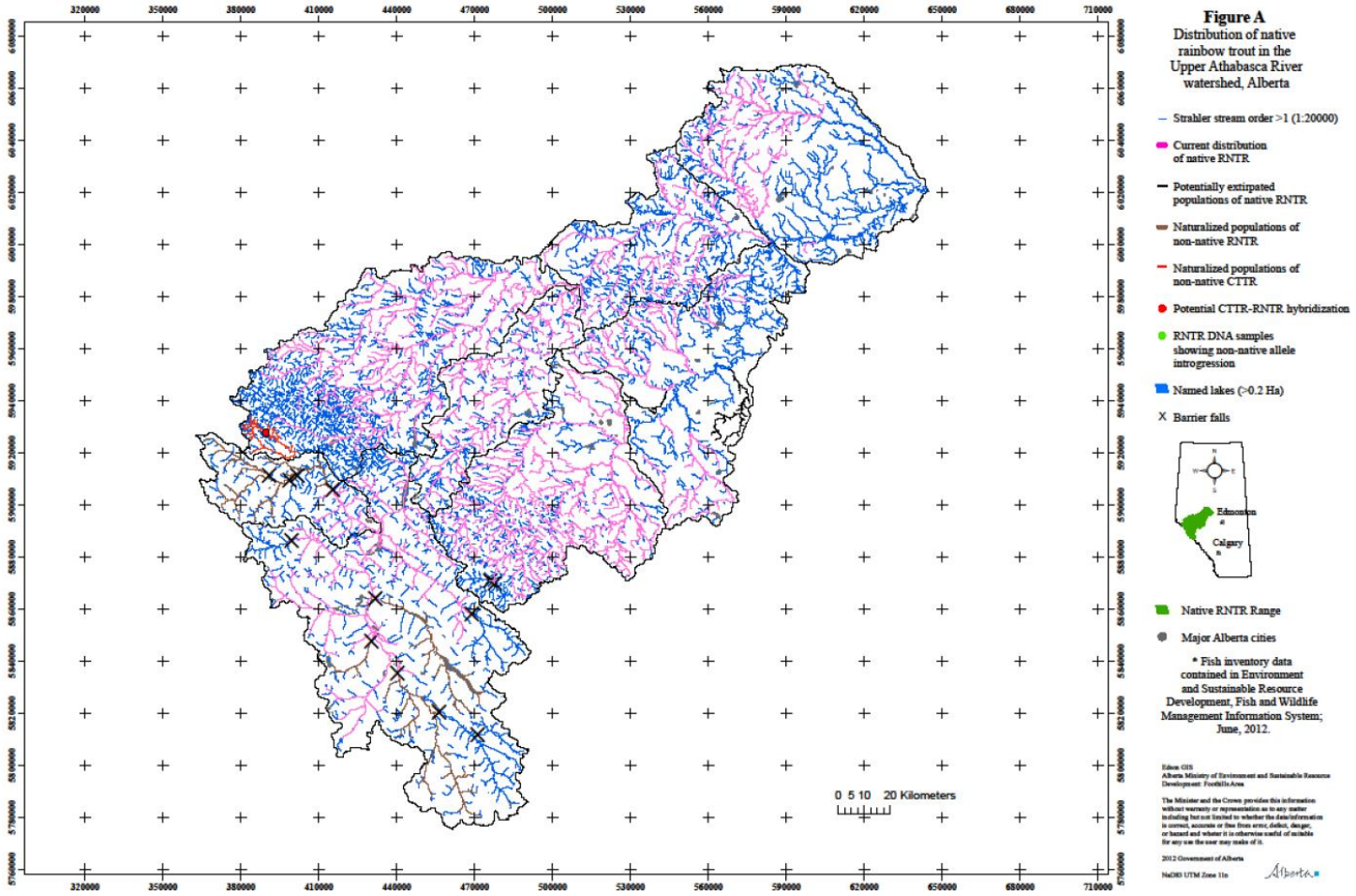


Figure 6 – *Athabasca rainbow trout distribution in Alberta, from ARTR Recovery Plan*

CONSERVATION STATUS

Arctic Grayling

The IUCN Red List of Threatened Species ranked Arctic grayling Least Concern in 2008 (IUCN 2014). The NatureServe system ranks ARGR as G4 globally and S2S3 in Alberta (NatureServe 2014). The Canada population of Arctic grayling has not been assessed by COSEWIC (2014). See Table 1.

The Arctic grayling was listed as Special Concern under the Alberta Wildlife Act in 1996 and a Management Plan was completed (Berry 1998). A status report was completed (Walker 2005) and Arctic grayling was listed as Special Concern in 2006. An updated status report is in preparation. When this is complete, Arctic grayling will be reassessed by the Alberta Endangered Species Conservation Committee.

The main reasons for the Special Concern designation for Alberta Arctic grayling were reductions in distribution and population size related to overharvest, habitat fragmentation caused by inadequate stream crossings, and possibly changes in water temperature regimes (Walker 2005).

Table 1 – *Conservation status of Arctic grayling*

Year	IUCN	Year	COSEWIC/SARA	Year	Wildlife Act	Year	NatureServe
2008	Least Concern	2014	SARA – No schedule, no status	2006	Special Concern	1996	G5 S3S4
		1996	COSEWIC – Not at Risk				
2008	Least Concern	1978	COSEWIC – Vulnerable				
2004	Least Concern						

Athabasca Rainbow Trout

The IUCN Red List of Threatened Species does not rank Athabasca rainbow trout. Rainbow trout were ranked as Least Concern in 2004, 2008, 2009, and 2012 (IUCN 2014). The NatureServe system ranks rainbow trout as G5 globally and S1 in Alberta (NatureServe 2014). The Athabasca rainbow trout population was assessed as Endangered by COSEWIC in 2014. This triggered a process leading to eventual listing of the species in the SARA and then to commence preparation of a Recovery Strategy. See Table 2.

An Alberta status report was completed in 2009 (Rasmussen and Taylor 2009) and the ESCC recommended a designation of Threatened. The Government of Alberta commenced preparation of a recovery plan but the Wildlife Act designation was deferred. The Athabasca rainbow trout was designated as Threatened under the Alberta Wildlife Act in 2014. An Athabasca rainbow trout recovery plan (draft) was completed and endorsed by the ESCC in 2014. At time of this writing, the recovery plan had not been approved.

