

PART VIII: Forest Ecosystem and Environmental Stewardship Practices

12. FOREST ECOSYSTEM AND ENVIRONMENTAL STEWARDSHIP PRACTICES

12.1 Soil Conservation Objectives

The ALRF objective for soils generally, is to conserve the inherent productivity and hydrologic function of soils within the Research Forest that are influenced by forest management practices.

Soils on the ALRF are predominantly fine-textured, with frequent silt and clay loam soils. Clay-rich B horizons can also create perched water tables and wet soil conditions in lower-lying locations, and limit the depth of rooting zones. The nature of these soil factors, both individually and in combination, make many ALRF soil types very sensitive to compaction and degradation due to mechanical disturbance and surface traffic. ALRF soils and site productivity will be conserved by limiting forest operations to certain conditions and seasons of activity to avoid soil damage.

ALRF practices for soil conservation (including soil disturbance limits, permanent access structure limits, maintenance of natural surface drainage patterns, slope stability, re-vegetation of temporary roads and disturbed sites, and/or soil amendments including fertilization) will be consistent with the *Forest and Range Practices Act* and the *Forest Planning and Practices Regulation*, and other provincial and federal legislation, as amended from time to time.

Specific soil conservation targets will be provided in stand-level Site Plans. Periodically at the ALRF, forest research, demonstration, or teaching purposes may propose to apply soil treatments or impacts that will vary from the above standard requirements. In such cases, the area of such treatment variances will be planned and spatially mapped in advance, be included in a professionally-prepared prior Site Plan, and appropriate agencies informed and consulted, to ensure compliance with legal standards.

A student group heads out to a field site with their instructors at the ALRF



12.2 Biological Diversity Objectives

Management of biological diversity (or “biodiversity”) objectives for both natural and managed ecosystems at the ALRF will incorporate the following inter-locking objectives and strategies at the landscape and stand / site levels:

- a) Landscape-level zoning, spatial reserves, and enhancement of spatial connectivity of Old Growth Management Areas and natural areas.
- b) Landscape-level objectives for tree species composition in managed forests within the Timber Harvesting Landbase (THLB), including but not limited to, deciduous / mixedwood management.
- c) Landscape-level objectives for harvest patch-size distribution (including silvicultural systems) in managed forests within the Timber Harvesting Landbase (THLB).
- d) Post-harvest structural retention of Wildlife Tree Retention Areas (WTRA's), individual live and dead trees (dispersed leave-tree retention), high-value wildlife trees, and coarse woody debris (CWD) within the THLB.
- e) Recognition and appropriate management practices for a range of types of aquatic habitats, riparian areas, and wetlands, as discussed further in this management plan.
- f) Recognition, protection, and management of areas of special management concern or significance within the landbase based on special geographic or ecological features, high value habitats, or high-value wildlife trees or tree groups.
- g) Ecosystem restoration where appropriate, within degraded habitats. And,
- h) Ecosystem representation within all of the above.

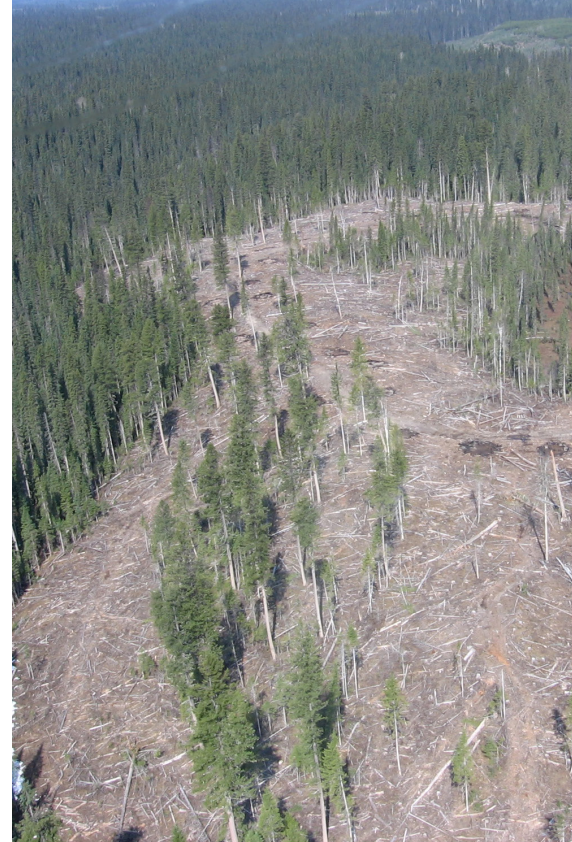
Measurable, verifiable target (results) and strategies for each of these goals are provided in the following sections of this Management Plan.

