APPENDIX “E”

Bioclimate, Ecodistrict and Ecologically Significant Features Mapping for the Dawson Planning Region, Yukon.

Final Report

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Executive Summary

In order to achieve the sustainable development objectives of the Land Use Planning Chapter (Chapter 11) of the Yukon First Nations Umbrella Final Agreement (UFA), planners require knowledge of the type, location and distribution of ecosystems. This project is being undertaken to provide broad scale ecosystem mapping as an initial step to assist the development of management interpretations for the ecosystem resources of the Dawson Planning Region. Specifically, this project provides mapping of bioclimate zones and ecodistricts at 1:100,000 scale and active riparian zones and wetlands at 1:50,000 scale.

The Dawson Planning Region complements and builds on the existing work in the adjacent North Yukon and Peel Watershed Planning Regions. This project provides regional level mapping in advance of an ecosystem classification at a resolution comparable to the Peel Watershed project. This regional level mapping also provides data for a variety of wildlife habitat and land use interpretations.

The Dawson Planning Region covers 45,288 km^2 (4,528,800ha) or about 10% of the Yukon territory. It spans the northern extent of the Boreal Cordillera ecozone and the southern extent of the Taiga Cordillera ecozone. Five ecoregions are found in the Dawson Planning Region. The Eagle Plains ecoregion is found in the extreme northeast, the North Ogilivie Mountains ecoregion is found in the northwest, the Mackenzie Mountains ecoregion is found in the center, the Yukon Plateau-North ecoregion is found in the center east and the Klondike Plateau in the southwest. Elevations range from under 300m where the Yukon River exits the territory to 2360m in the Tombstone Range.

Six bioclimate zones (Boreal Low (BOL), Boreal High (BOH), Subalpine (SUB), Wooded Taiga (WTA), Shrub Taiga (STA), Alpine (ALP)) were mapped. Bioclimate zones are broad areas of similar regional climate that are characterized by distinctive vegetation communities and patterns of these communities on the landscape. The primary data used to map bioclimate zones were:

1. Land cover - Earth observation for sustainable development of forest (EOSD)
2. Yukon Vegetation Inventory (YVI)
3. 100m interval contour information generated from CanVec (1:50,000 scale) data

Initially the Taiga/Boreal boundary was refined by observing broad patterns of tree distribution, known occurrence of permafrost and the concept that the Boreal forest is subject to influence of Pacific weather systems while the Taiga is subject to greater influence of Arctic weather systems. Elevation rules for mapping bioclimate zones were derived from the observations of the consistent elevation where distinguishing features of the upper zone boundaries were seen. The BOL is a narrow elevation band from 300 to 450m along the major rivers covering 269,855 hectares or 6% of the study area, characterized by greater tree size than elsewhere in the Dawson Planning Region. The BOH is by far the largest of the bioclimate zones found in the Dawson Planning Region covering 62% (2,799,469 ha.) of the region. The BOH is found between the Boreal Low and the Subalpine ranging from 450m to 1100m in the southern and central portion of the Dawson Planning Region and up to 1000m in the northern portion of the Dawson Planning Region. The Subalpine zone, the second largest bioclimate zone mapped, covers 14% (623,833ha) of the Dawson Planning Region. The SUB is found above the BOH and below the alpine zone. It is found at elevations of 1100m to 1500m in the south and central parts of the planning region and between 1000m and 1300m in the north. The Wooded Taiga zone is found in extreme north eastern portion of the Dawson Planning Region. The WTA covers 313,480ha. or 7% of the study area. It is found between about 450m to 900m below the Shrub Taiga. The Shrub Taiga zone is found in the Dawson Planning Region along the Dempster Highway north of North Fork Pass and on the Arctic side of the height of land in the North Ogilivie Mountains. The STA covers 323,532ha or 7% of the Dawson Planning Region. The STA is found above the WTA and below the Alpine bioclimate zone at elevations

between 900m and 1300m. The Alpine zone is found at the highest elevations throughout the Dawson Planning Region. In the south and central Dawson Planning Region it is found above 1500m and in the north above 1300m. The ALP covers 198,581ha or 4% of the Dawson Planning Region.

Ecodistricts are the level in the National Ecological Framework defined as subdivisions of ecoregions due to “distinctive climate, landforms and vegetation associations”. Ecodistricts were mapped through the examination of climate, physiography, glacial history, bedrock, surficial geology, drainage pattern and vegetation (EOSD and YVI) data. Thirty two ecodistricts were mapped and described both in the study area and in portions of the adjoining planning regions.