The main reasons for the 2014 Threatened status for Athabasca rainbow trout were reductions in distribution and population size related to competition and hybridization with non-native brook trout and rainbow trout, overharvest, habitat fragmentation caused by inadequate stream crossings, and other habitat changes related to human activities (Rasmussen and Taylor 2009, Alberta Athabasca Rainbow Trout Recovery Team 2014).

Table 2 – *Conservation status of Athabasca rainbow trout*

Year	IUCN	Year	COSEWIC/SARA	Year	Wildlife Act	Year	NatureServe
2014	Not assessed[1]	2014	SARA – No status, schedule	2014	Threatened	2008	G5 S1[1]
		2014	COSEWIC – Threatened			1996	G5 S1[1]

[1] This status is for rainbow trout. There is no IUCN or NatureServe ranking for Athabasca rainbow trout.

Bull Trout

The IUCN Red List of Threatened Species ranked bull trout Rare in 1988 and 1990, Indeterminate in 2006, and Vulnerable in 1996 (IUCN 2014). The NatureServe system ranks bull trout as G4 globally and S2S3 in Alberta (NatureServe 2014). The Canada bull trout population was subdivided into five designated units by COSEWIC.

In 2012, the Western Arctic bull trout population was assessed as Special Concern and the Saskatchewan – Nelson River population was assessed as Threatened (COSEWIC 2012). The majority of FMA waters are part of the Western Arctic bull trout population (Athabasca river watershed). A smaller proportion of FMA waters are part of the Saskatchewan River population (Brazeau River watershed). The COSEWIC assessments triggered the SARA process which includes eventual listing in SARA Schedule 1 and preparation of a Conservation and Management plan for the Western Arctic population and a Recovery Strategy for the Saskatchewan – Nelson River population. See Table 3. At time of this writing, the Western Arctic and Saskatchewan – Nelson River populations had No Schedule and No Status in SARA Schedule 1.

The first Alberta Bull Trout Management and Recovery Plan (Berry 1994) recommended Special Concern status. A Status Report (Post and Johnson 2002) was prepared and Alberta bull trout were listed as Special Concern in 2002. The Status Report was updated (Rodka 2009) and bull trout were designated as Threatened in 2014 (Alberta Wildlife Act 2014). An Alberta bull trout Conservation and Management Plan 2012-2019 was completed in 2012 (Rees et al. 2012) and the recent Wildlife Act designation will trigger development of an Alberta Bull Trout Recovery Plan.

Reasons for the recent Threatened status for Alberta bull trout include declines in distribution and abundance related to *"…the impacts of human activities, including migratory barriers, habitat degradation and fragmentation, angling pressure, past population management practices, and the stocking of non-native fish species*" (Rodka 2009).

Table 3 - *Conservation status of bull trout*

Year	IUCN	Year	COSEWIC/SARA	Year	Wildlife Act	Year	NatureServe
1996	Vulnerable	2014	Western Arctic population[1] COSEWIC – Special Concern SARA – No schedule, no status	2014	Threatened	2011	G4 S2S3
1994	Indeterminate	2012	Saskatchewan – Nelson River Population[1] COSEWIC – Special Concern SARA - No schedule, no status	2002	Special Concern		
1990	Rare						
1988	Rare						

[1] FMA bull trout in the Athabasca River watershed are part of the Western Arctic population as defined by COSEWIC. FMA bull trout in the Saskatchewan River watershed are part of the Saskatchewan – Nelson River population as defined by COSEWIC.

POPULATION STATUS ON FMA

Arctic grayling, Athabasca rainbow trout, and bull trout occur extensively in FMA waterbodies. West Fraser has financially supported fish inventory programs through the Foothills Research Institute and AESRD. The Government of Alberta maintains an online map and database (Fisheries and Wildlife Management Information System) showing fish species recorded at sampling locations. The FWMIS contains all historic records for the FMA and is updated continually by AESRD http://esrd.alberta.ca/fish-wildlife/fwmis/default.aspx

Arctic Grayling

Arctic grayling generally inhabit larger rivers and streams with less steep gradients. These are difficult to census using electro fishing, consequently population distribution and status is less well known than for Athabasca rainbow trout and bull trout.

Athabasca Rainbow Trout

Due to the need for genetic analysis to distinguish Athabasca rainbow trout from introduced non-native rainbow trout more work must be done to identify streams and other water bodies with pure genetic strain Athabasca rainbow trout and streams with genetically introgressed fish (hybrids) or pure genetic strain non-

native rainbow trout. Thirty-eight of 71 populations surveyed to date were considered to be "pure" Athabasca rainbow trout (Alberta Athabasca Rainbow Trout Recovery Team 2014). Recovery for the species will be focussed on water bodies with pure (Core populations) or nearly-pure (Conservation populations) Athabasca rainbow trout. Water bodies with significant presence of non-native rainbow trout genes will be classified as Impure, Stocked, or Naturalized populations and managed for recreational fisheries. They presently have limited conservation value for Athabasca rainbow trout (Alberta Athabasca Rainbow Trout Recovery Team 2014).

Bull Trout

AESRD subdivided Alberta into 51 bull trout core areas and classified each area for conservation risk. Five core areas overlap the FMA (Table 4).

Table 4 – *Bull trout core area assessment and conservation ranking for core areas that overlap the FMA (from Rees et al. 2012)*

Core Area	Conservation Ranking	Life History	No. of Subpop[1]	Pop size[2]	Occupancy[3]	Short-term trend
Brazeau River	Potential risk	Fluvial Resident	4	1-50	4-40	Stable
Pembina River	High risk	Fluvial Resident	2	50-250	40-200	Declining
McLeod River	At risk	Fluvial Resident	3	1,000-2,500	1,000-5,000	Declining
Athabasca River	Potential risk	Fluvial	3	1,000-2,500	1,000-5,000	Declining
Berland River	At risk	Fluvial	2	250-1,000	1,000-5,000	Declining

1. Number of known subpopulations in core area, extirpated subpopulations excluded.
2. Estimated number of mature adults (within category range).
3. Estimated number of occupied stream kilometres (within category range).