12.3 Wildlife Habitat

Identified Wildlife Strategies

Within the ALRF, there are (at the time of plan preparation) no known provincially- or provincially-designated Wildlife Habitat Areas, Wildlife Strategies, or Ungulate Winter Range, as defined in the *Government Actions Regulation*, or the *Forest Planning and Practices Regulation*.

As needed, new information on Identified Wildlife Strategies (or similar objectives identified by government) will be recognized and incorporated into this management plan via addenda to the plan.



(TOP) Post-harvest retention of mature Douglas fir leave trees and riparian reserves within an ALRF harvest cutblock (ABOVE) Snail, likely a Forest Disc snail (*Discus whitneyi*) observed on a log in old-growth forest, ALRF, summer 2016

Wildlife Trees and WT Retention Areas

Within the ALRF land-use zones designated for sustainable timber management, stand-level biodiversity will be maintained by post-harvest retention of the following features within the Site Plan area:

1. Representative areas with late-seral or multi-layered stand characteristics and/or identified high-value wildlife trees and varied structural stages and wildlife tree types, tree species, and size-class cohorts. And,
2. Younger or early-seral stand types with high existing wildlife use, biologically-important geographic features for wildlife (such as watering holes, major game trails, or mineral licks), and/or high potential to recruit rare or unusual stand characteristics or wildlife features as these stands age or develop.

Designation of WTRA's during forest operations will be guided by conservation and protection of the following features:

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| i. High-value wildlife trees and wildlife-tree concentrations. | |
| ii. Wildlife water sources. | vi. River floodplains and/or wetland complexes. |
| iii. Raptor ("stick") nests. | vii. Areas with multiple or overlapping high-value biodiversity / wildlife features. |
| iv. Areas of high ungulate use or bedding sites. | |
| v. Areas with frequent or repeated wildlife sightings. | |

WTRA management within the ALRF will be consistent with the following conditions, and meet the following targets:

- a) WTRA's will be designated in professionally-prepared Site Plans and their spatial locations recorded within the provincial RESULTS database.
- b) On average across the ALRF, WTRA areas will be at least 12% of the total area of the total harvest area of all cutblocks.
- c) For individual cutblocks greater than 10 hectares in area, the total amount of WTRA's that relate to the cutblock will be at least 3.5% of the cutblock harvest area.
- d) A WTRA may relate to more than one harvest area if all of the harvest areas that relate to the WTRA are: (i) encompassed within a single Site Plan, and (ii) the Site Plan also provides a logical, ecologically-based, and defensible professional rationale for the WTRA location(s) relative to harvest areas.
- e) Timber will not be harvested from a WTRA, except where specified in detail in a Site Plan, for the purposes of ensuring worker safety, and/or reducing of windthrow potential along identified WTRA boundaries. In general, WTRA's should be laid out to minimize and avoid disturbances to WTRA boundaries.
- f) Requirements for dispersed leave-tree and wildlife-tree retention within harvest cutblocks will be specified in applicable Site Plans. (See also Best Practices below).

At the ALRF, WT retention Best Practices will generally apply to all harvest areas under the Site Plan excluding road rights of way and roadside processing areas. Preferred retention trees and characteristics will include the following, where safe to do so:

- Whole (unstubbed) trees, unless stubbing is specified in the Site Plan.
- Live Douglas-fir and black cottonwood trees > 40 cm dbh for fisher denning sites (present and future) and other wildlife habitat.
- Western hemlock.
- Deciduous tree species.
- Retention of smaller understory trees < 20 cm dbh for greater on-block structural retention and cover, where consistent with the Site Plan and where operationally feasible. And,
- Other tree species or size classes retained as appropriate on a site specific basis.



Coarse Wood Debris Retention & Management

Coarse woody debris (CWD) are non-merchantable, non-utilized logs greater than 7.5 cm at the largest end left on a harvested area (or “cutblock”).

