Hinton Wood Products
A division of West Fraser Mills Ltd.

Edson Forest Products
A division of West Fraser Mills Ltd.

Trumpeter Swan
Habitat Conservation Strategy

Version 6
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Rick Bonar

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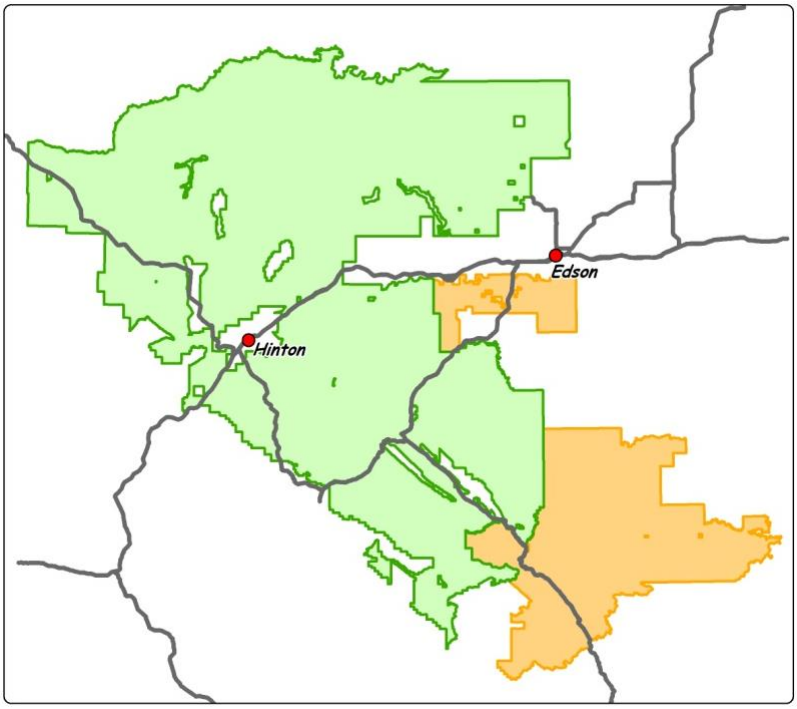
PREFACE

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

The trumpeter swan (*Cygnus buccinator*) is the largest North America waterfowl species. Trumpeter swans (TRSW) breed on the FMA and winter primarily in the United States. The Alberta TRSW population was designated as Threatened in the Alberta Wildlife Act[2] in 2001. The Alberta government developed two five-year recovery plans; the most recent is the Alberta Trumpeter Swan Recovery Plan 2012-2017 which was approved in 2012. The status of the TRSW in Alberta was reviewed by the Endangered Species Conservation Committee in 2013 and status designation change recommendations were submitted to the ESRD Minister. Nationally TRSW was down listed to not at risk in 1996 and TRSW currently has "no status" in SARA Schedule 1.

The global TRSW population declined to the brink of extinction in the early 1900s due to a variety of factors but principally killing by humans. The population is now increasing rapidly and was estimated in 2010 to be 46,225 birds in North America and 4,667 ± 794 in Alberta.

TRSW use exclusively aquatic habitats during the nesting season and during this time they are sensitive to human disturbance in surrounding areas. TRSW are highly territorial and each nesting lake typically has only one pair of swans.

There are 5 TRSW lakes on the Hinton Wood Products FMA and 4 on the Edson Forest Products FMA, plus 2 lakes that are within 800 m of the HWP FMA and 1 within 800 m of the EFP FMA. These lakes are part of the ESRD TRSW database but ESRD records do not indicate nesting on all of them. It appears that some of these lakes represent lakes with TRSW sightings and not evidence of nesting (D. Hobson, personal communication). TRSW do not nest on all lakes in any year, and some lakes have been used for nesting more often than others. There are additional lakes on both FMA that may be suitable for nesting and may be used by nesting TRSW as the population continues to expand.

West Fraser developed a conservation plan for each of the 12 known nesting lakes and will add new lakes as they are identified. However ESRD did not approve the main proposal, which was careful harvest within 200 m of nesting lakes. Consequently, no areas within 200 m of nesting lakes were included in the net landbase. West Fraser will continue discussions with ESRD in an effort to obtain approval for harvest and will implement the HCS when approval is obtained.

[2] http://www.sararegistry.gc.ca/default_e.cfm

INTRODUCTION

The trumpeter swan (*Cygnus buccinator*) is a migratory bird that breeds on lakes in the FMA. The largest waterfowl species in North America, adults are very large (to 12.7 kg, 150-183 cm length) with white plumage and black bill and legs. The smaller tundra swan (*Cygnus columbianus*) often, but not always, has a small yellow spot on the base of the bill. The trumpeter swan bill is flatter on top compared of the slightly up-curved bill of the tundra swan (Figure 1). The best way to distinguish between the two species is by the voice. Trumpeter swans have a deep trumpeting call and tundra swans have a higher whistling call. Immature birds of both species are grey-white in their first year. The Trumpeter Swan Society[3] has a good online guide to swan identification. Tundra swans breed in the Arctic and may pass through the FMA during spring and fall migration. Trumpeter swans breed on FMA lakes, and most pairs of swans observed during the breeding season (approximately June through September) will be trumpeters. The much smaller snow goose (*Chen caerulescens*) does not usually occur on the FMA.

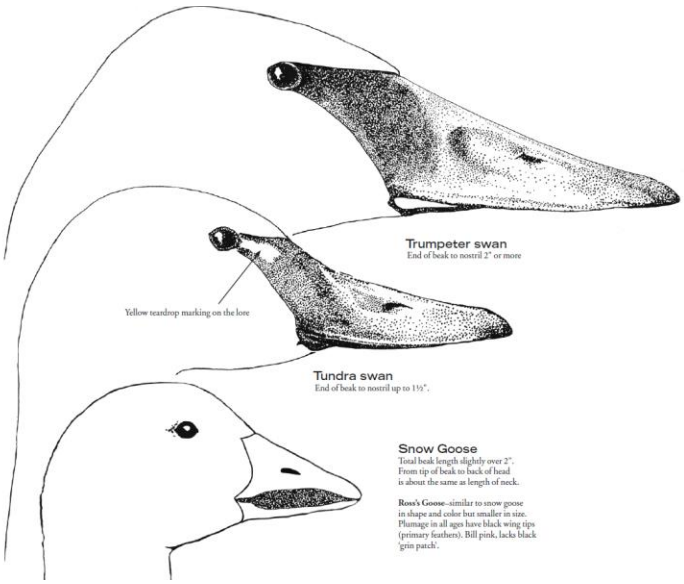


Figure 1 – *Head profiles of trumpeter swan, tundra swan, and snow goose, from Trumpeter Swan Society. These waterfowl species are all relatively large and mostly white.*

Trumpeter swans breed in western Canada and Alaska and in the northern USA east to the Great Lakes (Figure 1). There are three populations of Trumpeter Swans in North America: the Pacific Coast Population, the Rocky Mountain Population and the Interior Population. Trumpeter swans in Alberta are part of the Rocky Mountain Population (RMP). RMP swans winter primarily in the Greater Yellowstone area in the USA. RMP swans have been expanding their winter range including into currently unknown areas (USFWS 2013).

Trumpeter swan breeding habitat characteristics (James 2000).

- Lake of sufficient size to provide adequate room to take off (approximately 100 metres)
- Calm water without strong wave action or currents.
- Stable levels of unpolluted fresh water.
- Extensive areas of shallow (< 1 m deep) water with abundant aquatic plants and invertebrates and some areas of emergent vegetation.
- Isolation and security from human disturbance.
- A suitable nest site. Nests are usually located near shore, on small islands, or on muskrat and beaver lodges

[3] http://www.trumpeterswansociety.org/docs/Swan_Goose_ID.pdf

The trumpeter swan is a Special Concern species in Alberta. Nesting trumpeter swans use exclusively aquatic habitats and they are sensitive to human disturbance during the breeding season. There are 12 nesting lakes on or close to either the HWP or EFP FMA. This document describes the habitat conservation strategy for trumpeter swan nesting lakes on the FMA.

Figure 2 – *Breeding range of the trumpeter swan in 2010, from Groves 2012.*

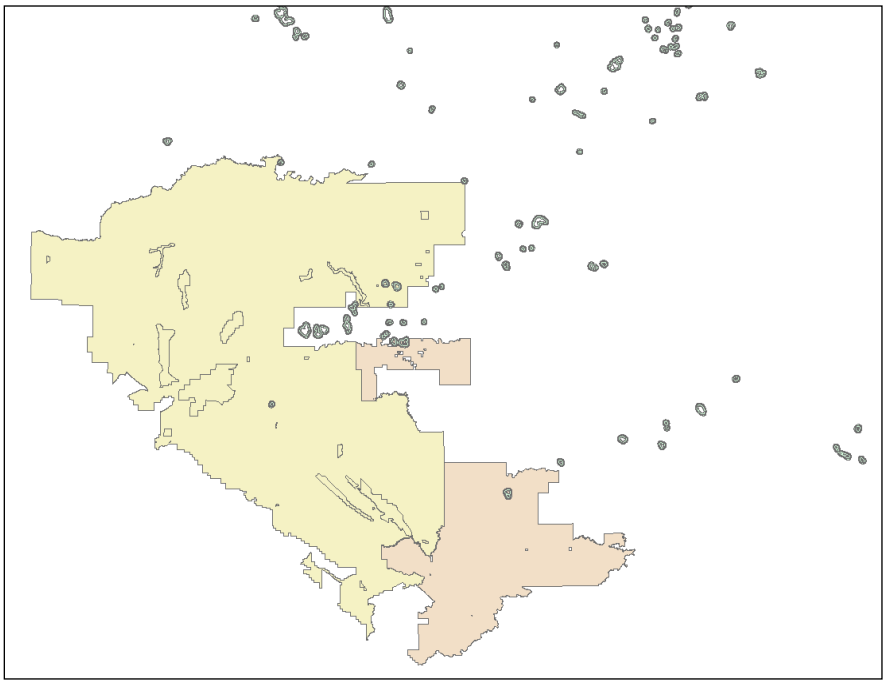


Figure 3 – *Trumpeter swan nesting season lakes (green polygons) in relation to the Hinton Wood Products (yellow shading) and Edson Forest Products (tan shading) Forest Management Areas, from Government of Alberta trumpeter swan waterbodies data source 2013*[4].