LIMITING FACTORS

Habitat

Good habitat for native cold water fish species has been described by the U.S. Fish and Wildlife Service as "cold, clean, complex, and connected". This includes cold water temperatures to fit the adapted needs of the species, clean water and clean substrates for spawning and rearing, complex habitats including functioning aquatic ecosystems with riffles and deep pools, undercut banks and large woody debris, and water body habitats that connect for annual spawning and feeding movements.

<u>Temperature</u>
Arctic grayling, Athabasca rainbow trout, and bull trout are found in cool waterbodies, which in the FMA are generally restricted to high elevation watersheds. In particular, bull trout are associated with cold water, with optimal temperatures below 15° C. Water temperature likely limits distribution of these species, and factors that acts to increase water temperature regimes would be detrimental to conservation. These include changes of groundwater and other cold water sources, increases in air temperature (e.g. climate change) removal of riparian shade, and disturbances in watersheds that change water yield in ways that elevate temperature regimes. Waters with temperature regimes suitable for bull trout are also suitable for Arctic grayling and Athabasca rainbow trout. Bull trout are generally considered to be the most cold water dependent of the three species.

<u>Clean Water</u>
Arctic grayling, Athabasca rainbow trout, and bull trout are associated with clear, low productivity water bodies with comparatively low levels of sediment, nutrients, and pollutants. Detrimental changes include increased sediment (primarily related to roads), excessive added nutrients (low levels of nutrient enrichment

can actually be beneficial), and entry of pollutants such as selenium leaching from rock layers exposed by mining. Alterations to sediment loads and timing related to human activities have detrimental effects including sediment intrusion into spawning gravels and habitats for aquatic invertebrates.

Complex Habitat

Arctic grayling, Athabasca rainbow trout, and bull trout are associated with complex habitat, with each species having somewhat different preferences. Common to all are flowing streams with complex channels, riffles, pools, spawning sites with clean gravel, undercut banks, large woody debris, and functioning riparian vegetation. This complex habitat is dynamic, changing over time in response to disturbances and recovery from disturbances. Disturbances include natural agents such as floods and forest fires, and human disturbances such as linear corridors and forest harvesting. The proper functioning condition concept (Prichard et al. 1993, Tripp et al. 2009) has been developed to determine if habitats are functioning in relation to where they would be expected to be in relation to disturbance history, and if they are likely to recruit and retire dynamic conditions over time within the Natural Range of Variation. Detrimental changes include factors that alter complex habitats outside their natural range or ability to recover function. They include channel alterations (e.g. stream crossings, physical channel alterations) and watershed changes that interact with channels (slope failures, deforestation, forest disturbance, etc.).

Important habitat aspects include suitable spawning areas. Fish need spawning areas with clean gravel substrates of appropriate size that are not subject to sediment intrusion or bedload movement during the time that eggs and alevins are in the gravel. For fall spawning bull trout, "*…high-quality spawning sites have groundwater influence where the incubating eggs benefit from stable flows, warmer water temperature in winter and lack of anchor ice"* (Rees et al. 2012).

Fish need pools that support key life cycle requirements, including overwintering. Overwintering pools are particularly important in smaller streams with resident fish such as Athabasca rainbow trout (Alberta Athabasca Rainbow Trout Recovery Team 2014).

Connected Habitat

Arctic grayling, Athabasca rainbow trout, and bull trout have complex life cycles that require fish to move freely through connected waterways. For example, some fish that live in larger rivers and lakes move either upstream or downstream to spawn and then return to their starting point. Factors that interfere with movements may be limiting in some situations. Movement barriers can fragment populations, interfere with their life cycle, and block access to habitat. Barriers do not always have to physically prevent movement (e.g. poor stream crossings, dams, waterfalls) but could be areas of unsuitable habitat (e.g. elevated water temperature in downstream reaches) that prevent or discourage fish movements through them.

Water flow regimes

Alterations to natural water flow regimes have potential negative impacts on all aquatic species including native fish. Examples include interruption of groundwater discharges at bull trout spawning areas, water removals that exceed in-stream flow requirements, roads altering flow dynamics, watershed vegetation condition, and changes to the timing of peak flows and low flows related to climate change and human activities.

Non-Native Species

From 1917 to 2012, more than 38 million fish of 14 salmonid species were stocked into the Upper Athabasca River watershed (Sterling and Cox in prep). Non-native species introduced to FMA waterbodies include brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*) cutthroat trout (*Oncorhynchus clarki*), and non-native strains of rainbow trout.

Competition

Non-native fish directly compete with native species and have expanded their range beyond the waters they were stocked into. In particular, brook trout and non-native rainbow trout populations have increased and

may continue to increase. Non-native species also may act as predators and/or reservoirs of parasites and diseases (Alberta Athabasca Rainbow Trout Recovery Team 2014).

Hybridization
Brook trout hybridize with bull trout and non-native rainbow trout hybridize with Athabasca rainbow trout. This mixing of genetic material impacts the gene pool and population size of the native species.

Human-caused Mortality

Arctic grayling, Athabasca rainbow trout, and bull trout are highly sought sport fish species and they are relatively easy to catch. Concern about legal overharvest, illegal killing, misidentification killing and hooking mortality has led to increasing restrictions on sport fishing. For example, angling for bull trout was restricted to catch and release province wide starting in 1995. Reduced catch limits, catch and release restrictions, bait bans, gear restrictions, and angling closures have been deployed with mixed success. Illegal harvest and misidentification harvest are still issues in some locations. Waters that have good angler access experience higher angling pressure and increased risk of human-caused mortality.

Food Supply

Arctic grayling, Athabasca rainbow trout, and bull trout eat mainly arthropods from both aquatic and terrestrial sources. Larger bull trout increasingly eat other fish including smaller bull trout. Cold water habitats are relatively unproductive due to cold water and low levels of nutrients. Factors that increase productivity are beneficial within optimal limits for each species. For example, elevated temperatures and nutrients can increase growth and productivity but if these factors increase too much they have a negative impact. Food supply is not thought to be a major current limiting factor for any of the species.

