Cumulative Effects Management in the Dehcho Territory

Preliminary Assessment and Results

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Introduction

The Deh Cho Land Use Planning Committee, the "Committee", was established in 2001 under the authority of the Deh Cho First Nations Interim Measures Agreement. The Committee will develop a land use plan (the Plan) for the Deh Cho territory for lands outside the existing boundaries of a local government and Nahanni National Park Reserve.

Regional land use planning in the Deh Cho territory is intended to form part of an integrated land and resource management regime and outline what types of activities should occur, generally where they should take place, and terms and conditions necessary to guide land use proposals and development projects over time. The Plan will involve finding a balance between development opportunities, social and ecological constraints, which reflect community values and priorities while taking into consideration the values of all Canadians. Upon approval of a Deh Cho Final Agreement, the approved Plan will be a land management tool that provides legally-binding direction and guidance to regulatory agencies and decision-makers in the evaluation of development projects, protected area proposals, and other potential land uses.

One of the issues the Committee wishes to provide guidance on is Cumulative Effects Management. In 2004, the Committee contracted Salmo Consulting Inc to complete research on Cumulative Effects Indicators and Thresholds and make recommendations for their application in the Dehcho territory (Salmo et al 2004). The Committee distributed copies of this research to communities and planning partners and requested feedback on the implementation of this work within the Land Use Plan.

We have now selected a set of indicators and thresholds to include in the land use plan and have completed a Preliminary Cumulative Effects Assessment of the Dehcho to demonstrate:

- How these indicators and thresholds would be implemented; and
- The current level of cumulative effects in the region.

This report explains the proposed cumulative effects indicators and demonstrates the results of the assessment using the selected indicators and thresholds. Readers interested in the original literature behind the recommendations should review Salmo's Report (web link provided in the Reference section at the end of the document).

What are Cumulative Effects?

Cumulative Effects are defined as "changes to the biophysical, social, economic, and cultural environments caused by the combination of past, present and "reasonably foreseeable" future actions" (CEAM 2004). Cumulative effects management means taking a holistic view of development and looking at the overall impacts of all development on the region. This is done by identifying broad indicators that allow us to monitor changes in the environment. An **indicator** is something we monitor to determine the overall health of the environment – e.g. air quality, water quality, wildlife habitat. We have to be able to measure them so we know whether the environment is healthy or not.

We set **thresholds** or limits for each indicator which states the level of impact that can safely occur. These thresholds are set by a combination of science and regional values. The science tells us how much an indicator is impacted by development. But it is our values that determine how much impact we are willing to allow in return for the economic benefits of developing our natural resources. These are usually determined by setting goals and objectives for the region, then setting thresholds to achieve those goals. This method of setting thresholds is called

"**Limits of Acceptable Change**" – i.e. we set how much change we will accept for each indicator.

Road density is a commonly used indicator of cumulative effects because every kind of development has to build roads or trails to access resources and get them to market, and roads have a significant impact on wildlife. By measuring how many roads are built in an area, we can gage the overall level of development and the impact it is having on wildlife. Research tells us that when there are too many roads, certain species will either leave the area or will decline in numbers. If we want that species to stay and prosper, then we need to set the thresholds below those road densities to ensure that doesn't happen. If it is not a species we are concerned about, or we don't want that species around, then we can set the thresholds higher to allow greater levels of development.

In some cases we are using a **Tiered Threshold** – this is a set of three thresholds for each indicator. The first threshold is set quite low and is called the **"Cautionary Threshold"**. When development hits this threshold regulatory authorities should require monitoring. As development increases, it would meet the "**Target Threshold"**. Developments meeting or exceeding this threshold should be subject to more intense scrutiny in their regulatory applications and should be attempting to reduce their impact on the indicator as much as possible. The final threshold is the "**Critical Threshold"** and will not be exceeded. This is generally set just below the level at which the resource is significantly impacted. No developments that propose to exceed the critical threshold should be permitted. In cases where we have only specified one threshold, this is the critical threshold and will not be exceeded.

Cumulative effects management allows regulatory authorities and decision makers to look at a new development proposal, determine where it falls in relation to the thresholds and determine if the impacts are environmentally acceptable and should be permitted.

Proposed Indicators and Thresholds

The Committee has identified seven indicators which will apply to the Dehcho territory for the purposes of cumulative effects management. As no development is permitted in Conservation Zones, this term only applies to Special Management and General Use Zones to varying degrees as set out below. As discussed above, the Committee has proposed the use of tiered thresholds as appropriate. Table 1 summarizes the proposed terms and their application. Following that is a general discussion of each term and the results of our Preliminary Cumulative Effects Assessment.

Table 1. Cumulative Impacts Indicators and Thresholds.

Indicator	Threshold	Species	Zone	Land Use
Corridor / Road Density	Critical: 1.5 km/km^2; Target: 1.2 km/km^2; Cautionary 1.0 km/km^2	Boreal Woodland Caribou	Special Management	All
	Critical: 1.8 km/km^2; Target: 1.5 km/km^2; Cautionary 1.0 km/km^2	Boreal Woodland Caribou	General Use	All
	0.6 km/km^2 in winter range	Mountain Woodland Caribou	Special Management	All