CONSERVATION STATUS

The IUCN Red List of Threatened Species ranked the trumpeter swan as Least Concern in 2004, 2008, 2009, and 2012 (IUCN 2014). The NatureServe system ranks trumpeter swan as G4 globally and S2S3 in Alberta (ACIMS 2014). The Canada population of the trumpeter swan was listed as Vulnerable by COSEWIC in 1978 and moved to the Not at Risk category in 1996 (COSEWIC 2013). The trumpeter swan was listed as Threatened under the Alberta Wildlife Act in April 1997 (Alberta 1997). A revised status report was completed in 2000 (James 2000) and the Alberta Wildlife Act designation was reconfirmed as Threatened in 2001, primarily because the Alberta population was below 1,000 breeding adults. Two Alberta Recovery Plans were prepared. The current recovery plan was approved in 2012 (ESRD 2012).

The main reason for the 2001 Threatened status for Alberta TRSW was a determination that there were fewer than 1,000 breeding adults. The estimated number of breeding adults from the 2010 survey was 936 ± 217 (ESRD 2010 trumpeter swan database). The TRSW Alberta population was reassessed by the ESCC in 2013 and the ESCC recommended down listing to Special Concern. The Government of Alberta changed the designation of TRSW to Special Concern in September 2014.

Table 1 – *Conservation status of the trumpeter swan*

Year	IUCN	Year	COSEWIC/SARA	Year	Wildlife Act	Year	NatureServe
2012	Least Concern	2013	SARA – No schedule	2014	Special concern	2014	G4 S2S3
2009	Least Concern	1996	COSEWIC – Not at Risk	2001	Threatened		
2008	Least Concern	1978	COSEWIC – Vulnerable	1997	Threatened		
2004	Least Concern						

[4] http://data.alberta.ca/data/trumpeter-swan-waterbodieswatercourse-0

POPULATION STATUS

The North American trumpeter swan population declined to as few as several hundred birds by the early 1900s due mainly to human killing. Protection provided by the 1918 Migratory Bird Convention Act and other conservation actions started a recovery that has accelerated in recent years. A multi-agency cooperative population estimate has been completed every five years since 1985. During that time the total population increased from 10,904 to 46,225 ± 1,172 (Groves 2012), and the Alberta population increased from 614 to 4,667 ± 794 (ESRD 2010 trumpeter swan database). In the 15 years between 1995 and 2010 the number of swans counted on the Alberta surveys increased 256% from 792 to 2,821 and the number of occupied waterbodies increased 272% from 184 to 685 (ESRD 2012). The average annual growth from the counts was 17.1% for swans and 18.1% for occupied waterbodies.

The Canadian portion of the Rocky Mountain Population was estimated at 10,550 ± 1,631 (95% CI), based on extrapolation from 4,150 swans actually observed during the survey (Groves 2012). The estimate is approximately double the 4,718 swans estimated in 2005. All Canadian areas of the Rocky Mountain Population showed growth since the 2005 survey, ranging from 20% in Yukon to over 170% in Alberta. The 2010 survey included a change in survey methodology that may have removed an underestimate bias and this may have influenced the magnitude of the estimated increases in British Columbia, Alberta, and the Northwest Territories (Groves 2012).

The RMP population winter counts in the USA showed an average annual increase of 5.5 % between 1972 and 2012, with a total of 6,425 counted in February 2013 (Olson 2013).

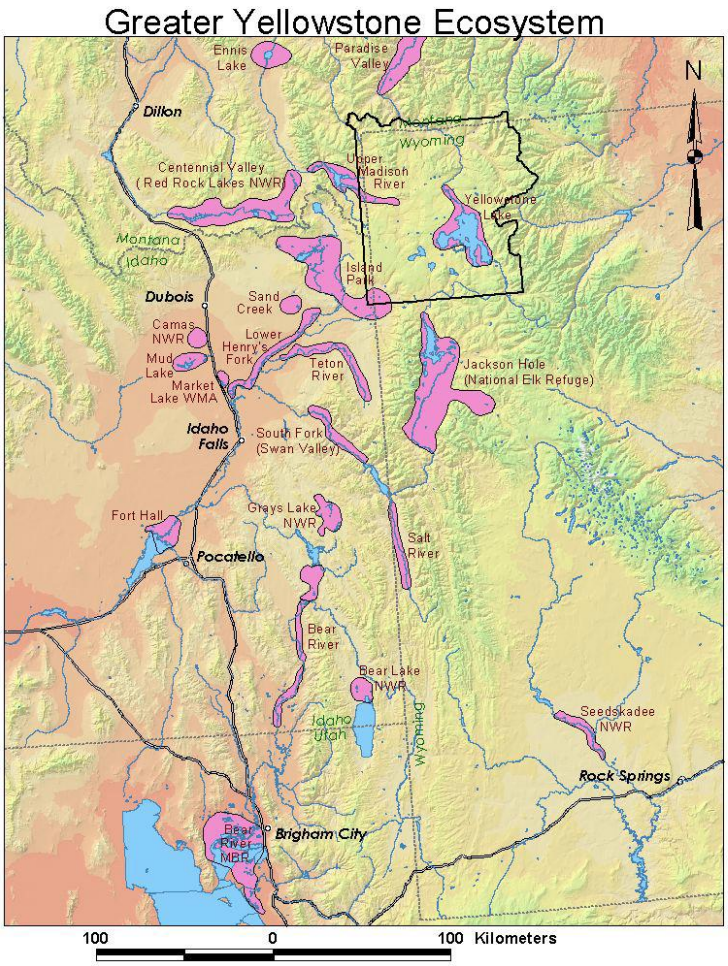


Figure 4 – *Trumpeter swan Rocky Mountain Population winter range, from Olson (2013)*

FMA OBSERVATIONS

Trumpeter swans have been observed on a number of FMA waterbodies. The Government of Alberta maintains a map (ESRD 2013) showing known or potential breeding lakes. Twelve lakes are either within the FMA or within 800 m of FMA boundaries (Table 2).

Table 2 *– Trumpeter swan lakes on or close to Hinton Wood Products and Edson Forest Products Forest Management Areas, from Alberta Environment and Sustainable Development online map, July 18, 2013*

				Lake	SMA Area in West Fraser FMA in ha			
Lake	**Name**	**FMA**	**Location**	**Area**	**0-200**	**200-500**	**500-800**	**Total**
1	Mud	Hinton	SW 6 48 15 5	57.8	79.0	157.3	213.0	449.3
2	Hackett	Hinton	NW 31 47 15 5	112.0	98.5	194.2	250.3	543.0
3	Nancy	Hinton	NE 19 58 22 5	12.0	44.1	112.0	168.2	324.3
4	Oxbow	Hinton	NE 29 54 19 5	7.8	47.7	75.7	65.5	188.9
5	Boundary 1	Edson	SW 34 52 19 5	82.5	90.2	247.4	288.5	626.1
6	Boundary 2[1]	Edson	NE 4 54 19 5	20.0	54.5	-	-	54.5
7	Octopus	Edson	SE 1 58 17 5	46.7	85.5	109.8	117.3	312.6
8	Annabelle	Edson	NE 5 54 21 5	67.3	71.7	131.8	141.5	344.9
9	Morningstar[2]	Hinton	SE 33 50 23 5	19.5	0.2	14.0	29.7	43.9
10	McPhee	Hinton	NW 36 52 19 5	14.7	32.3	98.4	169.6	300.4
11	Windfall[2]	Hinton	SE 27 54 19 5	64.6	6.1	34.8	66.6	107.5
12	Unknown[2]	Edson	SE 5-53-19-W5M	11.2	0.0	0.0	5.5	5.5
			Total	516.2	609.9	1,175.4	1,515.5	3,300.9

[1] Boundary Lake 2 is close to Boundary Lake 2 and the areas within 200-800 m of both lakes are reported for Boundary Lake 1.
[2] Morningstar, Windfall, and Unknown Lakes are outside the FMA but have some area within 800 m of the lake within the FMA.

In 2008 West Fraser started to maintain a database of FMA sightings and an annual survey of known breeding lakes which will be entered into the eBird[5] online database and updated as new observations are recorded. Survey information will also be provided to ESRD.

LIMITING FACTORS

Habitat Loss and Alteration

Breeding Habitat – The breeding distribution of TRSW in Alberta is mainly north and east of the FMA and growing (Figure 5). There has been some loss of suitable breeding waterbodies due to alteration or increased levels of human disturbance but the amount of loss has not been quantified (ESRD 2012). There are large numbers of potentially suitable waterbodies that are not currently used for breeding (ESRD 2012). TRSW pairs are territorial and each breeding lake usually supports only one nesting pair.

Non-breeding Habitat – TRSW use a wider variety of waterbodies during migration and not all birds with adult plumage bird breed in any given year. Non-breeding birds may use habitats that are not suitable for breeding in addition to potential breeding waterbodies. There has been some loss of suitable non-breeding waterbodies in Alberta due to alteration or increased levels of human disturbance but the amount of loss has not been quantified (ESRD 2012).

Winter Habitat – Alberta TRSW migrate to winter range in the United States, mainly to the tri-state area (Greater Yellowstone Ecosystem) at the juncture of the boundaries of Montana, Wyoming, and Idaho and nearby areas (Figure 2). Loss or alteration of wintering waterbodies, crowding, and winter food limitations are potential limiting factors. The Alberta TRSW population has been expanding into new winter range areas in recent years (Olson 2013).

Human Disturbance

TRSW are sensitive to human disturbance during the nesting period. Nesting ponds with nearby human activity may be avoided entirely, and disturbance after nesting starts can cause nest abandonment or reduced cygnet

[5] eBird http://ebird.org/content/canada

survival (James 2000). ESRD considers nesting habitat security as the major conservation issue for trumpeter swans in Alberta (ESRD 2012).