Predation

Fish are subject to predation by a variety of mammalian and avian predators, and by other fish. Athabasca rainbow trout and Arctic grayling are not normally predators of other fish, but larger bull trout are fish predators. Predation is not thought to be a major current limiting factor for any of the species.

Other Factors

There is little information on the role of accidents, parasites and diseases, climate change, etc.

HABITAT CONSERVATION STRATEGY

Roles and Responsibilities

West Fraser has no responsibility for management of any fish species. Commitments made in this document relate specifically and only to West Fraser management of the FMA and potential associated impacts on native fish species conservation. Other factors that may affect conservation are beyond the responsibility of West Fraser. As part of the West Fraser stewardship commitment West Fraser will consider and may partner with Alberta and others in their conservation programs.

West Fraser and Alberta are jointly responsible for developing, implementing, monitoring, and improving this HCS. Periodic revisions will be endorsed by the parties and the most current version of the HCS will be approved as part of FMP revisions.

West Fraser and Alberta will work together to implement a monitoring program and related investigations that may be commenced if conservation objectives are not being met.

Goals

The goal of the native fish habitat conservation strategy is to describe West Fraser activities that will contribute to long-term conservation of Arctic grayling, Athabasca rainbow trout, and bull trout on the FMA, as part of interconnected regional populations. It is expected that this HCS will also benefit other native fish species and aquatic biodiversity.

West Fraser will identify native fish water bodies and manage West Fraser activities in surrounding areas to minimize impacts and promote proper functioning condition of aquatic and riparian ecosystems. The habitat conservation strategy will be reviewed and revised as new information is acquired.

Forest Management Plan

The Alberta Arctic Grayling Management and Recovery Plan (Berry 1998), the Alberta Athabasca Rainbow Trout Recovery Plan 2013-2018 (draft) (Alberta Athabasca Rainbow Trout Recovery Team. 2014) and the Alberta Bull Trout Conservation Management Plan 2012-2017 (Rees et al. 2012) provide guidance on how to conserve Arctic grayling, Athabasca rainbow trout, and bull trout.

Native fish are not associated with the active landbase and in general forest management activities have no direct interface with aquatic ecosystems. The exceptions are stream crossings, roads close to water bodies, and harvest close to water bodies.

West Fraser will contribute to long-term conservation of native fish species by applying an Ecosystem-Based Management (EBM) approach to manage the FMA, with specific modifications close to water bodies for habitat conservation purposes.

Landbase Designation

West Fraser grows and harvests timber primarily on upland sites that have no direct interface with aquatic ecosystems used by native fish. All suitable sites in these areas are included in the active landbase.

West Fraser chose to exclude all lands within Class A and B Water Bodies and within the distance from the water body (Class A: 100 m; Class B: 30 m or 60 m) specified in the Water Act Code of Practice from the active landbase. The total excluded area was 3,412.4 ha. West Fraser believes that careful harvest within these areas can be compatible with protection of aquatic values but has no plans to propose harvesting in any of the Class A and B watersheds in the first 10 years. In addition, West Fraser will implement a new Ecosystem-based Management Riparian Management Strategy (RMS) and wishes to gain experience and knowledge before proposing to extend the application to Classified Water Bodies.

West Fraser mapped riparian areas on the Hinton FMA as part of the RMS. In total 34.5% of the FMA gross landbase was mapped as riparian (Figure 7). All operable and accessible lands within riparian areas were included in the active landbase (except Class A and B waterbodies). The landbase designation within riparian areas was compared to a landbase designation that followed the previous fixed-width buffer approach to riparian management. Under the fixed-width buffer system, 5.9% of the FMA gross landbase was within what would have been fixed-width buffers. Eliminating fixed-width buffers (except for Class A and B watersheds) resulted in 38,028.5 additional hectares (3.7% of gross landbase) of active landbase, including 31,921.8 hectares (3.1% of gross) in riparian areas and 6,106.6 hectares (0.6% of gross) that were outside riparian areas but within fixed-width buffer distances of water bodies (Figure 8). Of the total riparian area, 223,257.0 hectares (63.3 % of total riparian area) was designated as passive and 129,215.9 ha (36.7 %) was designated as active landbase.