Wetlands cover 289,391 ha or 6% of the study area. Five wetland types were mapped. Initially 14 classes including the five CWCS classes (bog, fen, marsh, swamp, shallow open water) and seven CWCS form/subform levels (e.g. veneer bogs) and two wetland classes not part of the CWCS unique to permafrost terrain (e.g. upland polygon trenches). Subsequently the 14 classes were aggregated to five wetland types (Toe and gentle slope wetlands, riparian wetlands, depressional wetlands, polygonal wetlands and open water). At times, complexes of two or more types were mapped, due to scale issues. In order to map wetlands customized queries were developed on an ecodistrict basis or more frequently for a group of ecodistricts utilizing EOSD, CanVec, DEM, Slope Curvature classes and the Active Riparian map. Subsequent to the initial mapping non-contiguous polygons less than 25ha were eliminated. This resulted in a reduction of wetlands mapped by about 50%. It is recommended that some of the wetlands lost in this cleaning of small polygons be retrieved by mapping areas dominated by many small wetlands as wetland/non-wetland complexes.

Active riparian refers to those areas along rivers and streams which are periodically flooded by flowing water. Five flooding regimes (reflecting frequency and severity of flooding) were mapped within the active riparian zone for this project. Active riparian zones cover 191,455ha or 4% of the Dawson Planning Region. The surficial geology maps provided the most useful starting point for extracting active riparian areas throughout much of the project area. In areas with no surficial mapping, active riparian was manually interpreted using 1:50,000 contours, hydrological layers (CanVec), satellite images, north Yukon regional terrain mapping and Yukon vegetation inventory (where available). Riparian areas were further classified according to the frequency of flooding based on the vegetation using the YVI where useable and the EOSD.

1 Introduction

1.1 Project Background

In order to achieve the sustainable development objectives of the Land Use Planning Chapter (Chapter 11) of the Yukon First Nations Umbrella Final Agreement (UFA), planners require knowledge of the type, location and distribution of ecosystems. This project is being undertaken to provide broad scale ecosystem mapping as an initial step to assist the development of management interpretations for the ecosystem resources of the Dawson Planning Region. Specifically, this project provides mapping of Bioclimate zones and ecodistricts at 1:100,000 scale and active riparian zones and wetlands at 1:50,000 scale.

While a formalized Ecological Land Classification (ELC) framework for the Yukon does not exist, work on ELC has occurred for about 30 years in the Yukon. The current approach has been under development since 2003. Concepts from the British Columbia Biogeoclimatic Ecosystem Classification (BEC) system (Pojar et al. 1987) and the Alberta Natural Sub-region/Ecosite models (Beckingham and Archibald 1996) will be integrated into the Yukon ELC. The Yukon ELC Framework builds upon the ecoregion and ecodistrict concepts of the National Ecological Framework (Smith et al. 2004), which provides the current basis for ecologically-based land management in the Yukon.

In two of the adjacent planning regions (North Yukon and Peel Watershed) the Yukon Government recently completed ecosystem mapping products to address planning needs similar to those of the Dawson Planning Region (Francis et al. 2005; Meikle and Waterreus 2008). The project for the Dawson Planning Region complements and builds on the existing work. The Peel Watershed ELC project resulted in the mapping of ecosystem classes at 25m resolution. The Dawson Planning Region project provides regional level mapping in advance of an ecosystem classification at a resolution comparable to the Peel Watershed project. This regional level mapping also provides data for a variety of wildlife habitat and land use interpretations.

1.2 Project Objectives

- Produce mapping of Bioclimate Zones at 1:100,000 scale
- Produce mapping of Ecodistricts at 1:100,000 scale
- Produce mapping of Wetlands at 1:50,000 scale (where possible this will be to class level of the Canadian Wetland Classification System: bog, fen, marsh, swamp, shallow open water)
- Produce mapping of Active Riparian zones at 1:50,000 scale
- Create meta data for the digital mapping provided
- Write this report outlining methods, results and issues

1.3 Study Area

The Dawson Planning Region (Figure 1) covers 45,288 km^2 (4,528,800ha) or about 10% of Yukon. It spans the northern extent of the Boreal Cordillera ecozone and the southern extent of the Taiga Cordillera ecozone. Thereby spanning the transition from discontinuous (Boreal) to continuous (Taiga) permafrost. Considerable variation in climate, glacial history, geology and physiography are found in the Dawson Planning Region.