Food Supply

During the nesting season TRSW eat aquatic vegetation obtained by dabbling in shallow open waters less than approximately 1 m deep. They select lakes with stable water levels, extensive shallow areas, and abundant aquatic vegetation. Food availability is likely a significant factor in nesting lake selection and nesting success (ESRD 2012).

Predation

Adults, cygnets, and eggs are subject to predation by a variety of mammal and bird predators. Both adults defend nests and cygnets but predator losses of eggs and cygnets can still be significant. Adult birds are not subject to high levels of predation. Predation is not currently considered to be a significant limiting factor for any TRSW population (Matteson et al. 1995, Mitchell and Eichholz 2010).

Powerline Collisions

As they are coming in to land or taking off from waterbodies TRSW sometimes collide with powerlines that cross over waterbodies or pass through nearby open terrain. These are localized occurrences in Alberta (Smith 2013).

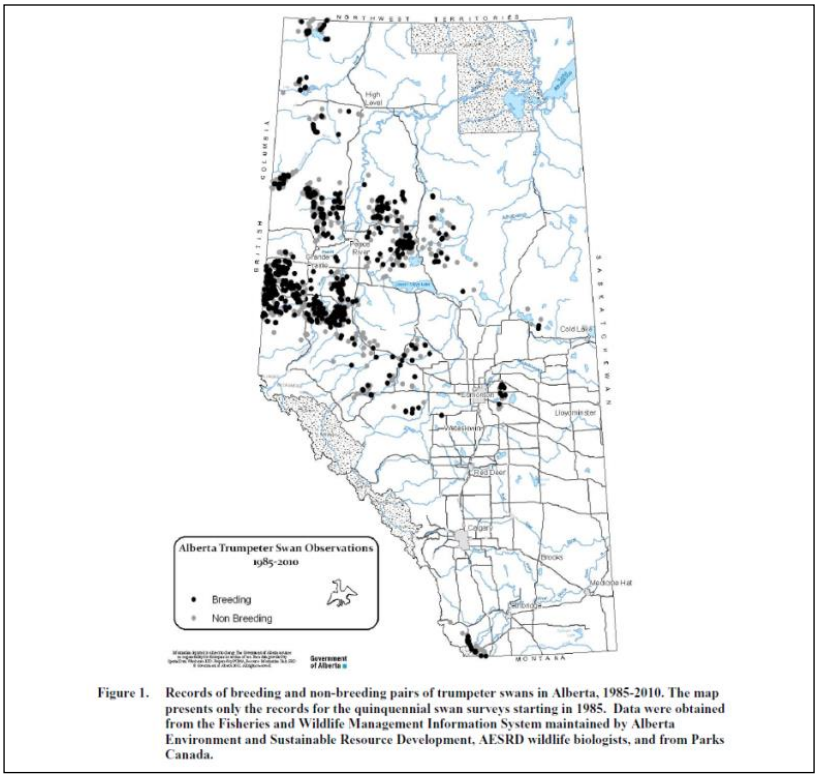


Figure 1. Records of breeding and non-breeding pairs of trumpeter swans in Alberta, 1985-2010. The map presents only the records for the quinquennial swan surveys starting in 1985. Data were obtained from the Fisheries and Wildlife Management Information System maintained by Alberta Environment and Sustainable Resource Development, AESRD wildlife biologists, and from Parks Canada.

Figure 5 – *Trumpeter swan breeding records in Alberta from swan surveys every 5 years starting in 1985, from ESRD 2012.*

Shooting

TRSW are protected but are sometimes killed illegally or accidentally by hunters who mistake them for tundra swans, which can be legally hunted in some areas. Shooting mortality is not considered a major limiting factor.

Lead Poisoning

Trumpeter swans ingest lead primarily while feeding in areas where hunters using shotguns firing lead shot or anglers using lead sinkers have been active. Lead shot is about the same size as the stony grit that swans eat to assist with grinding food in their gizzard. As few as 3 to 4 ingested lead pellets can cause death. Lead poisoning caused mainly by swan ingestion of lead shot was a major source of swan mortality in the Pacific Coast Population from 1999-2008 (Wilson et al. 2009). At least 2,577 trumpeter swans died of lead poisoning in the Fraser River Valley and in adjacent areas of Washington State. Non-toxic shot has been required for all waterfowl hunting in the United States since 1991 and in Canada since 1999. In some situations lead shot may still be used for other bird hunting. Lead poisoning has not been identified as a major source of mortality for the Rocky Mountain Population.

Other Factors

There is little information on the role of accidents, parasites and diseases, severe weather, climate change, etc. in relation to the trumpeter swan.

HABITAT CONSERVATION STRATEGY

Roles and Responsibilities

West Fraser has no responsibility for management of TRSW. Commitments made in this document relate specifically and only to West Fraser management of the FMA and potential associated impacts on TRSW conservation. Other factors that may affect conservation of the TRSW 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 trumpeter swan habitat conservation strategy is to describe West Fraser activities that will contribute to long-term conservation of trumpeter swans on the FMA, as part of an interconnected regional population.

West Fraser will identify trumpeter swan nesting lakes and manage West Fraser activities in surrounding areas to avoid human disturbance during the nesting season and habitat degradation. The habitat conservation strategy will be reviewed and revised as new information is acquired.

Forest Management Plan

The Alberta Trumpeter Swan Recovery Plan (ESRD 2012a) and ESRD (2012b) Recommended Land Use Guidelines for Trumpeter Swan Habitat provide guidance on how to conserve TRSW.

TRSW are not associated with upland habitat during the portion of the year that they occur on the FMA. They use larger waterbodies for both non-breeding and nesting habitat and feed on aquatic vegetation.

West Fraser will contribute to long-term conservation of TRSW by applying an Ecosystem-Based Management (EBM) approach to manage the FMA, with specific modifications within 500 m of TRSW nesting lakes. These modifications were developed for each known lake as part of the HCS. This will provide continual opportunities for TRSW to utilize existing lakes and expand into new nesting sites.

Landbase Designation

The Recommended Land Use Guidelines for Trumpeter Swan Habitat (AESRD 2012b) are for no timber harvesting within 200 m of the high water mark for nesting lakes. Based on a sample of three lakes, Barnes (1999) found reduced TRSW use of lakes that had forest management disturbance within 1,000 m compared to lakes with no harvesting within 1000 m. Barnes (1999) noted that four of five additional lakes with forest harvesting in the vicinity but further away than 1,000 m were used consistently by breeding TRSW and all of these five lakes did not show any noticeable change in TRSW use. The air photo analysis method used by Barnes (1999) did not determine the harvesting season or if human disturbance had not occurred during the nesting season, nor was the method able to isolate the effects of forest harvesting from other human disturbances, including increased road access. Actual human disturbance is the main factor related to non-use (e.g. Henson and Grant 1991). There is also evidence that TRSW habituate to some types and levels of human activity (e.g. Barnes 1999). All of the FMA TRSW lakes have existing infrastructure within 500 m and 6 of 12 have existing infrastructure within 200 m. Considering that the Alberta TRSW population is continuing to expand into unoccupied habitat, EBM harvesting within 200 m of lakes is low risk if screening vegetation

remains and human access is minimized by keeping new permanent roads and other infrastructure further than 500 m away.

Most of the known FMA TRSW lakes are surrounded by wetland areas that are already part of the passive landbase. However there are some lakes with productive forest lands located within 200 m of the high water mark. West Fraser identified these areas and developed a proposed landbase allocation for each lake that mitigates potential impacts on TRSW (Table 3) while supporting EBM using harvesting as a disturbance method within 200 m of lakes. In general active landbase within 200 m of the high water mark was identified as available for harvest provided that there was a screen of tall vegetation between the lake and the area proposed for harvest, or alternatively that partial cut silviculture systems were proposed. A landbase allocation plan and generalized forest management strategy was developed for each lake. In most cases these areas have significant overlap with riparian areas and the riparian management strategy will also apply. Details and site specific modifications for each lake will be incorporated into Final Harvest Plans when operations are proposed in the area of a lake. West Fraser will apply these principles to any new lakes that TRSW may start to use for nesting in the future.

ESRD did not agree to the proposed landbase allocation so all proposed active landbase areas within 200m were removed from the net landbase. They remain part of the West Fraser approach and West Fraser will continue discussions with ESRD in an effort to have them approved. When that occurs, West Fraser will proceed with implementation of the Trumpeter Swan Species Conservation Strategy. Specifically any FHP that occurs near nesting lakes in the SHS window will be adjusted to include harvest proposals within 200 m of nesting lakes.

TRSW do not use terrestrial habitats surrounding nesting lakes, so forest disturbance through harvesting conducted outside the nesting season combined with measures to ensure continued maintenance of low human disturbance during the nesting season should have no significant effect on TRSW.

Table 3 *– Proposed Landbase Allocation for area within 200 m of trumpeter swan nesting lakes on the Hinton and Edson FMAs. Data for the Edson FMA is not yet developed.*

Lake #	Name	Location	0-200 Passive	0-200 Active	total
1	Mud	Hinton	126.70	10.04	136.74
2	Hackett	Hinton	205.64	4.90	210.54
3	Nancy	Hinton	48.86	7.33	56.19
4	Oxbow	Hinton	14.35	41.30	55.65
9	Morningstar	Hinton	0.09	0.09	0.18
10	McPhee	Hinton	52.05	20.60	72.65
11	Windfall	Hinton	5.85	0.21	6.06
		Total	453.54	84.47	538.01
5	Boundary 1	Edson			
6	Boundary 2	Edson			
7	Octopus	Edson			
8	Annabelle	Edson			
12	Unknown	Edson			
		Total			

Infrastructure

All of the TRSW lakes described in this HCS already have permanent infrastructure within 500 m and half have infrastructure either existing or approved within 200 m (Table 4). There has been no assessment of which came first - the infrastructure or TRSW use. Regardless, the fact that TRSW continue in some instances to use lakes that have infrastructure within 500 m shows that TRSW are flexible in their habitat choices and tolerate some levels of human infrastructure and associated human use. Maps of the lakes on or within 500m of the Hinton FMA can be found in Appendix 2.