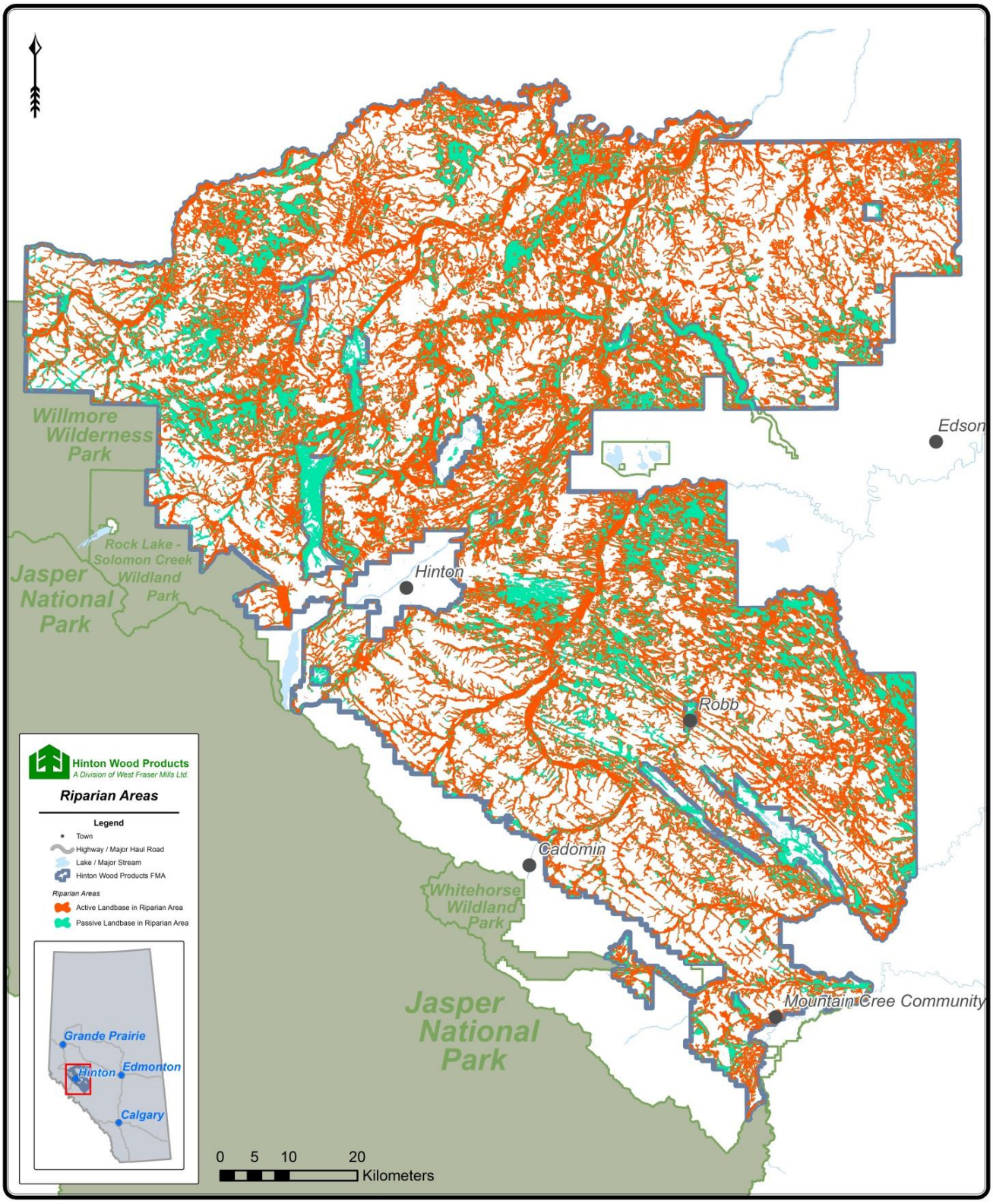


Figure 7 – *Riparian areas on the HWP FMA area classified by active and passive landbase.*

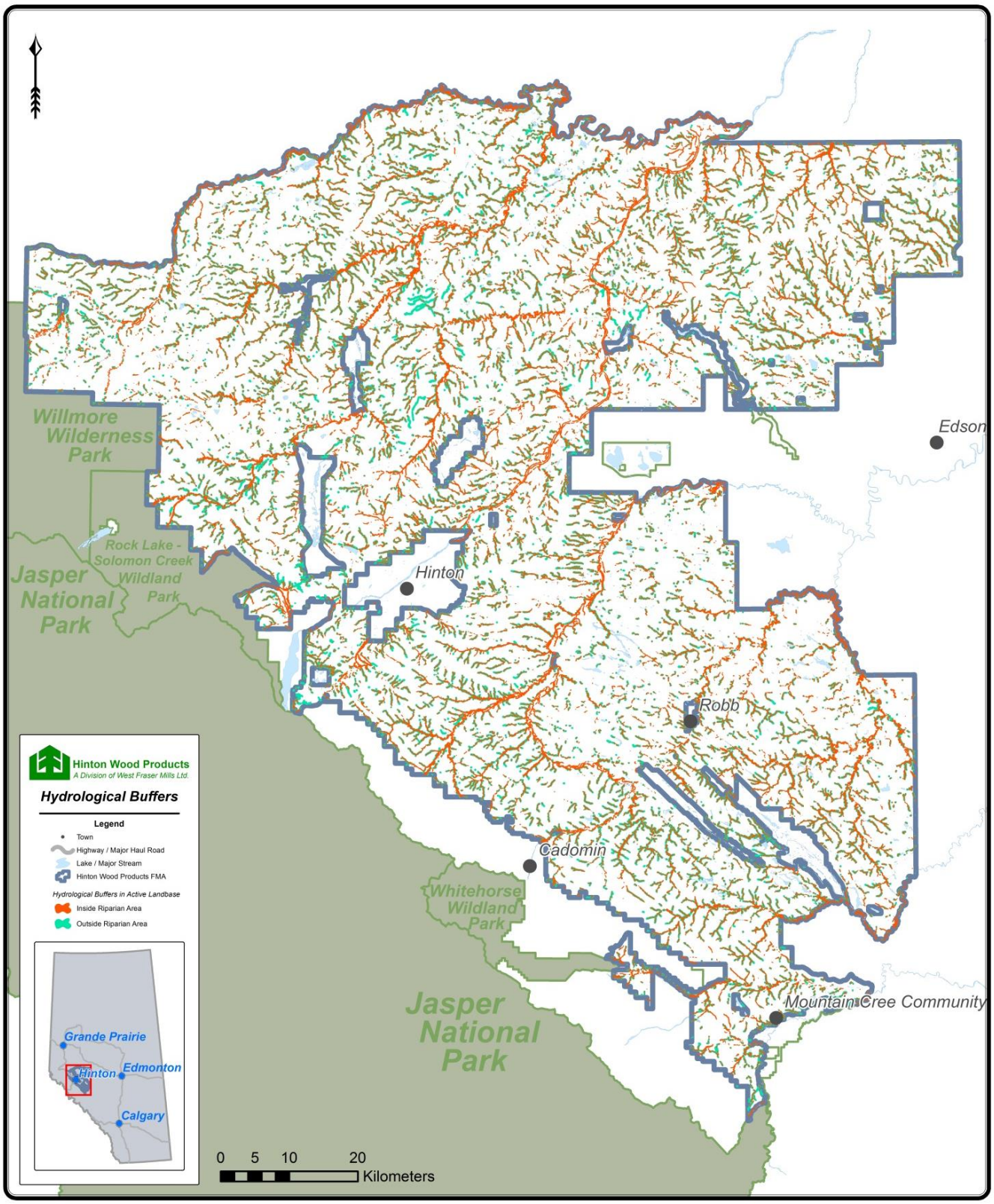


Figure 8 – *Areas that were formerly classified as fixed-with buffers and are now part of the active landbase on the HWP FMA area, classified by within and outside riparian areas*

Management Strategy

The FMP Management Strategy includes the following considerations for native fish species:

Active Landbase
- Apply the Riparian Management Strategy described in the FMP.
- Follow the Spatial Harvest Sequence for harvest of the active landbase.
- Harvest active landbase within riparian areas to maintain proper functioning condition in riparian areas and adjacent aquatic ecosystems over the long term while ensuring short term changes are within acceptable ranges.