CWD, as it lays in place on the forest floor and decays over time, plays important ecological roles as wildlife habitat and plant and fungal substrates and micro-habitats, and in natural nutrient and organic matter cycles including carbon sequestration. In general, the larger the CWD log size, the longer it will take to decay and provide more sustained ecological benefits and habitat attributes to the site.

CWD management on the ALRF will emphasize leaving a wide range of piece (log) sizes on harvested sites (excluding road construction), and a key management focus will be on post-harvest retention of CWD pieces greater than 30 cm (in butt diameter at the largest end of the log) being well dispersed on harvested units. Stevenson (2009) reported on ALRF operational performance in CWD retention on various cutblocks, providing the basis for updated goals for CWD management.

Timber harvesting and post-harvest fuel management treatments on the Research Forest area will retain average amounts of logs on cutblocks harvested over a 5-year or greater period (i.e. net harvested area) that meet the following criteria:

At least 50 cubic metres per hectare or more of logs of Decay Class 1 and 2, greater than 7.5 cm at the largest end, of which at least 30% of this volume are at least 5 m in length and 30 cm in diameter at one end.



(TOP LEFT) Abundant downed logs and coarse woody debris are a defining feature of old-growth forest habitats in the ALRF area
(TOP RIGHT) Downed logs following logging and prescribed burning on the “West Burn” (West Branch Road) at the ALRF, 1948 (ABOVE) Long-toed Salamander inhabiting rotten wood in a downed log at the ALRF

Specific harvest strategies for promoting CWD retention will include:

- i. Leaving sufficient amounts of larger non-merchantable or low-quality stems on-block or ideally “at the stump” (away from log processing and slash piling / fuel management areas).
- ii. Confining machine piling of logging debris and/or prescribed burning for fuel management to treatment of heavy roadside accumulations and occasional fine slash, and avoiding piling or burning of dispersed CWD. And,
- iii. Limiting or constraining biomass / bioenergy / pulp utilization on harvested sites at the ALRF so that biomass utilization does not reduce CWD retention below the above limits.



Flooded backwaters and oxbows along the Bowron River floodplain are important and productive aquatic and riparian habitats

12.4 Watersheds and Aquatic Habitats

Objectives, results, and strategies for watersheds and aquatic habitats (WSAH) for the ALRF are linked and interdependent with those for Riparian Areas under this plan. However, this WSAH section encompasses additional issues for aquatic and wetland ecosystem values over and above those for Riparian Areas alone.

Major watershed sub-basins within the ALRF are mapped and illustrated in Appendix A1.

The Aleza Lake Research Forest will manage and protect watersheds and water quality in a manner consistent with this Management Plan, the *Water Sustainability Act and Regulation*, the *Forest and Range Practices Act*, and the *Forest Planning and Practices Regulation*, as amended from time to time.

No community watersheds, licensed water users, or licensed water intakes are located within the Aleza Lake Research Forest at the time of preparation of this plan.

General ALRF land use objectives for watersheds, water quality and aquatic habitats (consistent with the Prince George LRMP, 1999) are:

1. To protect the quality and quantity of ground and surface water. (and)
2. To conserve the natural range of stream flow and watershed patterns and processes to safeguard fisheries, other wildlife, recreational values, and ecosystem functioning.

Specific results and strategies for ALRF water quality and aquatic habitats are:

- a) To protect and manage riparian areas (inclusive of waterbodies and watercourses) as per the Riparian Area results and strategies identified in this management plan.
- b) To develop / document best management practices (BMP's) to manage roads and drainage structures consistent with above legislation and regulations.
- c) To improve spatial inventory and mapping of fish-bearing vs non-fish-bearing streams on the ALRF during the term of this plan to reflect new information, including LiDAR digital elevation terrain models.
- d) To undertake watershed assessments on all ALRF watershed sub-basins (Appendix A1) as per WAP protocols (BC Min. of Forests, 1999).
- e) To manage fish-stream crossings consistent with the Fish-stream Crossing Guidebook (MFLNRORD, 2012, or as updated from time to time), and Pike et al (2010).
- f) Annual or bi-annually (every 2 years), to monitor and assess stream crossings and road culverts based on identified risk (e.g. - inspection of higher-risk structures at least annually, and more frequently on a routine basis and during freshet events). And,
- g) To develop and implement Amphibian-Habitat Best Management Practices for forest operations and road and drainage structure maintenance during the term of this plan.