Table 4 – *Human infrastructure within 500 m of trumpeter swan lakes on the West Fraser Hinton and Edson Forest Management Areas.*

Name	Infrastructure 200-500 m from lake	Infrastructure < 200 m from lake
Mud	2 LOC, 2 PLA, 2 MSL, 1 MLL (gas plant)	Seismic lines
Hackett	1 LOC, 1 PLA, 1 MSL	Seismic lines
Nancy	1 PLA, 1 LOC, 1 EZE (powerline), 1 VZE	Seismic lines
Oxbow	4 MSL, 4 LOC, 4 PLA	1 MSL[1], 1 LOC[1], 1 PLA[1], seismic lines
Boundary 1	3 MSL, 3 LOC, 3 PLA, 2 cutblocks	Seismic lines
Boundary 2	2 MSL, 2 LOC, 2 PLA, 2 cutblocks	1 MSL, 1 LOC, seismic lines
Octopus	1 MSL, 1 PLA, 2 EZE (railway), 2 LOC, 5 fields	Seismic lines, field
Annabelle	5 PLA, 1 MSL, 1 GRP, 1 RRD, 2 LOC, 1 field	1 MSL, 1 LOC, 3 PLA, seismic lines
Morningstar	1 LOC, 1 PLA	Cabin on lakeshore, seismic lines
McPhee	1 MSL, 2 PLA, 2 LOC	1 LOC, 2 waterfront cabins , seismic lines
Windfall	1 PLA , 1 LOC	1 PLA, seismic lines
Unknown	7 PLA, 6 MSL, 7 LOC, 1 EZE (railway), 10 fields, 8 building sites	2 MSL, 1 PLA, 1 EZE (railway), 2 buildings, seismic lines

[1] These dispositions were approved in 2008 but had not been built as of 19 July 2013.

Management Strategy

The FMP Management Strategy includes the following considerations for TRSW:

Active Landbase

- Harvest active landbase within 500 m of TRSW lakes while mitigating potential impacts of TRSW.
- Apply the landbase delineation that is identified in this HCS within 200 m of TRSW lakes.
- Follow the Spatial Harvest Sequence for harvest of the active landbase.
- Develop a detailed plan to emphasize TRSW conservation as part of FHP within 500 m of TRSW lakes.

Passive Landbase

- No operations in passive landbase within 500 m of TRSW lakes.
- Cooperate with any government-led activities to disturb the passive landbase.

Access

- No new permanent West Fraser roads within 500 m of TRSW lakes.
- Cooperate with any government-led initiatives to deactivate or reclaim existing West Fraser roads within 500 m of TRSW lakes.
- Cooperate with any government-led initiatives to deactivate or reclaim existing non-West Fraser access footprint within 500 m of TRSW lakes.

Infrastructure

- West Fraser has no permanent infrastructure within 500 m of any known TRSW lakes.
- No new permanent West Fraser infrastructure within 500 m of TRSW lakes.
- Cooperate with any government-led initiatives to deactivate or reclaim existing non-West Fraser infrastructure footprint within 500 m of TRSW lakes.

Disturbance

- April 1 to September 30, no direct West Fraser flights within 800 m vertical and horizontal distance of TRSW lakes, except as modified below.
- April 1 to September 30, no West Fraser mechanized operations (e.g. harvesting, road construction, site preparation, aerial herbicide application, etc) within 800 m of the high water mark of TRSW lakes if swans are present. West Fraser will check to ensure TRSW have left the lake before commencing operations between October 1 and November 15. There will be no operations in this period if TRSW are present.
- April 1 to June 30, no West Fraser mechanized operations (e.g. harvesting, road construction, site preparation, aerial herbicide application, etc) within 800 m of the high water mark of TRSW lakes.

- July 1 to September 30, West Fraser mechanized operations may occur within 800 m of the high water mark of TRSW lakes if surveys conducted on or after July 1 show TRSW are not present on the lake or nearby waterbodies.
- April 1 to May 15, West Fraser mechanized operations may occur within 800 m of the high water mark of TRSW lakes if the lake is still frozen, no TRSW are present, and the proposed operations can be completed prior to onset of open water that TRSW could use. Any operations that are commenced during this period will be immediately suspended if TRSW arrive at the lake.

Structure Retention

- Apply EBM procedures and practices to ensure retention of trees and patches at the planning and operations stages.
- Ensure retention screens views of cutblocks from the lake.

Riparian Management

- Apply Riparian Management Strategy for all areas within TRSW SMA that also fall into the Riparian Zone.

Mud Lake

Mud Lake is a large natural shallow lake with an island. It is entirely within the HWP FMA. The lake is surrounded by extensive open shoreline and treed wetlands. Mud Lake has been used by nesting TRSW for many years, but not in every year. Hackett Lake and Mud Lake are fairly close together. In most years TRSW use one of the two lakes but not both.

Habitat conditions are very suitable for TRSW nesting. There is extensive emergent vegetation and large areas of shallow water and the island has been used repeatedly as a nest site.

Mud Lake has a gas plant, 2 all-weather roads, and 3 pipelines within 500 m. There are no dispositions within 200 m. The noise from the gas plant is very noticeable from the lake but TRSW nesting on the lake seem to be habituated to the noise.

The 135.84 ha area within 200 m of the lake is a combination of mainly open and treed wetlands with small areas of upland ecosites. The landbase allocation is 10.14 ha active and 126.70 ha passive. The active landbase is 7.38 ha RSA Stratum 1 HW, 2.31 ha Stratum 7 SW, and 0.39 ha Stratum 4 SW/HW, and 0.05 ha Stratum 8 PL. Stand origins from AVI vary from 1880-1920. These ages would need to be field confirmed and may be subject to change. The active landbase is dominated by deciduous stands.

Suitable silviculture systems include variable retention. All of the upland areas that would be harvested are near the outer limit of the 200 m zone and would be screened from view from the lake by standing timber. Harvest season would be a combination of unfrozen and frozen ground. Application of these systems over time will retain continuous forest cover in the passive landbase within 200 m of the lake, which should have minimal impact of TRSW. This represents very low risk considering that the amount to be harvested is very low (7.5%) and is located around the outer edge of the 200 m zone. The existing TRSW habituation to the gas plant noise also suggests that TRSW will continue to use Mud Lake for nesting.

Hackett Lake

Hackett Lake is a large natural shallow lake with no islands located entirely inside the HWP FMA. It is surrounded by extensive open shoreline and treed wetlands. Hackett Lake and Mud Lake are fairly close together. In most years TRSW use one of the two lakes but not both. Mud Lake is used more often than Hackett Lake.

Habitat conditions are very suitable for TRSW nesting. There is extensive emergent vegetation and large areas of shallow water. Due to the size of the lake it does experience significant wave action in high winds, which is a less desirable aspect for TRSW.

Hackett Lake has 1 wellsite and 1 all-weather road at the outer edge of the 500 m zone and no development within the 200 m zone other than seismic lines.

The 210.53 ha within 200 m of the lake is a combination of mainly open and treed wetlands with small areas of upland ecosites. The landbase allocation is 4.90 ha active and 205.64 ha passive. The active landbase is 2.69 ha RSA Stratum 1 HW, and 2.21 ha Stratum 3 HW/SW. Stand origins from AVI vary from 1880-1930. These ages would need to be field confirmed and may be subject to change. The active landbase is dominated by deciduous stands.

Suitable silviculture systems include variable retention. All of the upland areas that would be harvested are near the outer limit of the 200 m zone and would be screened from view from the lake by standing timber. Harvest season would be a combination of unfrozen and frozen ground. Application of these systems over time will retain continuous forest cover in the passive landbase within 200 m of the lake, which should have minimal impact of TRSW. This represents very low risk considering that the amount to be harvested is very low (2.3% of the zone) and is located around the outer edge of the 200 m zone.

Nancy Lake

Nancy Lake is a shallow lake in the McPherson Creek drainage on the HWP FMA. This lake was used for nesting by TRSW in 1996 (discovered and reported by West Fraser) but to our knowledge has not been used again since.

Habitat conditions appear to be very suitable for TRSW nesting. There is extensive emergent vegetation and large areas of shallow water that are mostly covered in lily pads. There are no islands or peninsulas in the lake.

Nancy Lake has 1 all-weather road, 1 pipeline, and 1 powerline within 500 m and no energy sector development within 200 m other than seismic lines.

The 56.19 ha within 200 m of the lake is a combination of mainly open and treed wetlands with small areas of upland ecosites. The landbase allocation is 7.33 ha active and 48.86 ha passive. The active landbase is 7.33 ha RSA Stratum 8 PL. Stand origins from AVI vary from 1840-1890. These ages would need to be field confirmed and may be subject to change. The active landbase is dominated by pine stands.

Suitable silviculture systems include variable retention. All of the upland areas that would be harvested are near the outer limit of the 200 m and would be screened from view from the lake by standing timber or topography. Portions of the largest active landbase patch are in the Riparian Management Zone of the outlet creek and wet ecosites beside the creek will be protected from harvest. Harvest season would be a combination of unfrozen and frozen ground. Application of these systems over time will retain continuous forest cover in the passive landbase within 200 m of the lake, which should have minimal impact of TRSW. This represents very low risk considering that the amount to be harvested is low (13.04%) and is located around the outer edge of the 200 m zone.

Oxbow Lake

Oxbow Lake is an old oxbow of the Berland River along the northern HWP FMA boundary. West Fraser first became aware of this lake in 2013 when the ESRD provincial TRSW water body map was released. To the best of our knowledge TRSW had not been recorded as nesting on this lake, and the reason why the lake was included on the ESRD map is unknown (D. Hobson, personal communication). TRSW nesting on Oxbow Lake was confirmed in the 2014 nesting season.

There were no TRSW on the lake during a field visit on 23 July 2013. On 30 Aug 2014 an adult pair with 5 large flightless cygnets was observed on the lake.

This lake has 2 active wellsites with all-weather road access and 1 wellsite with winter road access within 500 m. Another wellsite location within 200 m was approved in 2008 but had not been constructed as of 23 July 2013.