Passive Landbase
- No operations in passive landbase.
- Cooperate with any government-led activities to disturb the passive landbase.

Roads
- Manage the West Fraser road network following the life cycle approach to minimize the physical road network over the long term.
- Cooperate with collaborative initiatives to manage roads and other access footprint owned and managed by others (e.g. Foothills Landscape Management Forum, Regional Access Plans).
- Apply best practices to minimize entry of sediment and other deleterious materials that originate from West Fraser roads into aquatic ecosystems.
- Manage West Fraser human use activities to ensure West Fraser does not contribute to human-caused mortality of native fish.
- Cooperate with government-led initiatives to manage human use to reduce human-caused mortality risk.

Watercourse Crossings
- Continue the West Fraser crossing inspection program to identify status and management needs for all West Fraser channeled watercourse crossings.
- Continue crossing remediation program to repair, replace, or remove West Fraser crossings that do not meet legal and corporate standards, on a priority basis. The objective is to first eliminate the backlog of existing crossings that need remediation work and then to remediate all crossings that need work on an ongoing basis, as they are inspected and the need for remediation becomes known.
- Ensure all new West Fraser crossings meet legal and corporate standards, including unrestricted fish passage, intact channel beds and banks, passage of peak flows without scour, no entry of sediment, safety, and cost.
- Cooperate with any collaborative initiatives to manage FMA stream crossings owned and managed by others (e.g. Foothills Landscape Management Forum, Foothills Stream Crossing Partnership, and Regional Access Plans).

Disturbance
- Ensure that total disturbance levels are within the NRV where feasible and practicable. The objective is to ensure there are no changes to natural water regimes related to alteration of forests outside NRV.

Structure Retention
- Apply EBM procedures and practices to ensure retention of trees and patches at the planning and operations stages, with a special emphasis in riparian areas to ensure a continuing supply of large woody debris to maintain aquatic ecosystem functions.

Riparian Management
- Apply Riparian Management Strategy for all areas bordering native fish waters.

Habitat Risk Assessment

Arctic grayling, Athabasca rainbow trout, bull trout, and other fish species occur in most fluvial water bodies and in many lakes and ponds on the FMA.

Conservation issues include:

1. Stream crossings may block fish movements, interfering with fish life cycles and isolating populations and habitat.
2. Roads and stream crossings may provide sources of sediment and other deleterious substances that could harm aquatic ecosystems used by fish.
3. Roads and stream crossings may alter flow timing and quantity, which could harm aquatic ecosystems and fish.
4. High levels of harvesting and other disturbances in watersheds could be outside the NRV, which could alter the natural water regime in a way that is harmful to fish.
5. Harvesting close to water bodies may provide sources of sediment and other deleterious substances that could harm aquatic ecosystems used by fish.
6. Use of herbicides and pesticides close to water bodies may lead to entry into water bodies and harmful effects on fish.
7. Harvesting close to water bodies may remove wood that is needed to maintain proper functioning conditions in riparian areas and adjacent aquatic ecosystems.
8. Harvesting close to water bodies may interfere with other ecological functions that are necessary for aquatic ecosystem and fish conservation. These functions include nutrient regimes, shade, food sources, channel stability and migration, etc.

The conservation risks of the identified issues are discussed individually in this HCS and a risk assessment matrix is included in Appendix 1.

Harvest Design and Schedule

Native fish habitat management does not require adjustments to the Spatial Harvest Sequence harvest design and schedule.

West Fraser will develop detailed plans for operations within riparian areas adjacent to any water body containing or flowing into fish-bearing waters as part of any FHP that is developed during the implementation of the FMP.

Access Management

West Fraser owns a network of permanent roads that are maintained for year around use. These are generally class (see definitions) 2 and 3 roads that access multiple compartments. Additional permanent roads are needed for periodic use and are maintained during periods of use. These are generally class 3 and 4 roads that provide access within compartments. West Fraser also requires a network of temporary roads that include AOP roads and block roads. These are generally class 4, 5, and 6 roads.

The West Fraser road network connects to roads owned by others, primarily the Alberta government and the energy industry. West Fraser has no responsibility for these roads but attempts to work with others to minimize and manage the overall road network.

Life Cycle Approach

As the long term industrial tenure holder on the FMA West Fraser has an interest in the long term road footprint and plays a lead role in access development and management. West Fraser developed the Life Cycle Approach (LCA) to manage both West Fraser roads and roads and other footprint owned by

others. Using this Life Cycle approach, HWP developed Long Term Access Plan for each of the five working circles on the FMA area.

As part of these LTAP's HWP reviewed all roads and associated footprint on the FMA and conducted an assessment from the perspective of long term West Fraser access needs. Within each working circle LTAP the following information was provided:

1. An overview map showing:
   - The LTAP area with base map features
   - Compartment boundaries
   - Existing and proposed roads and stream crossings
   - Existing and proposed access control locations

2. An ortho map showing:
   - The LTAP area
   - Existing and proposed roads and stream crossings

3. A brief description of the area

4. A brief description of the status of existing roads

5. A description of major resource value issues.

6. A table that lists the major road corridors used for hauling within the LTAP area.

7. A table that lists all existing Class 1, 2, 3 and 4a roads within a given Working Circle (In appendices). Included in this table is:
   - Length of the road with the WC
   - Owner of the road (HWP or External)
   - Road class
   - Compartments accessed by given road
   - Number of culverts and/or bridges over intermittent or permanent stream. Please note that for externally owned roads, the list may be incomplete. There may be more than reported on any given road.
   - A strategy for each road (Maintain, Deactivate or Reclaim). The existence of an LTAP strategy on a road does not necessarily mean it will be completed within any given time frame, but rather when the opportunity presents itself (e.g., oilfield road disposition offered to HWP, HWP has equipment in the area, HWP budgets allow for some deactivation work, external funding comes available, etc.), the strategy can be put into action.

8. A table that lists proposed new permanent roads.

These LTAPs can be found in Appendix 13 of HWP's 2014 DFMP.