Indicator	Threshold	Species	Zone	Land Use
	1.61 km/km^2	Moose	Special Management	All
	0.6 km/km^2	Grizzly Bears	Special Management	All
Habitat Availability	<10% loss of habitat for all VEC species (EBA, 2003)	All VECs	Dehcho wide	All
	<5% of available habitat disturbed	Boreal Woodland Caribou	Special Management	All
	<3% of moderate to high capability habitat disturbed	Moose	Special Management	All
	<30% of available habitat cleared	Marten	Special Management	All
	<10% of available habitat disturbed	Grizzly Bears	Special Management	All
Minimum Core Area	Critical: >65% large core areas (> 1,000 Ha and 500 m wide); Target: >75% large core areas; Cautionary: >85% large core areas	All	Special Management	All
Minimum Core Area (continued)	Critical: >40% medium core areas (>200 ha and 350 m wide); Target: >50% medium core areas; Cautionary: >65% medium core areas)	All	General Use	All
Minimum Patch size	>5 ha	Moose	Special Management	All
	>515 ha	Boreal Woodland Caribou		
	>1,000 ha of suitable habitat	Grizzly Bear		
	>200 ha of suitable habitat	Marten		
Specialized Habitat Features	No disturbance (minimum 250 m buffer)	All VECs	Special Management	All
	No Net loss (with mitigation or compensation)		General Use	All
Significant Environmental Features	No disturbance	N/A	Special Management	All
	No Net loss (with mitigation or compensation)		General Use	All
Stream Crossing Density	<0.32/km^2	Fish	Special Management	All
	<0.5/km^2	Fish	General Use	All

Corridor/Road Density

One of the biggest impacts of development on wildlife is roads and other linear corridors. Where there are roads or trails, there are people. Greater access means greater hunting pressure and higher wildlife mortality both from hunting and vehicle collisions. Animals will encounter more people on a regular basis. The typical wildlife response to humans is to either flee the area or remain but experience increased stress levels. Both of these outcomes use the animal's energy reserves required to survive the winter or reproduce. Even minor disturbances at critical periods can be sufficient to reduce survival and reproductive rates the following year, either of which leads to population declines. Linear corridors also provide easier travel corridors

for predators, further contributing to declines in some species. For this reason, corridor/road density has been chosen as the key indicator of cumulative impacts.

Corridor and Road density will be used to manage impacts from linear development greater than 1.5 m wide. Any linear disturbance of 1.5m or less in width will not be included in this density analysis. Woodland caribou are the most sensitive species to development in the Dehcho. Because they show sensitivity to seismic lines and are thought to occur over most of the Dehcho, we are using corridor density as the primary indicator at this time. Corridor density includes roads, trails, utility corridors, pipeline right-of-ways and seismic lines. In areas where caribou are not known or expected to occur, the less restrictive road density (which only includes seasonal and all weather roads) would be applied instead. Density should be calculated using Oil and Gas sections.

Regulatory Authorities will initiate species monitoring and special management when Cautionary and Target Thresholds are exceeded, respectively. Where only a single threshold is present, this is considered the critical threshold. The Dehcho Boreal Caribou Working Group is in the process of being established. This group may revise this term for Boreal Woodland Caribou in consultation with our Committee.

Habitat Availability

Loss of habitat is a key factor in the decline of many species. This term is meant to monitor the overall loss of suitable wildlife habitat in the Dehcho so that regulatory authorities, decision makers and developers can determine the impacts of their decisions on wildlife and take steps to either reduce or mitigate the effects of their projects. Habitat availability is based on the % of habitat disturbed or altered for species found within the planning unit. It is calculated for the entire Dehcho territory as an overall indicator of habitat disturbance. The Committee is proposing an overall threshold of 10% loss of habitat in general with more specific values set for more sensitive species. The VECs or Valued Ecosystem Components were established in the Committee's wildlife report completed by EBA Engineering. They are Dall's Sheep, Moose, Wood Bison, Woodland Caribou, Mountain Goats, Grizzly and Black Bears, Waterfowl, Trumpeter Swans, Whooping Crane, Peregrine Falcon, and Fish. Values for individual species were set in accordance with habitat requirements as determined through the scientific literature. Readers are encouraged to review the Salmo Report for specific details related to the recommended thresholds.

Minimum Patch Size and Core Area

It's not just the amount of habitat that is important to wildlife survival but also how it is distributed. A single large area of habitat is better for wildlife than many small patches. A patch that is round or square is better for most species than a patch that is long and narrow because the rounder patch is better buffered from surrounding disturbances. As development increases, we not only see a loss of habitat, we see habitat fragmentation – large areas of intact habitat are broken into many smaller areas that are not as good for some species of wildlife.

As described above, every human-wildlife encounter causes stress or energy use by the animal, or death. To address this, biologists try to maximize the amount of "secure" or safe habitat where wildlife can be left undisturbed. Realizing that humans are everywhere, they do this by defining a minimum area of secure habitat that animals need to range for a 24-48 hour period. They then try to ensure that there are sufficient numbers of these patches close enough

together than the species can occupy its regular range, minimize disturbances, and have enough energy to survive and reproduce.

Minimum Patch Size and Minimum Core Area work together to achieve this. Habitat patches are areas of habitat secure from disturbance and mortality associated with human activities. Core areas are relatively undisturbed source areas for plant and animal populations that are at least 500 m from high use human disturbance features and should be larger than the home range or territory of the target species (Salmo et al. 2004). Habitat patches that meet the minimum patch size requirement are considered Core area. Biologists have identified how much core area species need to be able to survive and reproduce (as a % of overall habitat) and the thresholds were set accordingly to ensure viable populations of important species. Analysis was completed for the entire Dehcho territory to determine which patches meet the minimum size requirement for various species and determine how much of the Dehcho remains in a Core Area.

Specialized Habitat Features

Specialized habitat features are areas or features that are critical to the survival or reproduction of the population. They include but are not limited to mineral licks, dens, wallows, nests, calving areas, spawning areas, staging areas, whelping areas, and lambing areas, key migration routes. As areas that are critical to the survival of the populations, all development will avoid disturbing these areas, not just when they are in use, but also ensuring that these features remain intact during off seasons so that they can be used again in the future.

Significant Environmental Features

These are sites of important ecological significance in the region which include but are not restricted to karst topography, hot and cold springs, waterfalls, ravines, cliffs and other unique geological features. These are locations valued by humans for aesthetic, cultural or scientific reasons, some of which also provide unique wildlife habitat for different species (e.g. cliffs, hot springs, and karst). All development will avoid disturbance of these areas.