Most of the 55.5 ha within 200 m of the lake is within the channel migration zone (floodplain plus abandoned floodplain) of the Berland River and all of it is within the Riparian Management Zone. The landbase allocation is 41.4 ha active and 14.4 ha passive. The active landbase is 20.44 ha RSA Stratum 7 SW, 16.95 ha Stratum 3 HW/SW, and 3.73 ha Stratum 8 Pl. Stand origins from AVI vary from 1870-1910. These ages would need to be field confirmed and may be subject to change. The active landbase is roughly comprised of three components: a younger age class that is merchantable but should not be scheduled for several decades to allow more time for growth; a medium age class that is merchantable but again could benefit from more growth, and an older age class that is suitable for harvest in the next decade.

Suitable silviculture systems include group or single tree selection in strata 3 and 7 and variable retention in stratum 8. Harvest season would be mostly frozen ground. Application of these systems over time will retain continuous forest cover in the active landbase within 200 m of the lake, which should have minimal impact on TRSW. This represents very low risk considering that the lake is likely not suitable for TRSW nesting.

Boundary 1 Lake

[Edson FMA]

Boundary 2 Lake

[Edson FMA]

Octopus Lake

[Edson FMA]

Annabelle Lake

[Edson FMA]

Morningstar Lake

Morningstar Lake is located outside the northeast corner of the Hinton FMA. The outer boundary of the 200 m zone overlaps the FMA on the south side. West Fraser first became aware of this lake in 2013 when the ESRD provincial TRSW water body map was released. This lake is not listed in the Edson TRSW nesting lakes database and the reason why the lake was included on the ESRD map is unknown (D. Hobson, personal communication).

There was 1 adult TRSW on the lake during a field visit on 19 July 2013. The lake was not visited in 2014. Habitat conditions appear to be suitable for TRSW nesting. There are areas of emergent vegetation and there are extensive shallow waters. There are no islands or peninsulas in the lake.

This lake has a lower grade all-weather road within 500 m. There are no energy sector developments within 200 m other than seismic lines. There is a cabin on the north shore that is accessed by an OHV trail. It is not known who owns the cabin and whether or not it is used during the TRSW nesting season.

The 0.18 ha within 200 m of the lake on the FMA is a small area of upland ecosites bordering the outer edge. The landbase allocation is 0.09 ha active and 0.09 ha passive. The active landbase is 0.08 ha RSA Stratum 8 PL and 0.01 ha Stratum 5 PL/HW. Stand origins are from the 1950 Windfall Burn. Ages would need to be field confirmed and may be subject to change. The active landbase is dominated by pine stands.

Suitable silviculture systems include variable retention. Harvest season would be unfrozen ground. Harvest of the very small area of upland will retain continuous forest cover in the landbase within 200 m of the lake, which should have minimal impact of TRSW. This represents very low risk.

McPhee Lake

McPhee Lake is a natural shallow lake with an island beaver lodge and a beaver dam at the lake outlet that controls the water level in the lake. West Fraser first became aware of this lake in 2013 when the ESRD provincial TRSW water body map was released. This lake is not listed in the Edson TRSW nesting lakes database and the reason why the lake was included on the ESRD map is unknown (D. Hobson, personal communication).

There were no TRSW on the lake during field visits in 2013 and 2014. Habitat conditions appear to be suitable for TRSW nesting. There are areas of emergent vegetation and shallow water and the beaver lodge would be a potential nest site.

Most of McPhee Lake is outside the HWP FMA with the exception of portions of two bays on the south side. Approximately two thirds of the area within 200 m of the lake is within the FMA. This lake has an all-weather road and pipeline within 500 m. There is 1 active wellsite with winter road access and 1 pipeline within 200 m. There is an all-weather road to 2 cabins located on the north shore of the lake. One cabin is older and the other was constructed in 2013. The cabins are owned by the McPhee family from Edson and are for seasonal use. The frequency of human use during the TRSW nesting season is unknown but would likely influence whether or not TRSW attempt to nest on the lake.

The 72.66 ha within 200 m of the lake is a combination of wetland and upland ecosites. The landbase allocation is 20.6 ha active and 52.05 ha passive. The active landbase is 17.02 ha RSA Stratum 1 HW, 2.67 ha Stratum 3 HW/SW, and 0.91 ha Stratum 5 PL/HW. Stand origins from AVI vary from 1880-1910. These ages would need to be field confirmed and may be subject to change. The active landbase is dominated by deciduous stands.

Suitable silviculture systems include variable retention with increased retention along the treeline with the lake to provide screening and a future source of wood to maintain riparian function. Harvest season would be a combination of unfrozen and frozen ground. Application of these systems over time will retain continuous forest cover in the active landbase within 200 m of the lake, which should have minimal impact of TRSW. This represents very low risk considering that due to the presence of the cabins and related human use the lake may not be suitable for TRSW nesting.

Windfall Lake

Windfall Lake is located outside the Hinton FMA. The 200 m zone overlaps the FMA on the east side. West Fraser first became aware of this lake in 2013 when the ESRD provincial TRSW water body map was released. This lake is not listed in the Edson TRSW nesting lakes database and the reason why the lake was included on the ESRD map is unknown (D. Hobson, personal communication). The ESRD map encloses a cluster of 4 lakes and Windfall Lake is the furthest north and 3rd largest of the 4. The lake is approximately circular and 300 m across.

There were no TRSW on the lake during field visits in 2013 and 2014. Habitat conditions appear to be marginally suitable for TRSW nesting. There are no areas of emergent vegetation. There are extensive shallow waters but little submerged vegetation due to the organic bottom of the lake. There are no islands or peninsulas in the lake.

This lake has an all-weather road, a pipeline, and a wellsite within 500 m. The pipeline extends into the outer area of the 200 m zone.

The 6.06 ha within 200 m of the lake on the FMA is mainly wetland with a small area of upland ecosites bordering the outer edge. The landbase allocation is 0.21 ha active and 5.21 ha passive. The active landbase is

0.21 ha RSA Stratum 2 HW/PL. Stand origins from AVI vary from 1900-1950. These ages would need to be field confirmed and may be subject to change. The active landbase is dominated by mixedwood stands.

Suitable silviculture systems include variable retention. Harvest season would be a combination of unfrozen and frozen ground. Harvest of the small area of upland will retain continuous forest cover in the landbase within 200 m of the lake, which should have minimal impact of TRSW. This represents very low risk considering that the nesting suitability of the lake is likely low.

Habitat Risk Assessment

TRSW breed on large lakes and lakes primarily in the Aspen Parkland and Boreal Natural Subregions. Larger water bodies are preferred as the swans prefer at least 100 m of open water for takeoff.

Conservation issues include:

1. Human disturbance close to nesting lakes during the nesting season may cause swans to avoid nesting or abandon nests or young.
2. Alterations to habitat surrounding nesting lakes may cause swans to stop using lakes for nesting.
3. Alterations to habitat surrounding nesting lakes may lead to increased human disturbance of swans during the nesting season.
4. Alterations to habitat surrounding nesting lakes may lead to increased natural predation on swan nests, young, and adults.
5. Sediment, pollutants, or nutrients from roads, pipelines, spills, etc. may enter nesting lakes and directly impact swans or alter habitat and food resources.
6. Structures close to nesting lakes and swan flyways, especially overhead transmission lines, may lead to accidental swan deaths resulting from collisions with structures.

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

Trumpeter swan habitat management does not require adjustments to the Spatial Harvest Sequence harvest design and schedule. However harvest season within 800 m of TRSW lakes is subject to the restrictions described above.

West Fraser will develop a detailed plan for operations within 800 m of any TRSW lake as part of any FHP that is developed during the implementation of the FMP.

Access Management

West Fraser will not construct any new permanent roads within 500 m of TRSW lakes. West Fraser will cooperate with any government-led initiatives to mitigate, deactivate, or reclaim existing West Fraser and non-West Fraser roads (permanent and temporary) and other infrastructure footprint within 500 m of TRSW lakes.

Final Harvest Plans

Any Final Harvest Plans within 800 m of identified TRSW lakes will reference the active and passive landbase and operations timing requirements 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 the 200 m zone.

Harvest Planning and Operating Ground Rules

TRSW habitat conservation will follow these guidelines.

- As a first priority, operations within 800 m of TRSW lakes will take place outside the nesting season, April 1 to September 30.
- Where operations are desirable during the nesting season (e.g. summer operable ground, non-frozen ground site preparation, completion of winter operations, etc.) operations may occur within 800 m during the nesting season provided a survey is done first to show the lake is either not being used in the year of proposed operations (no swans on breeding lakes and other nearby lakes after July 1[6]), or to confirm that adults and juveniles have left the lake at the end of their nesting and rearing period.

MONITORING

ESRD maintains an ongoing trumpeter swan conservation program. In 1996 West Fraser located a previously unknown trumpeter swan nesting lake on the HWP FMA. West Fraser and ESRD will continue to cooperate by exchanging information and developing conservation strategies for trumpeter swan nesting lakes on the FMA.

West Fraser does an annual ground survey of TRSW nesting lakes on the FMA and reports sightings to ESRD. These and additional incidental TRSW sightings will also be reported to the eBird online database.

RESEARCH AND CONTINUAL IMPROVEMENT

TRSW appear to tolerate some level of human activity in areas surrounding breeding lakes. Little is known about effects that harvesting within 200 m of the high water mark might have on lake occupancy and nesting success (see Barnes 1999), but effects are expected to be very low if human disturbance during the nesting season is minimized. West Fraser will cooperate with any government-led projects to assess TRSW response to harvesting close to TRSW lakes.

New information will be regularly reviewed and incorporated into revisions of the trumpeter swan conservation strategy.

REFERENCES

Alberta Government. 1997. Alberta Wildlife Act AR 143/97, Schedule 6, Section 4(I) to 4(l).

Alberta Conservation Information Management System. 2014. http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-(acims).aspx

Alberta Environment and Sustainable Resource Development. 2012a. Alberta Trumpeter Swan Recovery Plan, 2012-2017. Alberta Species at Risk Recovery Plan No. 29. Alberta Environment and Sustainable Resource Development, Edmonton, Alberta, Canada.