Hansard ("Camp") Creek above the Aleza Forest Road crossing

12.4.1 Riparian Areas

Definitions and Key Concepts

Riparian areas are those areas that surround water bodies and watercourses in a watershed, including lakes, ponds, streams, or wetlands. These areas are generally composed of moist to saturated soils (sub-hygic to hydric) and associated plant communities and ecologies, and incorporate many interactions between the water, soil, microorganisms, plants and animals. Riparian zones are important transition areas that connect aquatic ecosystems with the land, and support a wide diversity of terrestrial, semi-aquatic, and aquatic plant and animal life. Additionally, riparian areas link the ecosystems through which water flows, providing pathways for wildlife, dispersal of plants, food sources, and nutrient transfer.

On the ALRF, as elsewhere, riparian areas support critical natural functions important to management of biodiversity, fish and fish habitat, and aquatic ecosystems including contributions of vegetation and leaf litter, shade and wind protection, habitat for insects and amphibians, inputs of large woody debris, streambank stability, and moderating temperature and moisture conditions.

ALRF Management Intent for Riparian Areas

The ALRF recognizes the statutory requirements set by the Province for management of riparian areas, and also considers potential additional best management practices. The ALRF in this plan will also use additional riparian-feature definitions and strategies appropriate to the specific climate, terrain, soils, and ecology of the ALRF landbase.

Statutory Framework

ALRF forest practice requirements related to riparian areas (including areas related to streams, wetlands and lakes) will be consistent with the riparian stewardship requirements provided by the *Forest and Range Practices Act* and the *Forest Planning and Practices Regulation*, as amended from time to time. Additionally, ALRF riparian management standards will exceed FRPA and FPPR standards in circumstances specified under this management plan.

This plan provides additional clarification of riparian definitions and terms of reference, for more locally-specific interpretation and application of riparian management at the ALRF.

Proposed ALRF variances from provincial statutory requirements – and additional supporting definitions and interpretations provided in this plan will be based upon:

- Expert opinion and consensus in available literature (for riparian-feature definitions),
- The specific ecology, geomorphology, hydrology, and character of ALRF riparian systems and individual watersheds.
- ALRF management experience and local knowledge in riparian area management. And,
- The best available science and management recommendations from regional riparian, watershed, and stream management research.



Sampling of fish populations in Hansard Creek, ALRF

Supporting Definitions for Interpretation of ALRF Riparian Features

12.4.2 Linear Riparian / Aquatic Features – Rivers and Streams

Streams

A stream is commonly defined and understood as “a body of running water (as a river or brook) flowing on the earth” (Merriam-Webster Dictionary, 2017).

Under the Forest and Range Practices Regulation (2016) the legal definition of a “stream” is “a watercourse, including a watercourse that is obscured by overhanging or bridging vegetation or soil mats, that contains water on a perennial or seasonal basis, is scoured by water or contains observable deposits of mineral alluvium, and that (a) has a continuous channel bed that is 100 m or more in length, or (b) flows directly into (i) a fish stream or a fish-bearing lake or wetland, or (ii) a licensed waterworks.”

The FPPR traditionally defines 6 different classes of streams based on stream width, fish presence, and other criteria. Small watercourses that do not meet the statutory definition of a stream are referred to in this plan as “non-classifiable drainages” (abbreviated as “NCD’s”).

NCD’s (including associated headwater seepage areas, springs, and watercourses with organic, non-alluvial beds) are contiguous to downstream classifiable streams, and are important hydrological features that will be recognized and managed appropriately in the course of ALRF forestry activities.



Floodplains

The Forest Planning and Practices Regulation (2016) defines an “active flood plain” as “the level area with alluvial soils, adjacent to streams, that is flooded by stream water on a periodic basis and is at the same elevation as areas showing evidence of... flood channels free of terrestrial vegetation,... rafted debris or fluvial sediments, recently deposited on the surface of the forest floor or suspended on trees or vegetation, or... recent scarring of trees by material moved by flood waters.”

Under this plan, the ALRF will consider floodplains active at any part of the year to be part of the riparian management area of any classifiable stream.