Stream Crossing Density

Stream Crossing Density is similar to the Road/Corridor Density but for water and fish. This is an indicator of sediment and mortality sources and stream habitat fragmentation in a watershed. It is expressed as the number of access corridor (road, trail, utility corridor or cutline) crossings per km^2 of stream or watershed. It is calculated using oil and gas grids.

Analysis Parameters

The human disturbance data was digitized from 5m resolution IRS satellite imagery. Anything visible when viewed at a scale of 1:10,000 and compared to 1:50,000 NTS mapsheets was captured in the dataset. This includes roads, trails, seismic lines, cutblocks, utility corridors, communities, airstrips, wellsites and anything else visible in the imagery using the described parameters.

The Habitat Availability, Minimum Patch Size and Minimum Core Area terms use a 250 m buffer around seismic lines and a 500 m buffer around all other human disturbance. Seismic lines

were buffered by 250 m for all current analysis to address woodland caribou avoidance of these features as determined by several recent studies (Dyer 1999, James and Stuart-Smith 2000 [In Salmo et al. 2004]). All other features, which are expected to have higher human use, were buffered by 500 m as they represent a greater disturbance to wildlife. This is considered a conservative estimate of the "zone of influence" or area impacted by disturbance, since avoidance is generally related to activity levels rather than the features themselves (Mattson 1993, Dyer 1999, Gibeau 2000, ELI 2003 [In Salmo et al. 2004]).

Lakes are excluded from the Core Area calculations as they are not affected by land-based disturbance.

Results

Figures 1-8 show the results of the Preliminary Cumulative Effects Assessment. Analysis was done for all cumulative effects terms proposed in the Working Draft, with the exception of the Specialized Habitat Features and Significant Environmental Features which only specify avoidance.

Human Disturbance

Figure 1 illustrates the known human disturbance as digitized from 5 m resolution IRS Satellite Imagery. The actual disturbance or human footprint includes such features as primary roads, secondary roads, trails, seismic lines, cut blocks, airports, communities, unspecified clearings, wellsites, gas plants, campgrounds, golf courses, quarries, mines, lumber mills, dumps, and junk yards.

Corridor / Road Density

Figure 2 shows the current corridor density in the Dehcho, calculated using Oil and Gas grid sections. The grid sections were chosen because they provide the highest level of detail and are a legally defined grid system. This means the results should be reproducable, no matter who completes the analysis. They are also used to define oil and gas rights so will simplify decisions about whether a particular area is open for rights issuance as they will use the same boundaries. As expected, parts of the Cameron Hills and Fort Liard have already exceeded the Critical Thresholds proposed. The same is true for the development area east of Hay River and south of Great Slave Lake. Most of the Dehcho falls well below the thresholds set for all species. The small patches that are approaching and exceeding the higher thresholds are clearly visible with this analysis and identify areas where regulators should be applying more rigorous analysis to development proposals and requiring higher environmental standards to reduce cumulative impacts.

Minimum Patch Size

Figures 3 to 6 identify those habitat patches falling above and below minimum patch size requirements for woodland caribou, moose, grizzly bear and marten. The red and grey areas in each map represent habitat patches too small to meet daily requirements and disturbed areas, respectively. The yellow areas meet the minimum size requirements and represent core habitat for each species. The analysis was done on the basis of overall species range. As grizzly range only covers the western half of the Dehcho, the analysis is limited to that section.

Similarly, the Committee has no documented range data for boreal woodland caribou north of the existing Nahanni National Park Reserve (just Mountain Woodland Caribou) so that section is left white (no analysis).

Minimum Core Area

Figure 7 rolls up minimum patch size data to show overall core area for the Dehcho. The white layering covering part of the map shows the Special Management Zones and General Use zones over which all the Cumulative Effects Terms Apply. The large core area analysis will protect far ranging species such as caribou and grizzly bears. The medium core area size will meet habitat requirements for less mobile species such as moose and marten.

Table 2 shows how much land falls into core areas for the entire Dehcho region as well as for each zone. Zones 18 – 29 are Special Management Zones where the Critical Threshold is set at >65% of habitat in large core areas. Five of these zones are already below this threshold. The General Use Zone has a critical threshold of >40% of habitat in Medium core areas. At this time, development falls well below that threshold. The overall plan area is currently below the critical thresholds for both medium and large core area.

Table 2. Core Area Calculations.

Zone	Zone Name	Zone Area (m^2)	Disturbance	Non Core [<200 Ha]	Med Core [>200 Ha]	Lg Core [>1,000 Ha]
1	Pehdzeh Ki Deh	16,406,750,000	10%	0%	90%	88%
2	Five Lakes	570,125,000	36%	7%	57%	32%
3	Sibbeston Plains	6,104,375,000	20%	1%	79%	71%
4	Edehzhie	24,151,062,500	12%	0%	87%	85%
5	Sambaa K'e / Redknife River	10,764,625,000	29%	3%	68%	53%
6	Greater Nahanni Ecosystem	23,237,375,000	1%	0%	99%	99%
7	Birch Lake	619,562,500	4%	0%	96%	95%
8	Kotaneelee / Fisherman Lake	1,075,000,000	15%	1%	85%	82%
9	Fort Liard CZ (a,b,c)	242,500,000	54%	13%	33%	0%
10	Upper Mackenzie	827,625,000	21%	3%	75%	63%
11	Great Slave Lake Shoreline	945,187,500	12%	2%	86%	81%
12	Hay River Corridor	506,875,000	56%	8%	35%	20%
13	Heart Lake, McNally Creek, Muskeg River	1,553,312,500	16%	1%	83%	79%
14	Kakisa and Tathlina Watershed	6,296,812,500	19%	1%	80%	75%
15	Buffalo Lake	1,064,875,000	17%	0%	83%	82%
16	Falaise Lake Wetland Complex	1,044,187,500	12%	0%	88%	87%
17	Northwest Point and Islands	244,625,000	3%	0%	97%	97%
18	Nahanni Greater Ecosystem	4,967,125,000	2%	0%	98%	98%
19	Jean Marie / Martin River	4,787,375,000	22%	2%	76%	66%
20	Nahanni SMZ	3,291,000,000	15%	1%	84%	79%
21	Cameron Hills Blackstone / Arrowhead River	14,381,500,000	38%	5%	56%	36%
22	Trout River	1,809,062,500	24%	2%	74%	62%