<u>Deactivation</u>

West Fraser will deactivate West Fraser roads that are identified as permanent periodic when they are not being used by either West Fraser or others. West Fraser will participate in Regional Access Plan processes to identify access needs of others before implementing large scale deactivation. Some West Fraser roads have already been deactivated and West Fraser will continue with ad hoc deactivation while Regional Access Plans are being developed.

Reclamation

West Fraser will reclaim West Fraser roads that are identified as no longer needed for West Fraser use or use by others. This will generally apply to roads held under disposition. Roads held under AOP approval will be reclaimed if the road was constructed after 2010. AOP roads that were constructed in 2010 or earlier will be reclaimed on a voluntary basis if reclamation is identified in Regional Access Plans. West Fraser will participate in Regional Access Plan processes to identify access needs of others before implementing large scale reclamation. Some West Fraser roads have already been reclaimed and West Fraser will continue with ad hoc reclamation while Regional Access Plans are being developed.

West Fraser routinely reclaims and reforests block roads in conjunction with completion of harvesting, haul, and reforestation activities, except where a need for keeping open access has been identified (e.g. trapper access, silviculture access). This practice will continue.

West Fraser will request reclamation on completion of intended use for all roads and other footprint owned by others that have been designated for reclamation by West Fraser. West Fraser will accept disposition transfers from others if the road is designated to become part of the long term West Fraser road network.

Regional Access Plans

West Fraser is a member of the Foothills Landscape Management Forum and participated in the development of the Berland Smoky Regional Access Development Plan. West Fraser will continue to participate in Regional Access Plan processes and will implement those portions of approved RAP that apply to West Fraser.

Definitions

Watercourse classification

Swales – depressional features created by extreme events during previous climatic regimes that are completely vegetated and lack an open channel.

Seepage-fed channels – open channels that lack sufficient flows to transport all of the sediment and organic material that accumulates within them during the average year but are subject to rapid evacuation of this material during major runoff events.

Fluvial channels – open channels that have sufficient flow to transport most of the material that they receive at average annual runoff levels.

Watercourse crossings

Watercourse crossing – any structure such as a culvert, bridge, ford, etc. used to provide access across a water body. West Fraser regularly inspects all crossings of channeled water bodies on West Fraser roads and maintains records for each crossing. Crossings of swales are also inspected regularly as part of road inspections.

Satisfactory crossing – safety, fish passage, erosion and functionality all meet the current standard for watercourse crossings.

Non-satisfactory crossing – one of more of safety, fish passage, erosion, and functionality falls to meet the current standard for watercourse crossings.

Safety – this refers to any aspect of the crossing that could be a human safety hazard.

Fish passage – this refers to the ability of any fish that frequent a water body to pass through a crossing both upstream and downstream under all flow conditions.

Erosion – this refers to whether or not there is evidence of sediment from the crossing or associated road entering a water body.

Functionality – this refers to whether or not a crossing is able to function as it was intended, including passage of peak flows without scour, design and location, etc.

Remediation priority – crossings assessed as Non-Satisfactory are given a High, Medium, or Low priority based on a risk assessment comparing frequency of occurrence versus severity of occurrence. High and Medium priority crossing issues are addressed as soon as possible. Low priority crossing issues are monitored for status changes and repaired as resources permit.

Watercourse Crossings

Roads and associated stream crossings play a critical role in access for resource management activities. Older crossings designed and installed to previous standards or not properly maintained can impact fish habitat and fish movements and can become safety issues.

Since 1995, West Fraser has maintained an annual stream crossing program that includes inspections of West Fraser crossings of channeled watercourses and remediation actions according to a priority ranking. Remediation of crossings that do not meet legal or

corporate standards includes maintenance, repairs, replacement, or removal of crossings. Information from the inspections is used to develop annual remediation plans and long-term capital remediation plans. Additional data from FRI and FWMIS such as basin reports and fish information are also used in the planning process. West Fraser is a member of the Foothills Stream Crossing Partnership (FSCP) and incorporates information from non-West Fraser FMA crossings owned by others into West Fraser remediation plans. The crossing inspection protocol is consistent with the protocol used by the FSCP (McCleary et al. 2007, online at https://foothillsri.ca/).

At the end of 2013 on the Hinton FMA West Fraser owned approximately 1,878 existing crossings on channeled watercourses and approximately 2,882[3] cross-drains. Numerous crossings owned by others are also stored in the West Fraser database but are not an active part of the West Fraser crossing inspection program. Crossings owned by FSCP members are inspected as part of the FSCP program. West Fraser is extending the crossing inventory and inspection program to include the Edson FMA. In 2013 a total of 1,127 watercourse crossings were inspected, 1,109 by trained in-house staff and 18 by professional engineers (Table 5). During 2013, the annual stream crossing remediation program included 3 major/capital projects, 36 repairs/new installs, and numerous maintenance activities to address localized erosion, drainage and wear and tear issues.

Table 5 – *West Fraser 2013 crossing inspections and remediations*

	Hinton FMA				Edson FMA			
	Culverts	**Bridges**	**Other**	**Engineered**	**Culverts**	**Bridges**	**Other**	**Engineered**
Inspections	823	124	6	17	153	3	0	1

Forest management activities have both direct and indirect impacts on water quality, which in turn affects aquatic ecosystems. Impacts increase with amount of disturbance in a watershed basin and the effects are more pronounced in smaller basins. Impacts occur in response to natural disturbances (e.g. forest fire) and management activities (e.g. roads and harvesting). Roads and stream crossings play a critical role in allowing road access into areas for resource management activities. If installed to older standards or not properly maintained, stream crossings can impact fish habitat and movement through crossings or can become safety issues.

Aquatic systems such as lakes and rivers are interconnected and pose a complex management problem as activities influencing the watercourse in one area can impact other areas within the watershed. There is a large network of permanent roads on the FMA that are owned by others. West Fraser initiated and is a founding member of the FSCP, a group of organizations working together to address crossing issues in large areas based on collecting crossing information using a common protocol and coordinating remediations on a priority watershed basis. The long term strategy is to have all owners of crossings on the FMA join the program leading to a future where all known backlog crossing issues have been remediated and ongoing maintenance remediates new issues as they arise.