Non- Linear Riparian Areas – Water bodies to wetlands

Lakes, Ponds, and Wetlands

A lake is commonly defined and understood as “a considerable inland body of standing water” (Merriam-Webster Dictionary, 2017) or “a large area of water surrounded by land and not connected to the sea except by rivers or streams” (Cambridge Dictionary, 2008). A pond is a “body of water usually smaller than a lake” (Merriam-Webster).

The Forest Planning and Practices Regulation (FPPR, 2016) does not otherwise define lakes or ponds, but does define different classes of “lakes” based on their size (in hectares) and their location within specific biogeoclimatic zones. However, the FPPR has no management criteria for lakes or ponds < 1 hectare in the Sub-boreal Spruce biogeoclimatic zone.

Therefore, the ALRF uses the following approaches and definitions in lake and wetland management:

The BC Lake Survey Field Guide (BC Ministry of Environment, 2008) defines a lake as “an open waterbody with a depth greater

Extensive pond and wetland complexes are a frequent feature of ALRF plateau landscapes



than 2 metres and with less than 25% of its surface area covered with wetland vegetation”. This survey document further states that “by default, an open waterbody less than 2 metres deep is a wetland”.

The FPPR defines a “wetland” as “a swamp, marsh, bog, or other similar area that supports natural vegetation, that is distinct from adjacent upland areas”.

In the provincial guide to the wetlands of British Columbia, MacKenzie and Moran (2004) define wetlands in more detail, as “areas where soils are water-saturated for a sufficient length of time such that excess water and resulting low soil oxygen levels are principal determinants of vegetation and soil development. Wetlands will have a relative abundance of hydrophytes in the vegetation community and/or soils featuring “hydric” characters.”

The BC Ministry of Environment’s (BC MoE) Guidelines for Amphibian and Reptile Conservation (2014) and related recent operational guidelines (e.g. Wind and Beese 2008) emphasize the ecological importance of small shallow seasonal / ephemeral ponds and shallow-water wetlands for effective amphibian breeding and rearing habitat, and the vital function of such small ponds and wetlands in separating amphibians and their juveniles from fish predation. From an amphibian and reptile habitat perspective, MoE guidelines therefore emphasize the natural hydrological regime of lakes, ponds, and wetlands areas, not just the vegetation and soils of the area.

Based on such guidance, the ALRF will follow the following best practices and guiding principles for maintaining the hydrological features needed by amphibians and reptiles:

- Consider and conserve the natural hydrological regime of sensitive areas for amphibian habitat, including shallow-water wetlands.
- Avoid undue impacts, or draining, or dredging of natural wetlands during forest operations.
- Ensure that management (site) plans and operational practices (including road maintenance) consider and conserve the hydrology of wetlands and other watercourses.



(TOP) ALRF amphibians dependent on shallow water wetlands include the Western Toad (ABOVE) Long-toed Salamander

Significant ALRF Wetland Types

Wetlands may be non-forested, lightly wooded, or forested. As noted by McKenzie and Moran, “wetlands include a broad range of ecosystem types, from those permanently flooded by shallow water and dominated by aquatic organisms to forested sites with merely wet soils”.

This ALRF management plan recognizes and will manage all wetland types, including forested wetlands.



At the ALRF, Sundews (*Drosera* spp.) are insectivorous plants found only in raised nutrient-poor peat bogs

Transitional Riparian Ecosystems

Riparian areas encompass a very wide range of features, ecological conditions and vegetation types from fully aquatic, semi aquatic, semi terrestrial, and terrestrial ecosystems. On gently rolling and near-level plateau terrain in the ALRF landscape, ecological changes can be gradual, and there are many transitional ecosystems. Areas near or adjacent to wetlands, streams, and lakes and ponds have such transitional or ecological features, and these can vary seasonally.

Two transitional riparian ecosystems that are quite common on the ALRF, and that have high management significance on the ALRF, include (a) shallow-water wetlands, and (a) forested swamps.

Shallow-water Wetlands

“Shallow-water Wetlands” as defined by the Canadian wetland classification system are: “open waters that cover at least 75 percent of a total wetland area in summer and have a midsummer depth of less than 2 metres. They are commonly referred to as ponds, pools, shallow lakes, oxbows, reaches, channels, or impoundments, and are usually edged by water-eroded shorelines or by the landward margin of mudflats, floating vegetation mats, or shrubs. Not infrequently, this type of wetland is found within other wetland types” (National Wetlands Working Group, 1997).