Zone	Zone Name	Zone Area (m^2)	Disturbance	Non Core [<200 Ha]	Med Core [>200 Ha]	Lg Core [>1,000 Ha]
23	Fort Simpson Woodlot	37,375,000	52%	8%	40%	0%
24	Birch Falaise Corridor	2,478,187,500	4%	0%	96%	95%
25	Peel River Plateau	5,858,750,000	1%	0%	99%	99%
26	Liard Range/Franklin Mountains	2,393,437,500	17%	2%	80%	76%
27	SE Mackenzie Mountains	5,585,062,500	5%	0%	95%	94%
28	Fort Providence SMZ	465,937,500	29%	1%	70%	56%
29	Trout Lake Access	601,437,500	26%	1%	73%	59%
30	Special Infrastructure Corridor	695,500,000	46%	8%	46%	14%
31	General Use Zones	54,498,437,500	15%	1%	84%	80%
	Overall Plan Area	**197,505,062,500**	**15%**	**1%**	**84%**	**79%**

Stream Crossing Density

Figure 8 shows stream crossing density as calculated using the oil and gas grids. The critical thresholds are set at 0.32 crossings/km^2 for Special Management Areas and 0.5 crossings/km^2 for General Use Zones. Some areas in the southern Dehcho have exceeded the Special Management Zone threshold. The maximum threshold has only been exceeded in 4 grids.

Habitat Availability

Overall habitat availability has been calculated in Table 3 for 4 key species. The proposed threshold was no more than 10% loss overall for all VEC species. As you can see, that level has already been exceeded. Individual habitat availability targets were less than 30%,10%, 5%, and 3% for Marten, Grizzly Bear, Boreal Woodland Caribou and Moose, respectively. There is still adequate habitat availability for Marten. Grizzly bears are currently at the Critical Threshold. Boreal Woodland Caribou and Moose thresholds have already been exceeded.

Table 3. Habitat Availability in the Dehcho Territory.

Species	Total Ha in Range	Total Ha Disturbed	% of Habitat Disturbed
Marten	20,943,336	2,927,060	14%
Grizzly Bear	8,790,964	905,123	10%
Boreal Woodland Caribou	19,776,200	2,914,538	15%
Moose	20,943,345	2,927,062	14%
Dehcho Wide	**20,943,345**	**2,927,062**	**14%**

It is important to note that this analysis was completed using buffered disturbance as illustrated in Figure 1. As such, this does not measure % of habitat loss – it measures % of effective or secure habitat loss since the area calculated includes both the actual footprint of disturbance plus the 250m and 500m zones of influence or buffers where habitat is affected but not actually lost. We expect that the Dehcho is in fact below the proposed thresholds when only the

footprint is used. Future analyses will be run to show the significance of the 250 and 500 m buffers on these calculations.

The results provided here are preliminary. In some cases they do not reflect the specific wording of the terms, but were calculated on a more general basis. For instance, conservation zones were included in all analysis for information purposes as zone boundaries may change with future revisions to the Working Draft. Figure 7 shows the zones to which the thresholds currently apply with a clear white layer over the base data. At this time, seismic lines were included in all analysis. As data and zones are further refined, there may be instances where seismic lines should be excluded from the analysis to address human disturbance issues for less sensitive species.

Figure 1. Human Disturbance in the Dehcho Territory as determined by 5 m Resolution IRS Satellite Imagery. Seismic lines are buffered by 250 m and all other features by 500 m.