Alberta Environment and Sustainable Resource Development. 2012b. Recommended land use guidelines for trumpeter swan habitat. Alberta Environment and Sustainable Resource Development, Edmonton, Alberta, Canada.

Alberta Trumpeter Swan Recovery Team. 2006. Alberta Trumpeter Swan Recovery Plan, 2005-2010. Alberta Species at Risk Recovery Plan No. 12, Alberta Sustainable Resource Development, Fish and Wildlife Division, Edmonton, Alberta, Canada.

Banks, T.R. 1999. Effects of land use changes on trumpeter swan (*Cygnus buccinator*) use of lakes in the Grande Prairie Region of Alberta. MSc thesis, University of Alberta, Alberta, Canada. http://www.collectionscanada.gc.ca/obj/s4/f2/dsk2/ftp01/MQ40027.pdf

Canadian Wildlife Service Waterfowl Committee. 2011. Population status of migratory game birds in Canada: November 2011. CWS Migratory Birds Regulatory Report Number 34.

C.O.S.E.W.I.C. 2014. Canadian species at risk. Committee on the status of endangered wildlife in Canada, Ottawa, Ontario. http://www.cosewic.gc.ca

[6] This date assumes that any nesting attempts will begin prior to July 1.

Groves, D.J. 2012. The 2010 North American trumpeter swan survey. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Juneau, AK.

Henson, P. and T.A. Grant. 1991. The effects of human disturbance on trumpeter swan breeding behavior. Wildlife Society Bulletin 19: 248-257.

James, M. L. 2000. Status of the trumpeter swan (*Cygnus buccinator*) in Alberta. Wildlife Status Report Number 26, Alberta Environment Fisheries and Wildlife Management Division and Alberta Conservation Association, Edmonton, Alberta.

IUCN. 2014. IUCN red list of threatened species. International Union for Conservation of Nature and Natural Resources, http://www.iucnredlist.org/

Matteson, S, S. Craven, and D. Compton. 1995. The trumpeter swan, Publication G3647, University of Wisconsin, Madison, Wisconsin, USA. http://www.trumpeterswansociety.org/docs/WI2Trumpeter_Swans.pdf

Mitchell, Carl D. and Michael W. Eichholz. 2010. Trumpeter Swan (*Cygnus buccinator*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/105doi:10.2173/bna.105

Moser, T.J. 2006. The 2005 North American trumpeter swan survey. United States Fish and Wildlife Service, Denver, Colorado. URL, January 30, 2007: http://www.fws.gov/migratorybirds/reports/wps05/TrumpeterSwan/THE%202005%20TRUMPETER%20SWAN%20SURVEY%20REPORT.pdf

Olson, D. 2013. Trumpeter swan survey of the Rocky Mountain population winter 2013. U.S. Fish and Wildlife Service, Lakewood, Colorado, USA. http://www.fws.gov/mountain-prairie/species/birds/trumpeterswan/Rocky_Mountain_Population/2013_Winter_Trumpeter_RMP_Survey%20.pdf

Smith, P.A. 2013. Status of the trumpeter swan *Cygnus buccinator*) in Alberta Update 2013. Alberta Environment and Sustainable Resource Development and Alberta Conservation Association, Edmonton, Alberta.

United States Fish and Wildlife Service. 2013. Trumpeter swan survey of the Rocky Mountain Population winter 2013. United States Fish and Wildlife Service, Lakewood, Colorado, USA. http://www.fws.gov/mountain-prairie/species/birds/trumpeterswan/Rocky_Mountain_Population/2013_Winter_Trumpeter_RMP_Survey%20.pdf

Wilson, L.K., G. Grigg, R. Forsyth, M. Tolksdorf, V. Bowes, M. Smith, and A. Scheuhammer. 2009. Lead poisoning of Trumpeter Swans in the Pacific Northwest – Can recovered shot pellets help to elucidate the source? Extended abstract *in* R. T. Watson, M. Fuller, M. Pokras, and W. G. Hunt (Eds.). Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund,
Boise, Idaho, USA. http://www.peregrinefund.org/subsites/conference-lead/PDF/0120%20Wilson.pdf

World Conservation Monitoring Centre. 2000. URL, December 21, 2000: www.wcmc.org.uk/data/rl_anml_combo.html.

World Conservation Monitoring Centre. 2007. URL, January 30, 2007: http://www.iucnredlist.org/search/details.php/6056/summ

West Fraser. 2014. Hinton Wood Products and Edson Forest Products Species at Risk Guide. West Fraser Mills Ltd., Hinton, Alberta, Canada.

Appendix 1 – *Trumpeter swan risk assessment matrix.*

Activity	Aspect	Impact	Probability	Severity	Risk	Strategy
Harvesting and site preparation	Insufficient retention adjacent to shoreline	Swans may not nest on the lake	Improbable – Swans use lakes with human development nearby (e.g. agricultural, infrastructure)	Low – There are many unused lakes that swans could use as alternates	D	Retain shoreline screening vegetation on all nesting lakes
Harvesting and site preparation	Non-West Fraser human disturbance during nesting period	Reduced nesting success due to increased human disturbance	Improbable – very little human activity near lakes and not expected to increase	Low – There are many unused lakes that swans could use as alternates	D	Retain shoreline screening vegetation on all nesting lakes
Harvesting and site preparation	West Fraser disturbance during the nesting period	Reduced nesting success due to increased human disturbance	Improbable – procedures in place to prevent disturbance	Low – few TRSW lakes on FMA	D	Avoid disturbance during nesting period
Permanent road construction and use	Permanent WF roads within 500 m of nesting lakes	Reduced nesting success due to increased human disturbance	Improbable – procedures in place to prevent road construction within 500 m	Low – few TRSW lakes on FMA	D	No permanent WF roads within 500 m of TRSW lakes
Human Infrastructure	Sediment, pollutants, or nutrients enter nesting lakes	Alteration of habitat reduces nesting or nesting success	Improbable – procedures in place to prevent entry of substances into lakes	Low – few TRSW lakes on FMA	D	Apply procedures to prevent substances from entering TRSW lakes
Human Infrastructure	Structures	Collisions	Improbable – procedures in place to infrastructure near lakes	Low – few TRSW lakes on FMA	D	Apply procedures to avoid infrastructure near TRSW lakes

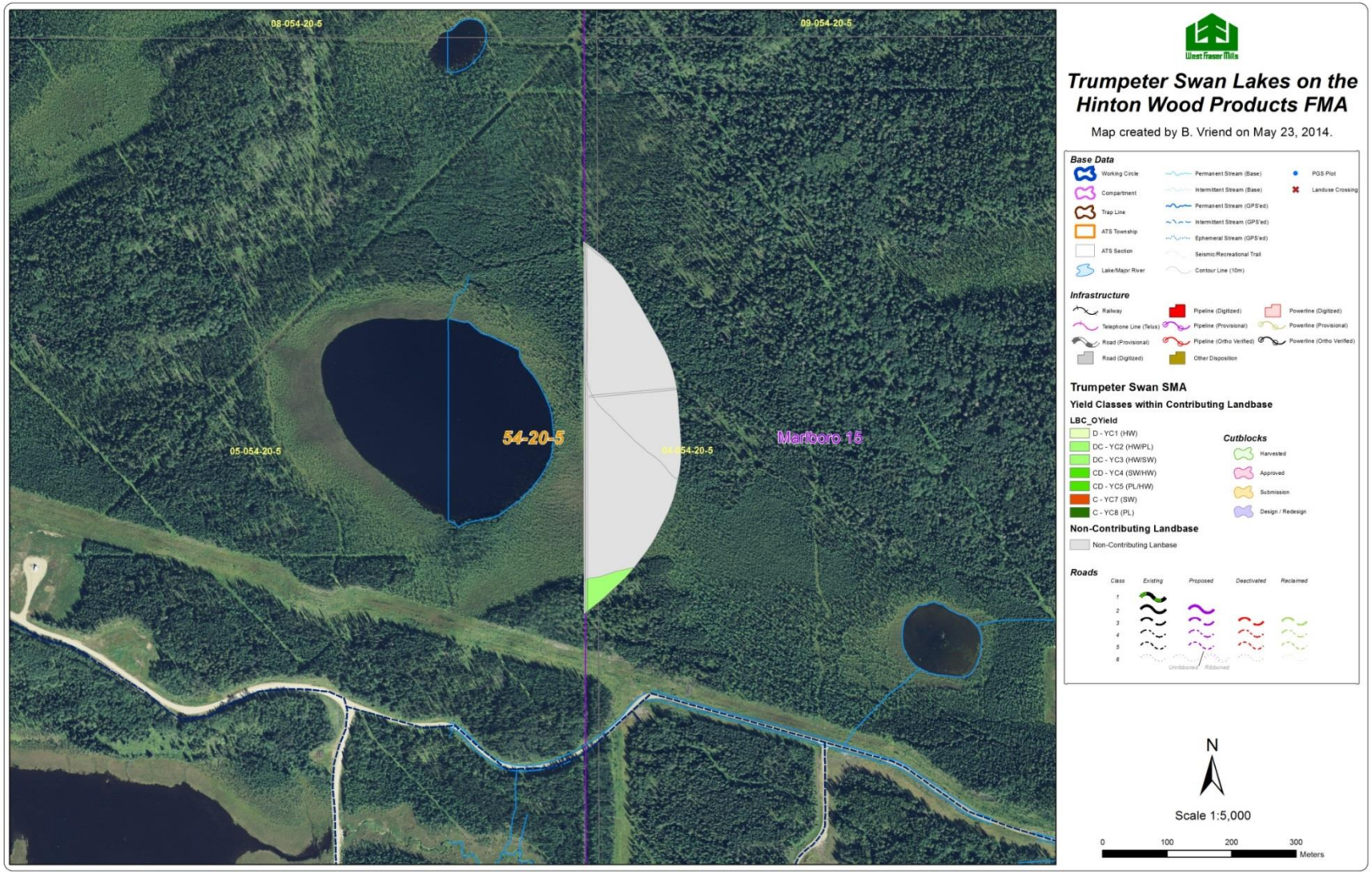
Activity – an activity that may result in a negative effect on conservation.
Aspect – the presumed result of the activity.
Impact – the negative conservation effect.
Probability – the frequency that the impact may occur. Nil: Activity not currently undertaken; Improbable: Likely to never happen; Remote: 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