On the ALRF, these frequently include beaver ponds back-flooding lowlying areas, and seasonal marshes and fens which temporarily inundate during spring and fall seasons. Shallow-water wetlands occur in some low-lying depressional areas in the northern upland and plateau of the ALRF, but also are particularly abundant on the Bowron River floodplain in the southern portion of the ALRF. Due to the influence of more mineral-rich groundwater and surface hydrology, they tend to be richer plant communities and wildlife habitat than the raised peat bogs which are the more common wetland type on the ALRF.

Forested Swamps (Spruce-Horsetail SBSwk1-09 Site Series)

The Spruce – Common horsetail – Leafy moss Swamp Site Association is a forested wetland common in the SBSwk1 subzone as the 09 site series (MacKenzie and Moran, 2004). As this type often occurs on lower and toe slopes and margins of other wetland types, where there is significant flow of mineral-rich groundwater, they are technically recognized (as above) as a class of wetlands known as “forested swamps”.

Though inherently variable, these can be moderate productivity sites for commercial tree growth, with spruce and subalpine fir rooting on elevated mounds. The shrub layer may be well developed or sparse, with twinberry (*Lonicera involucrata*) most prominent. Common horsetail (*Equisetum arvense*) is abundant but many other upland and wetland species are common. The diverse moss layer includes leafy mosses (*Mnium* spp.) and ribbed bog-moss (*Aulacomnium palustre*) usually in depressions, and feathermosses including *Pleurozium schreberi* on raised mounds. Soils most often have a thin, dark, well-humified, woody peat veneer over fine-textured mineral soils, but occasionally deeper peat deposits are encountered.

On the ALRF, due to their often well-developed forest cover, taller trees, and productivity, forested swamps in the SBSwk1-09 site association (and similar SBSwk-10 Devils Club-Lady Fern sites) have had a frequent history of timber harvesting activities due to their substantial timber values. These sites have been included in many individual past and current ALRF cutblocks, and form part of the ALRF timber harvesting landbase. These can often also be challenging sites for reforestation due to cold wet soils (DeLong 2003), and longer reforestation periods than would be expected than on warmer or more well-drained upland sites.

On the ALRF, forested swamps may be harvested, regenerated, and managed for sustainable timber production on a site-specific basis, within the ALRF timber harvesting land base.

Results and Strategies for Riparian Areas in the ALRF

ALRF forest practices in and adjacent to riparian areas will be consistent with (i.e. – meet or exceed) the *Forest and Range Practices Act* and the *Forest Planning and Practices Regulation* (FPPR) as amended from time to time, except for the following circumstances, where a higher minimum standard of riparian management will apply:

A. Riparian Reserve Zones on S4 Streams (small fish-bearing streams)

Under this management plan, the minimum riparian reserve zone (RRZ) on high-value (known fish-bearing) S4 streams within the ALRF will be 20 metres on each side of the stream. The intent of this provision is that these reserves will be to windfirm boundaries, and apply to the main stem or primary perennial fish habitat within these stream reaches.

B. Headwater “NCD” Non-channelized Water Flows, Seepage Areas, and Springs

Headwater non-channelized surface water drainages, water-seepage areas, or springs are important hydrological features affecting headwater stream water quality, quantity, and timing. Because headwater flows, seeps, and springs in many cases may be non-channelized and/or also sub-surface water flows, they may not be classifiable streams, and may be determined to be a Non-classifiable Drainages (NCD) according to provincial stream classification criteria under the FPPR. Nevertheless these areas need management attention and appropriate measures during forest operations to manage and protect hydrological functions (Nordin and Bradford, 2017).

In ALRF operational planning, Non-classified Drainages (NCD) that include significant seepage areas and/or springs, will be spatially mapped on all ALRF operational plans, and it is recommended that a minimum Machine-Free Zone (MFZ) of 5 to 8 metres from the outside edge of the feature will be applied.

In addition, during the term of this Management Plan, the ALRF will develop Best Management Practices for the recognition and management of site characteristics and ecosystems related to these hydriparian areas including non-channelized surface flows, seepage areas, and springs on the ALRF.

C. Riparian Management Areas for Shallow-water Ponds

Under this management plan, the recommended Riparian Management Zone (RMZ) for shallow-water ponds > 0.25 hectares in area within the ALRF is 20 metres from the terrestrial (upland) edge of the waterbody and/or wetland feature.