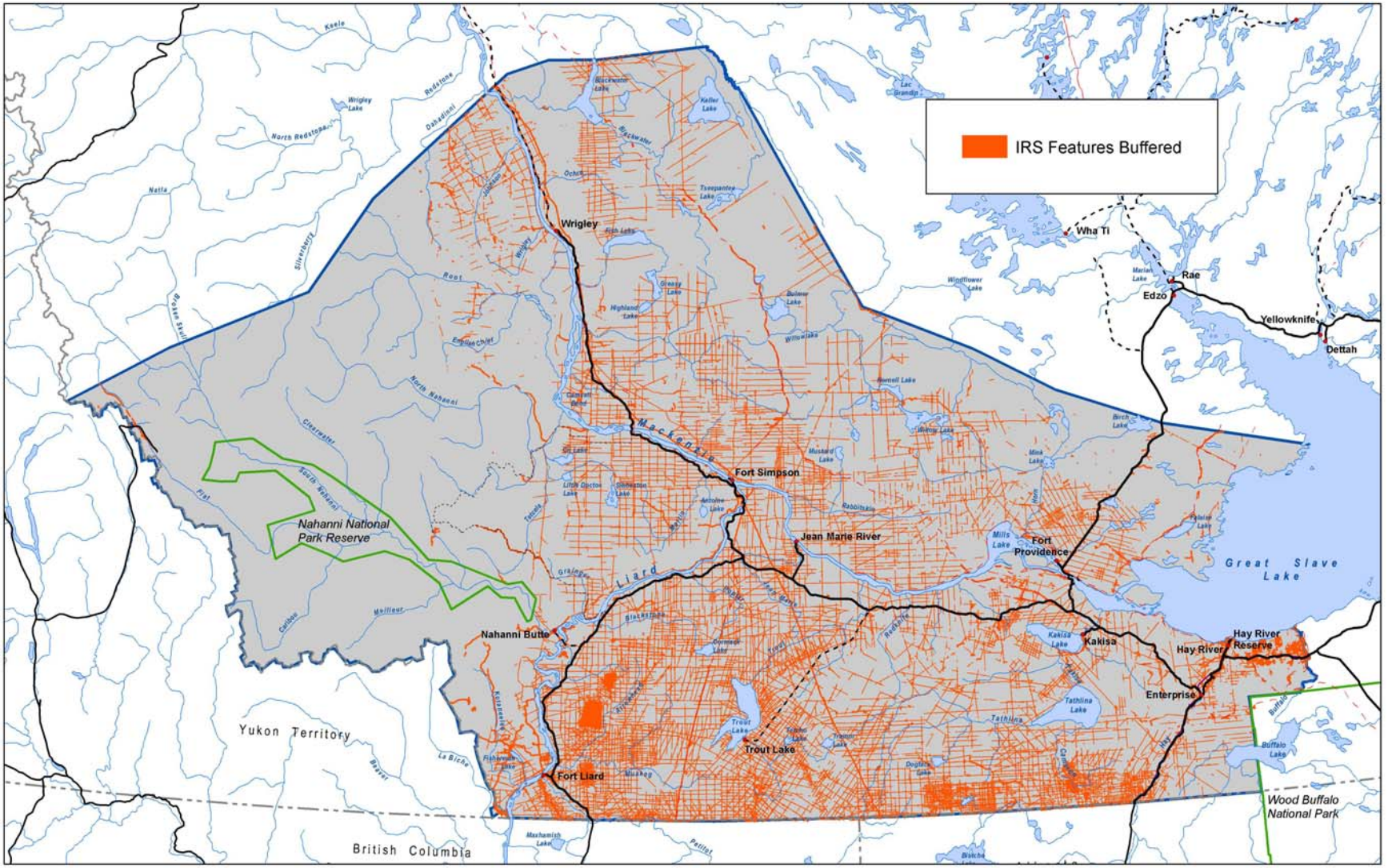
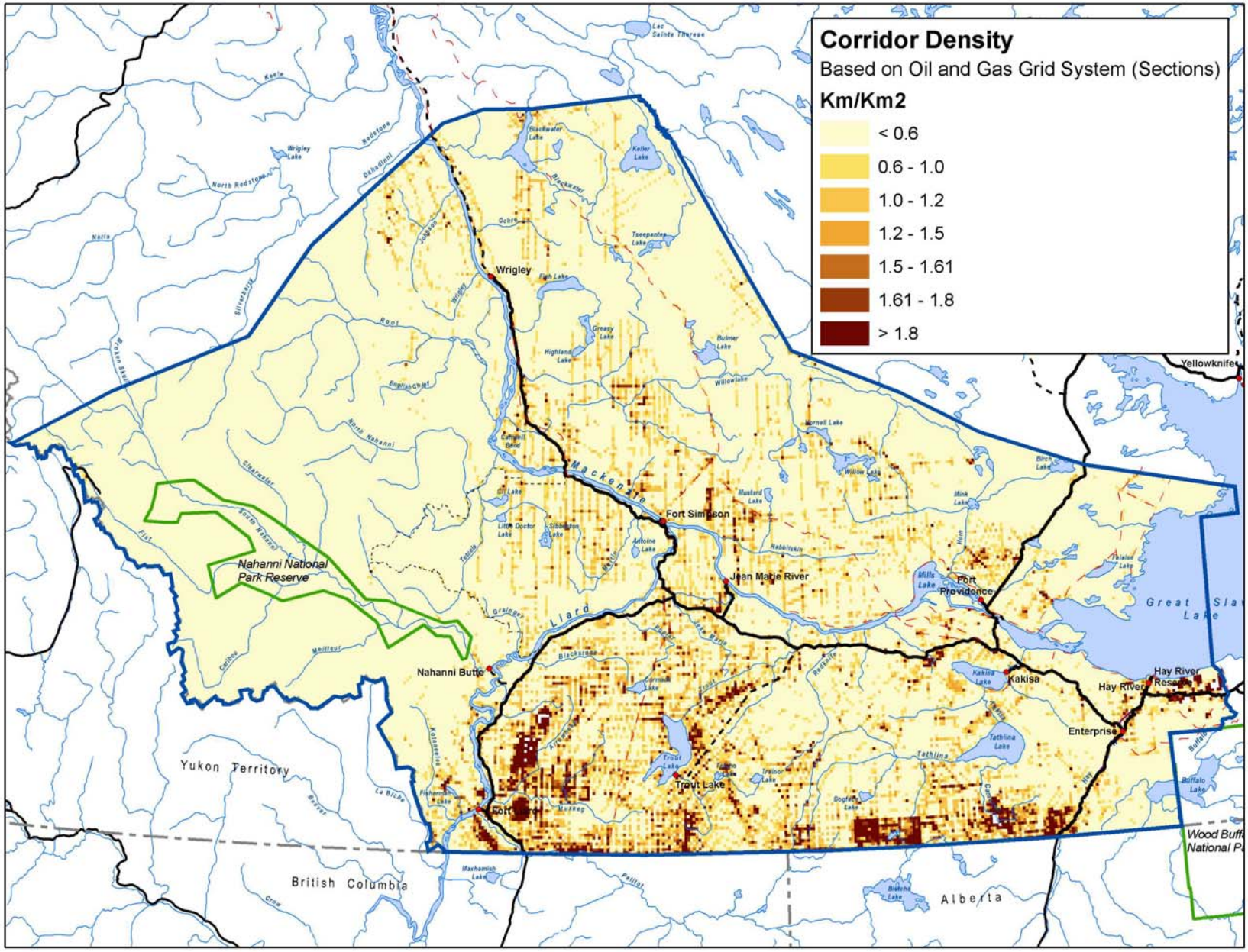
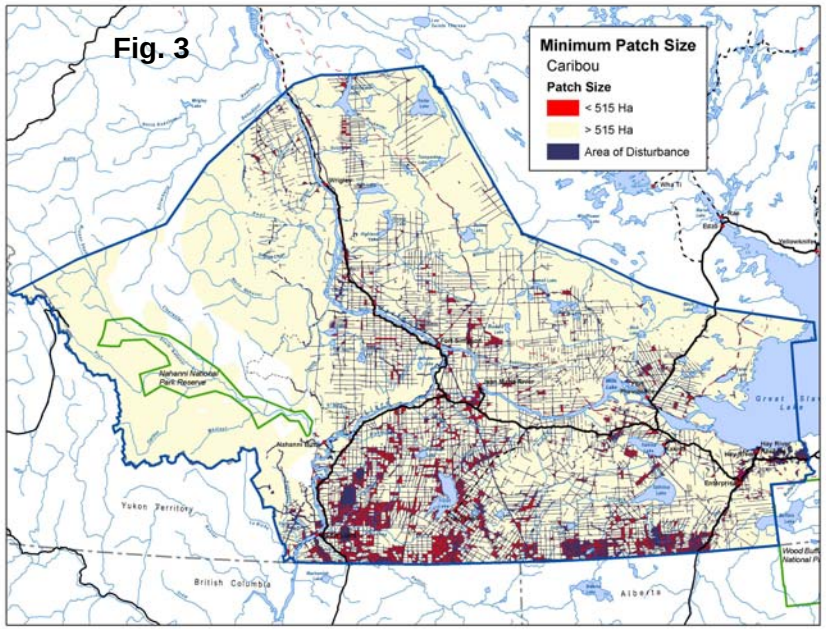
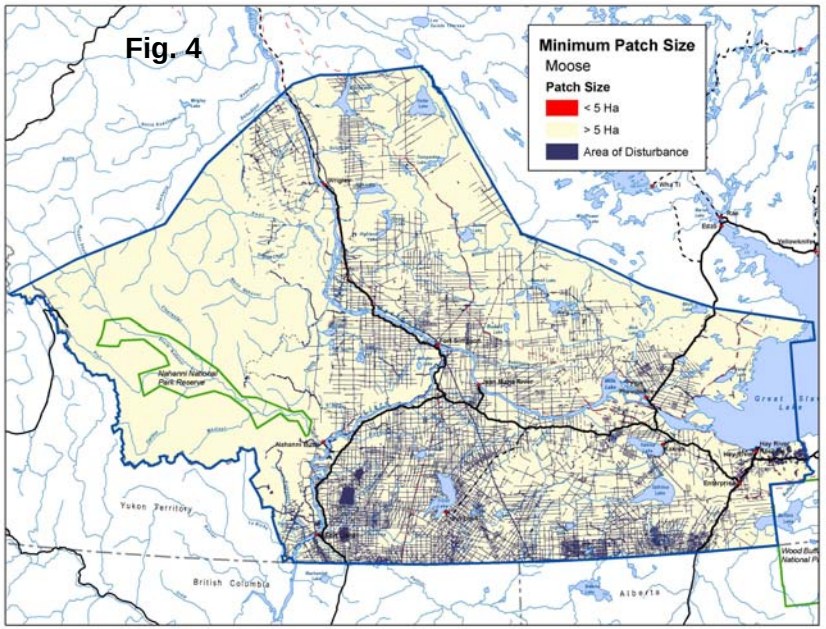