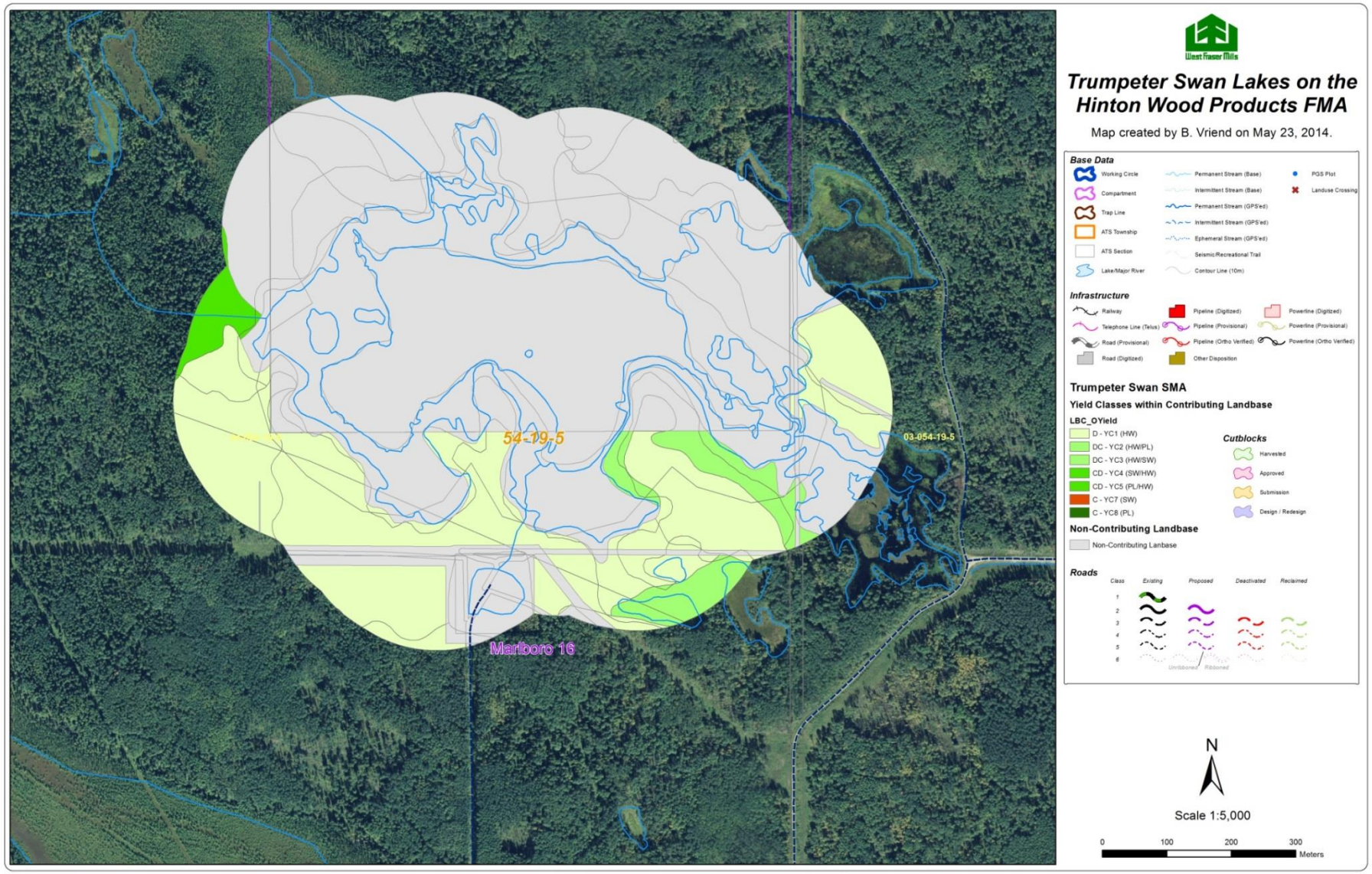
Probability of impact	Severity of impact			
	Catastrophic	Major	Minor	Negligible
Frequent	A	A	A	C
Probable	A	A	B	C
Occasional	A	A	B	D
Remote	A	B	C	D
Improbable	B	C	C	D