D. Management of Forested Swamps (Ws07 or SBSwk1-09 sites)

Under this plan, commercial timber harvesting and sustainable timber management is acceptable practice in SBSwk1-09-leading “forested wetland” site series based on a qualified professional pre-harvest assessment and Site Plan, if the sites have a high likelihood for reforestation to required standards, and are managed to windfirm harvest boundaries.

Portions of SBSwk109 forested wetlands not suitable for sustainable forest management must be excluded from harvest areas, and may, if suitable, be integrated into adjacent Wildlife Tree Retention areas.

E. Management of Riparian Areas associated with Ravines

On the ALRF, ravines are natural landscape features that have been deeply incised over time by water, into fine-textured lacustrine parent materials. In the ALRF’s wet climate, ravines frequently have periodic, ephemeral, or perennial streamflows and seepage. Forest practices associated with ravines must maintain the integrity of stream-side riparian management areas, slope stability, and minimize related sediment sources.

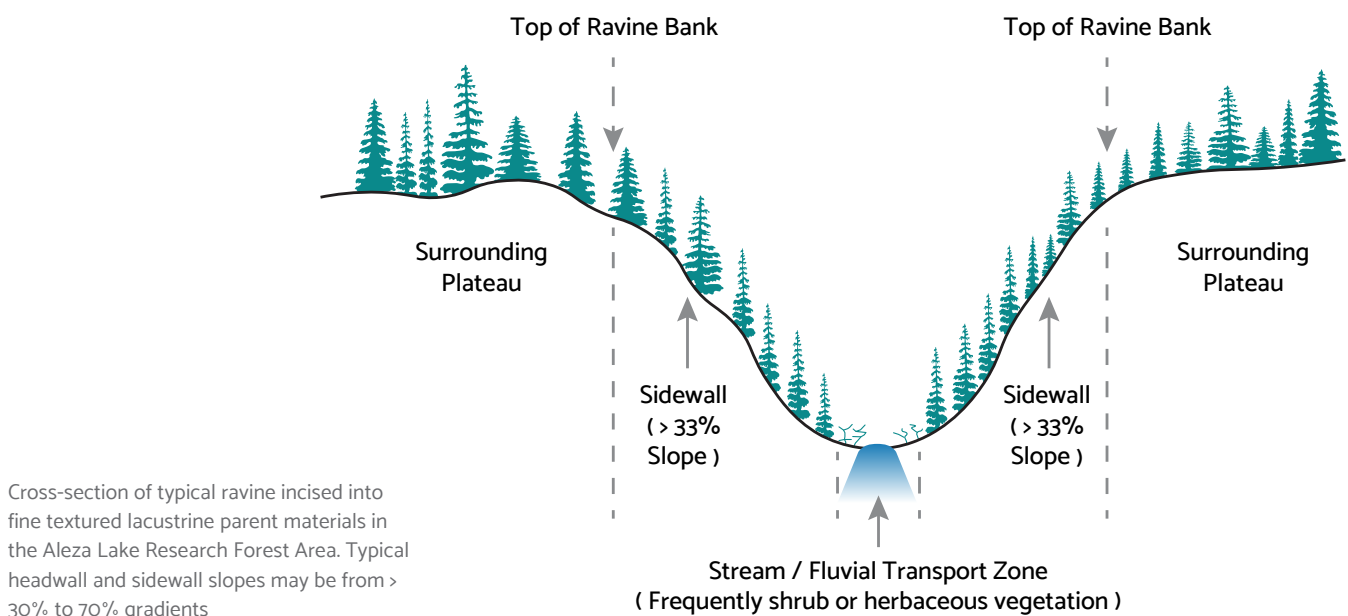
For the purposes of this Management Plan and associated operational planning, the terms “ravine” and “top of the ravine bank” are defined as follows (adapted from the *Provincial Riparian Areas Regulation, 2004*):

- A “ravine” is defined as a *narrow steep-sided valley that is commonly eroded by running water and has sidewall or headwall grade greater than 3:1 or 33%. And,*
- The “top of the ravine bank” means the first significant break in a ravine slope where the slope break occurs such that the grade beyond the break (away from the ravine) is less than 3:1 or 33% slope for greater than 15 metres horizontal distance from the slope break.