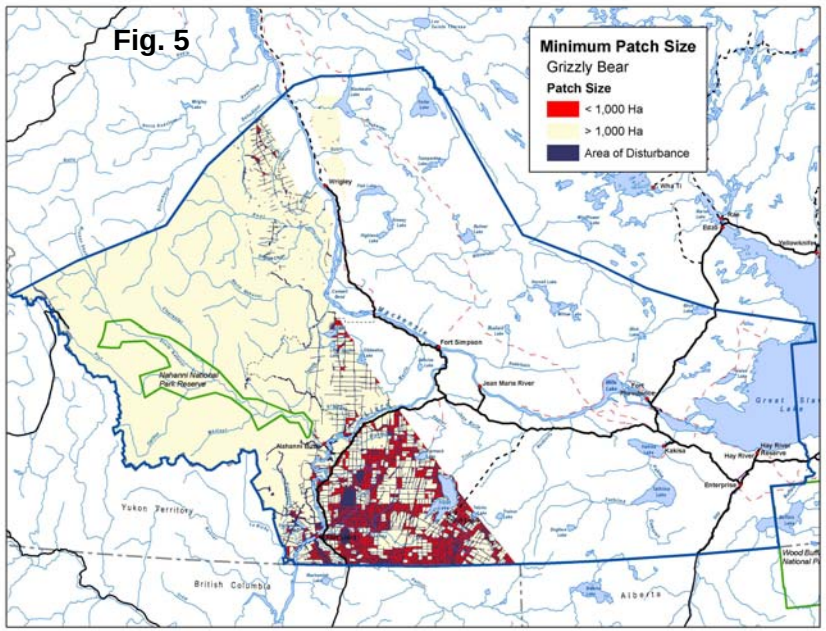
Figure 2. Corridor Density in the Dehcho Territory.



Figures 3-6. Minimum Patch Size Analysis for Boreal Woodland Caribou, Moose, Grizzly Bear and Marten.