Appendix 2 – *Trumpeter Swan nesting lake maps and landbase allocation.*

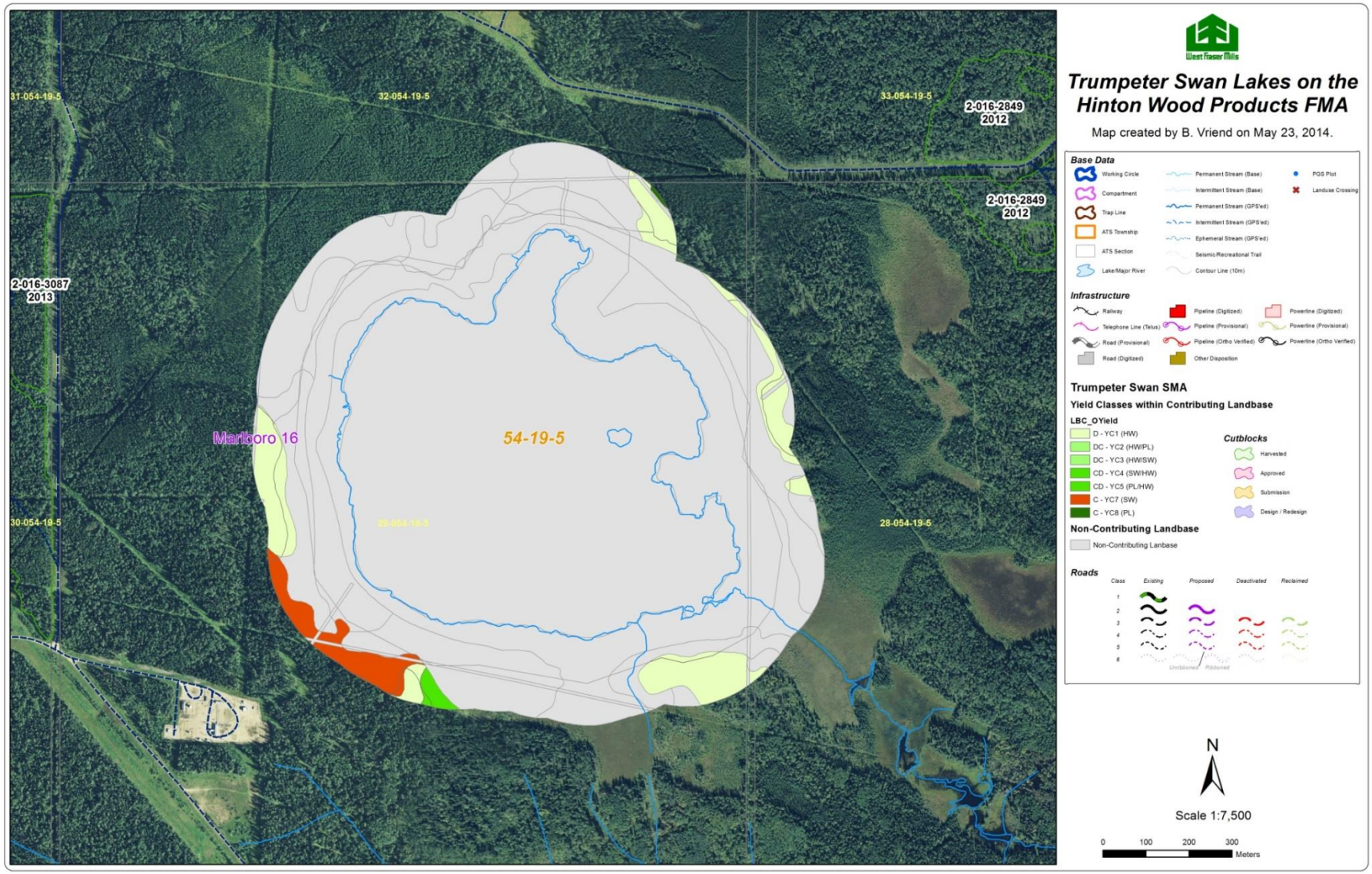
Windfall Lake SE 27 54 19 5



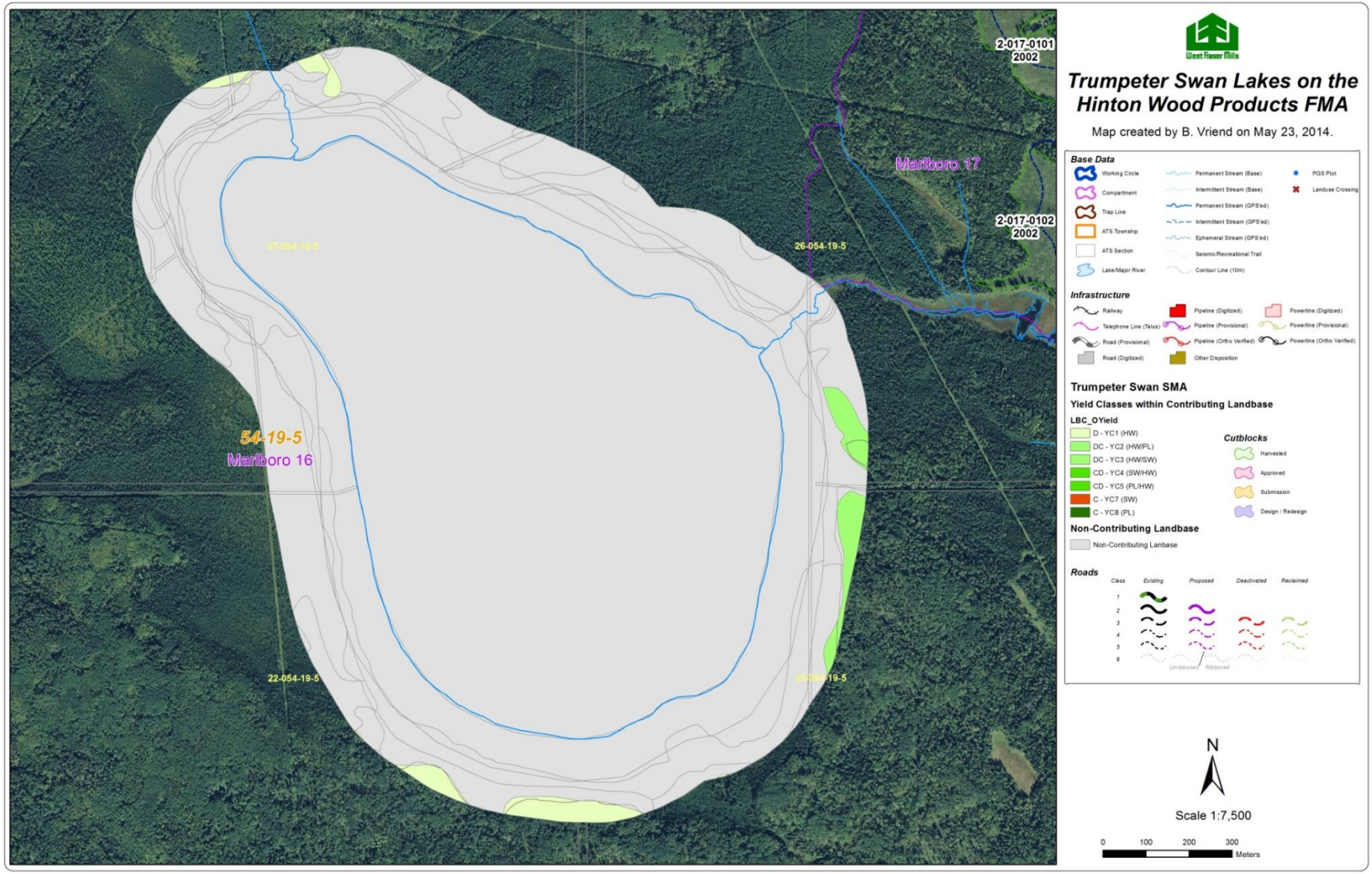
McPhee Lake NW 36 52 19 5



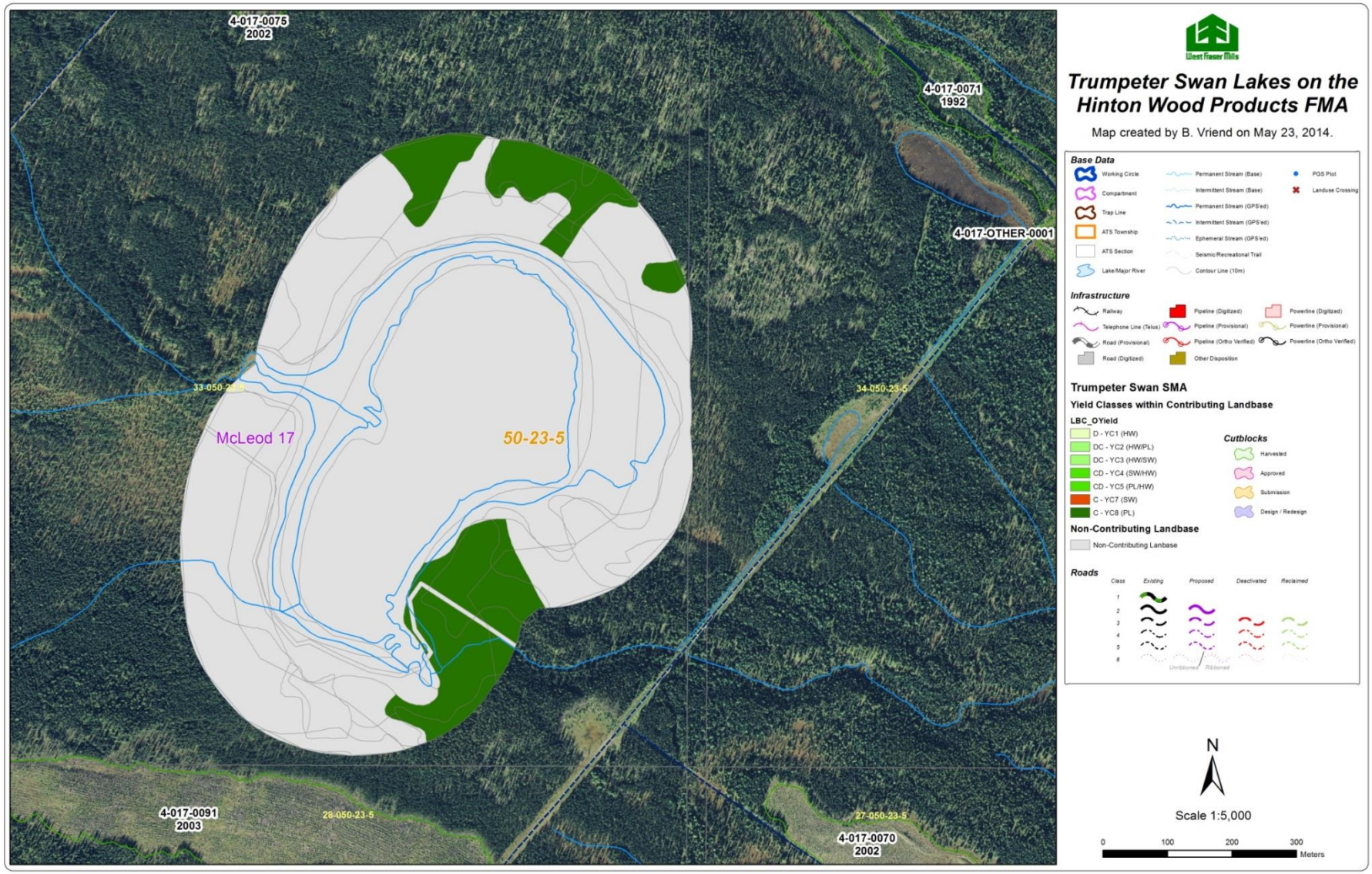
Mud Lake SW 6 48 15 5



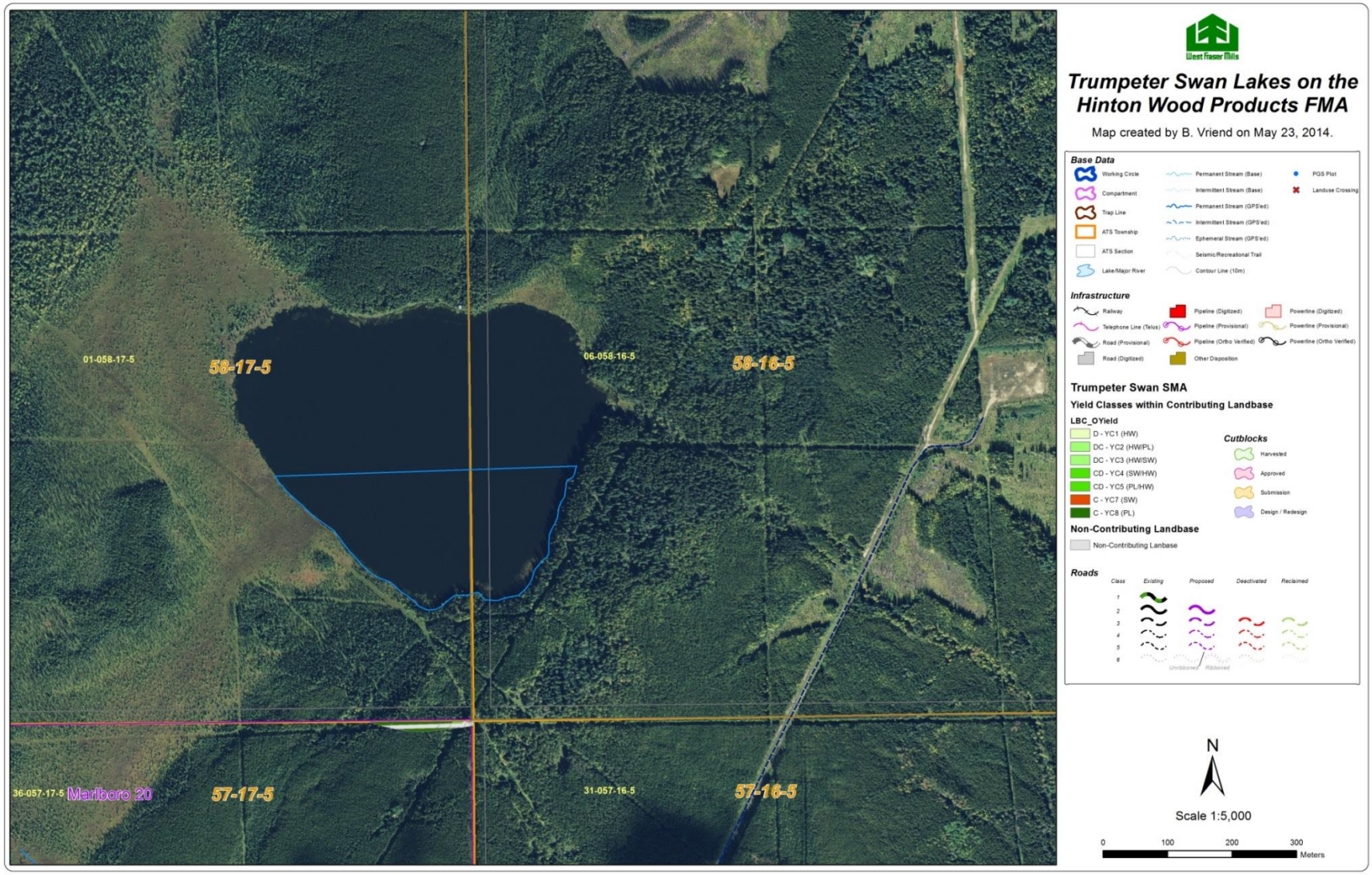
Hackett Lake NW 31 47 15 5



Nancy Lake, NE 19 58 22 5



Morningstar Lake SE 33 50 23 5



Oxbow Lake NE 29 54 19 5