For ALRF operational planning in areas associated with classifiable streams in ravines, the following minimum riparian management standards will apply:

- The top of the ravine bank will be determined and verified by field reconnaissance, and clearly indicated on planning maps.
- Forest practices within the ravine, and adjacent to, and along the ravine bank will ensure appropriate measures to address: (a) slope stability and sediment production potential, (b) tree windthrow risk, (c) the stream classification, and (d) stream, fish and aquatic habitat, and water quality protection and management considerations.
- Where observed site conditions warrant and/or as per professional practice requirements, a qualified Terrain Stability Assessment (APEG-ABCFP Joint Guidelines, 2008) may need to be undertaken on or around ravines where forest operations are planned. Geotechnical recommendations resulting from such assessments may supersede this section and the minimum provisions of this Management Plan.

Figure 9: Cross-section of a typical ravine and location of top of the ravine bank



12.5 Invasive Plants: Management Strategies and Best Practices

Management strategies for invasive plants within the ALRF will include periodic monitoring of invasive species, assessment of infestations, and management of noxious weeds to reduce and mitigate the spread of specified species.

Invasive plant management strategies at the ALRF will focus on linear road corridors that provide key dispersal routes for the seeding-in and spread of invasive plants that prefer early seral open conditions.

Based on current information at the time of preparation of this management plan:

Three thistle species (Canada thistle (*C. arvense*), Marsh Plume thistle (*C. palustre*), and Scotch thistle (*O. acanthium*) will be the primary focus of species-specific invasive-plant management and best practices. Canada and Marsh Plume thistles are listed provincially-regulated noxious weeds under the *Weed Control Act* in the Fraser Fort George Regional District. Scotch thistle is an invasive species though not currently listed as noxious for this area.

Oxeye Daisy (*L. vulgare*), Orange Hawkweed (*Hieracium* spp.), and Hemp Nettle (*Galeopsis tetrahit*) are not listed as noxious weeds for this regional district, and will be considered under more general management provisions for limiting disturbed seedbeds and the spread of invasive plants.

Thistle management

Thistles, such as the Canada, Marsh Plume and Scotch thistles found at the ALRF, prefer disturbed soils or bare ground and the seeds are dispersed primarily by wind (Invasive Species Council of BC, 2014). All prefer early-seral successional conditions and high light availability, and are gradually out-competed and shaded out by other species at later stages of vegetation and stand development.

Canada thistle is perennial, and can reproduce by vegetative spreading into larger colonies, while Marsh Plume and Scotch thistle are biennial species that are primarily wind-dispersed by seed. Marsh Plume thistle prefers moist sites of high water availability and higher water tables (NWIPC, 2014), while Canada and Scotch thistle tend to prefer well-drained soils.

At the ALRF, allocation of available resources for active treatment and reduction of thistle infestations (by mechanical cutting of stems, seedheads, and uprooting and disposal of rosettes) will be prioritized to the following areas directly along and adjacent to (within 10 metres of):

1. Permanent walking and interpretive trails (to reduce dispersal of seeds attaching to trail users).
2. In the vicinity of buildings and visitor facilities.
3. Permanent all-weather road corridors. And
4. Recently-disturbed construction sites or rehabilitation within 100 m of permanent road corridors.

Managing linear road corridor to limit spread of invasive plants

Along permanent road corridors at the ALRF (Aleza FSR, East Branch Road, West Branch Road, Bear Road, Ridge Road), road maintenance activities (e.g. grading, ditching, culvert maintenance and replacement, and disposal of surplus soil) periodically reduce native vegetation cover and expose mineral soil seedbeds that may encourage seeding-in and establishment of invasive plants.

In addition to the thistle monitoring and active management measures described above, the primary strategies for mitigating the spread of invasive along permanent road corridors will be:

1. Prompt revegetation of exposed mineral soils - within the road right-of-way and outside the road running surface - with agricultural or horticultural seed mixes free of weed species, or where feasible, adjacent seed sources for native plants. And,
2. Practices that encourage the retention of the root mats of existing established non-invasive plants, especially lower-growing species, without impairment of road drainage and function.

Updating and revision of invasive-plant strategies

ALRF strategies for management of noxious/invasive plants will be updated periodically and as required, based on new information.