Human Use Management

Human use management is the responsibility of the Government of Alberta. West Fraser will ensure that West Fraser activities in the area of human use support native fish conservation. West Fraser will comply with regulatory requirements for physical access controls. However West Fraser believes that physical access controls are generally not the best way to manage human use and will continue to advocate for other approaches.

Native Fish Mortality Risk

Where feasible and practical, West Fraser will not construct any new permanent roads within 100 m of fish-bearing water bodies, except where crossings are necessary or there are no other feasible and practical alternatives. West Fraser will cooperate with any government-led initiatives to mitigate, deactivate, or reclaim

[3] The cross-drain inventory is incomplete and is gradually being added to over time.

existing West Fraser and non-West Fraser roads (permanent and temporary) and other infrastructure footprint within 100 m of fish bearing water bodies.

Final Harvest Plans

Any Final Harvest Plans within riparian areas bordering fish-bearing water bodies will reference the active and passive landbase, harvest schedule, and other commitments identified in this HCS and confirmed in the Spatial Harvest Sequence. Special silviculture systems considerations, if any, will be described for all blocks that occur within riparian areas bordering fish-bearing water bodies.

Harvest Planning and Operating Ground Rules

Native fish habitat conservation will follow the amendments to the Harvest Planning and Operating Ground Rules described in the FMP, in particular the Riparian Management Strategy. The Ground Rules will be negotiated and approved as part of the FMP approval.

MONITORING

ESRD maintains ongoing conservation and recovery programs for Arctic grayling, Athabasca rainbow trout and bull trout, as well as other native fish species. These programs include inventory and monitoring programs. West Fraser will continue to cooperate with ESRD programs.

West Fraser will continue to monitor roads and watercourse crossings and use the information to support the maintenance and remediation program.

As part of FMP implementation West Fraser will design and implement a program to monitor implementation and outcomes for the new Riparian Management Strategy. Results of the monitoring program will be reported as part of the FMP reporting process and referenced in future revisions of this HCS.

RESEARCH AND CONTINUAL IMPROVEMENT

Arctic grayling, Athabasca rainbow trout, and bull trout are relatively well known compared to other native fish species. The existing management and recovery plans for Arctic grayling, Athabasca rainbow trout, and bull trout and new plans as they are developed all contain sections of research and knowledge needs. West Fraser will cooperate with government-led projects to conserve native fish where West Fraser judges there is value.

New information will be regularly reviewed and incorporated into revisions of the native fish habitat conservation strategy.

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Appendix 1 – *Native fish risk assessment matrix.*

Activity	Aspect	Impact	Probability	Severity	Risk	Strategy
Harvesting and site preparation	Insufficient retention adjacent to shoreline of fish-bearing waters	Loss of proper functioning condition	Remote – Aspect could only occur if there is an inadequate plan or operations error or both	Low – Occurrence would be localized and recovery would occur	D	Follow Riparian Management Strategy
Harvesting and site preparation	Inadequate erosion control adjacent to or upslope from fish-bearing waters	Sediment entering water bodies causes loss of PFC	Occasional – Occurrence could occur if best practices are not followed, or if heavy precipitation overwhelms erosion controls	Low – Occurrence would be localized and recovery would occur	D	Follow Riparian Management Strategy
Harvesting and site preparation	Overall disturbance level in watersheds	Alteration of natural water regimes	Remote – procedures in place to ensure harvest level in watersheds remains within NRV	Low – Unlikely to happen, occurrence would be localized, and recovery would occur	D	Implement SHS
Stand tending	Herbicide entry into fish-bearing waters	Lethal toxicity of fish or sub-lethal effects	Improbable – procedures in place to prevent disturbance	Low – Herbicide use near water is stringently controlled	D	Follow herbicide application requirements
Permanent road construction and use	Permanent WF roads close to fish-bearing waters	Sediment entering water bodies causes loss of PFC	Probable – Erosion control is an ongoing maintenance task. Incidents are relatively common.	Medium to High – Depends on amount and timing of sediment entering fish-bearing waters	A	Continue and strengthen inspection and erosion control remediation system
Temporary road construction and use	Temporary WF roads, skid trails, etc. close to fish-bearing waters	Sediment entering water bodies causes loss of PFC	Probable – Erosion control is an ongoing maintenance task. Incidents are relatively common.	Low to Medium – Depends on amount and timing of sediment entering fish-bearing waters	B	Ensure best practices are applied to minimize erosion
Watercourse crossings	WF watercourse channel crossings	Structure is partial or full barrier to fish movements	Probable – Many older structures are partial or full fish barriers (e.g. hanging culverts).	Medium to High – Backlog of barrier crossings, however most WF crossings are not full fish barriers	B	Identify and remediate problem crossings according to priority rankings
Watercourse crossings	Watercourse channel crossings on FMA owned by others	Structure is partial or full barrier to fish movements	Probable – Many older structures are partial or full fish barriers (e.g. hanging culverts).	Medium to High – Backlog of barrier crossings, however most crossings are not full fish barriers	B	Work with FSCP and AESRD to collaborate based on priority watershed rankings

Activity – an activity that may result in a negative effect on conservation.
Aspect – the presumed result of the activity.
Impact – the negative conservation effect.
Probability – the frequency that the impact may occur. Nil: Activity not currently undertaken; Improbable: Likely to never happen; Remote: Less than once a year; Occasional: Monthly to yearly; Probable: Weekly to monthly; Frequent: Daily to weekly.

Severity – the level of severity that the impact could cause. Each of 5 severity aspects is rated on a scale of 1 – 3, with 1 = low, 2 = medium, and 3 = high. Aspects are: size of the impact, duration of the impact, cost of changing the impact, likelihood of recovery after the impact occurs, and length of time for recovery to occur. Each aspect is scored, and the total Severity score is Negligible 0 – 6; Minor 7 – 9; Major 10 – 12, and Catastrophic 13 – 15.
Risk – a combination of Probability and Severity according to the Risk table:

Risk evaluation table

Probability of impact	Severity of impact			
	Catastrophic	Major	Minor	Negligible
Frequent	A	A	A	C
Probable	A	A	B	C
Occasional	A	A	B	D
Remote	A	B	C	D
Improbable	B	C	C	D