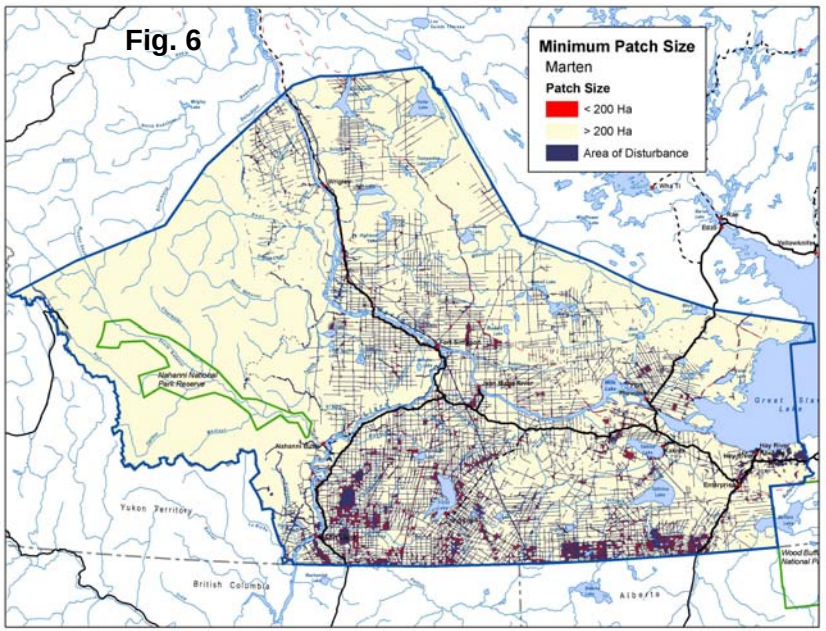


Figure 7. Core Area Analysis of the Dehcho Territory.

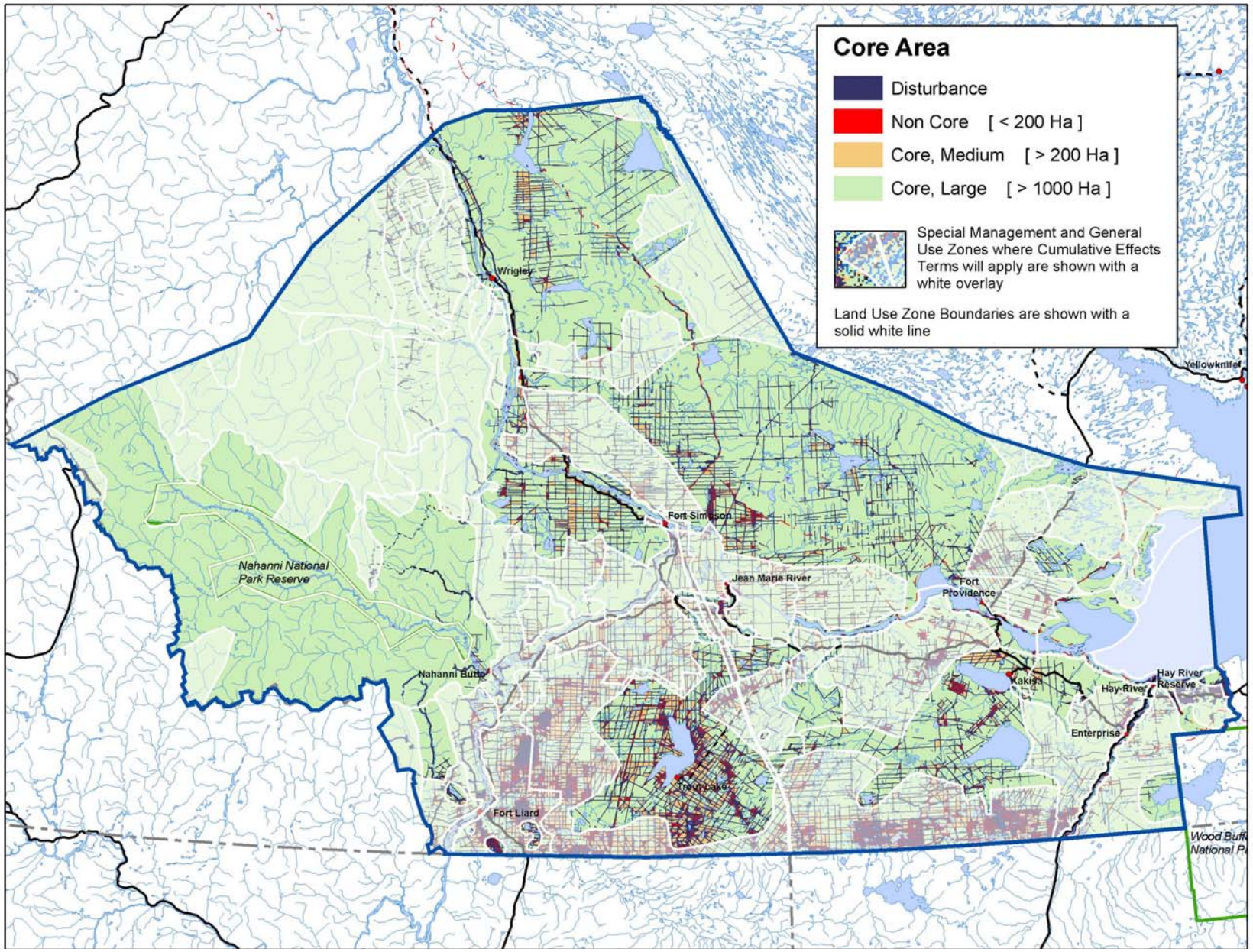
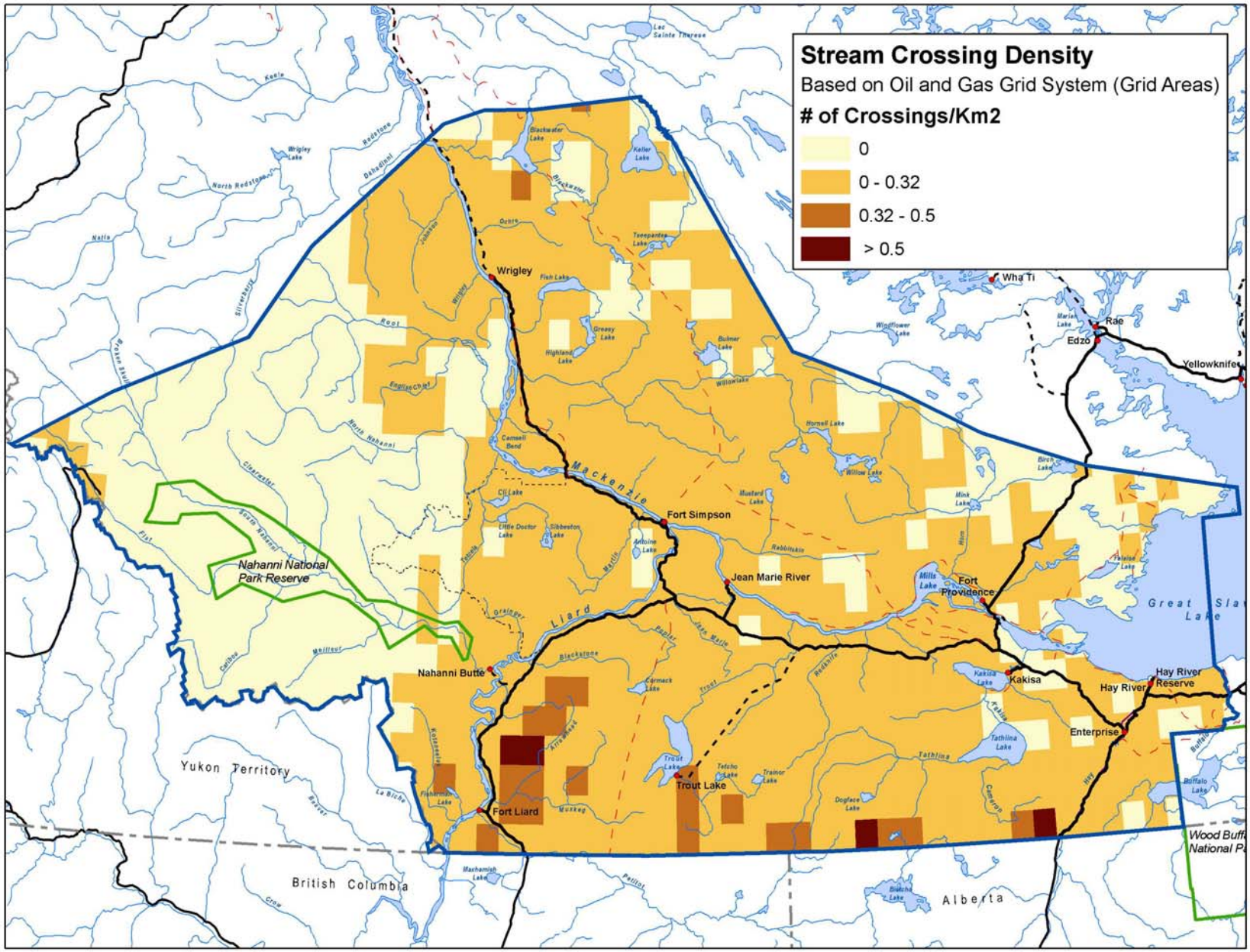


Figure 8. Stream Crossing Density Analysis of the Dehcho Territory.



Implementation

Regulatory authorities such as the Dehcho Resource Management Authority, the Mackenzie Valley Land and Water Board or the Mackenzie Valley Environmental Impact Review Board would have primary responsibility for implementing the Cumulative Effects Management Terms. As these bodies review applications, they would be responsible for ensuring the Developer or some other agency completes a cumulative effects assessment to determine whether the proposed development, in conjunction with pre-existing human disturbance, meets or exceeds any of the thresholds. Another proposed term in the Working Draft, Digital Post-Operation Mapping, requires developers to supply authorities with current human disturbance data following new disturbances to facilitate on-going cumulative effects monitoring and management.

Where critical thresholds are met or exceeded by a proposed project, regulatory authorities will reject the project as proposed. The developer can redesign the project to reduce cumulative impacts such that the thresholds are not exceeded, use better technologies such that impacts are so minimal they are not included in analyses (for instance minimum impact seismic that falls below 1.5 m in width), or complete mitigation /reclamation work on previously disturbed lands to lower the disturbance index.

Conclusions

The Deh Cho Land Use Planning Committee is committed to implementing cumulative effects management through the Land Use Plan. The Committee has proposed seven terms that address various aspects of cumulative effects and will allow for effective monitoring and management. As mentioned previously, thresholds are set by values. If the values change, so should the thresholds. Currently, critical thresholds are set below levels at which wildlife impacts are known to occur. Where used, target and cautionary thresholds are set well below this to trigger increased monitoring and vigilance on the part of Developers and Regulatory Authorities.

The Committee has completed preliminary analysis to illustrate the implications of our proposals as we currently envision them. More refinement is required as we move from theoretical analysis to implementation. As we revise the Working Draft in the coming year, we will be working with regulatory agencies and planning partners to refine these cumulative effects terms so that they are clearly understood, implementable and enforceable. We welcome and encourage broad input and participation in this process.

References

CEAM. 2004. NWT Cumulative Effects Assessment and Management Strategy and Framework Website. Available at http://www.ceamf.ca/.

Salmo Consulting Inc. et al. 2004. Deh Cho Cumulative Effects Study, Phase 1: Management Indicators and Thresholds. Prepared for the Deh Cho Land Use Planning Committee, Salmo Consulting Inc in association with Axys Environmental Consulting Ltd., Forem Technologies and Wildlife & Company Ltd., Calgary. Available at: http://www.dehcholands.org/reports_cumulative_effects_report.htm.