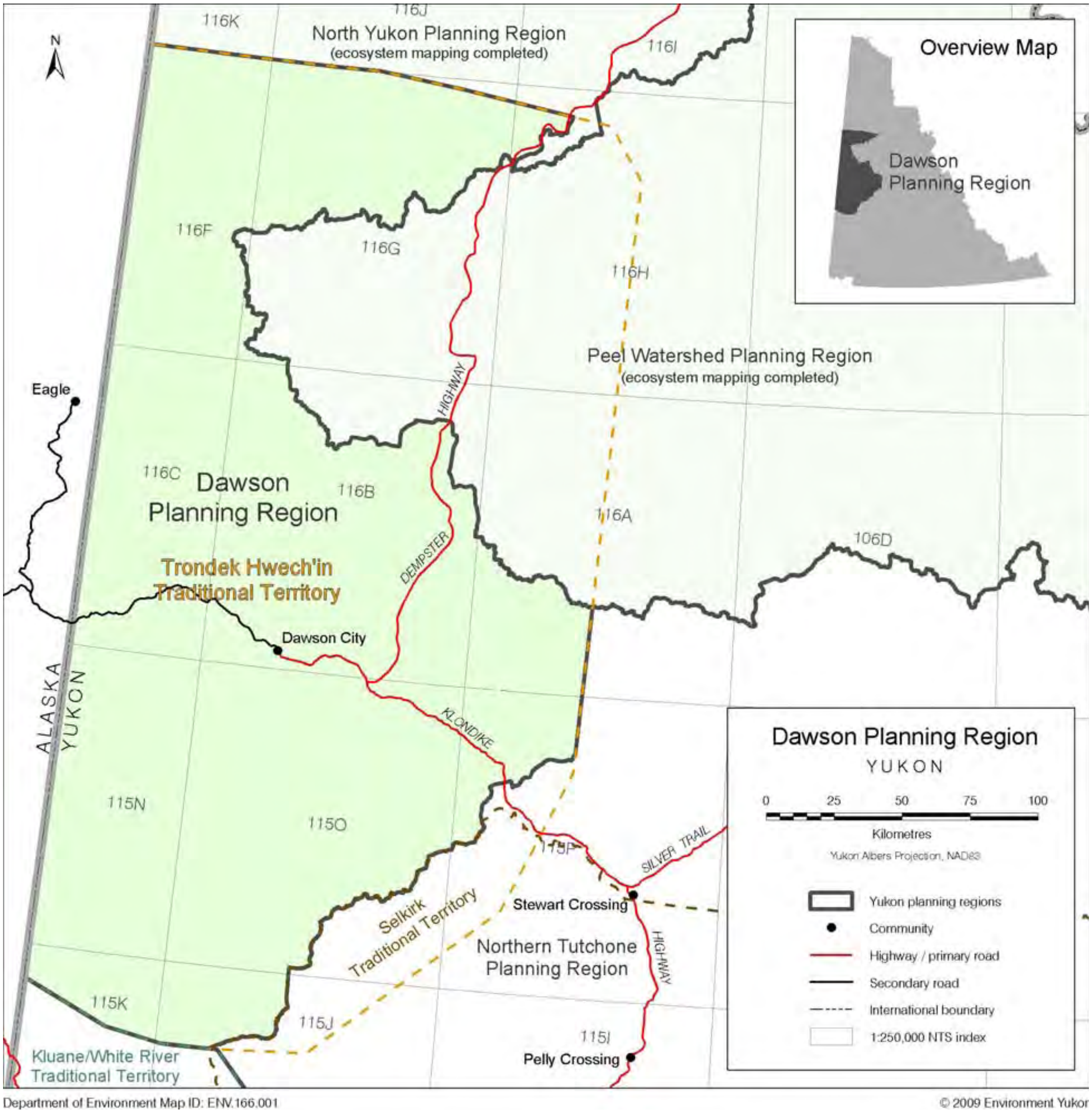
The region spans more than 3 degrees of latitude from the unglaciated dissected Klondike Plateau in the South to the rugged Southern Ogilvie Mountains which were glaciated at least 3 times in the last 3 million years, and then onto the more subdued unglaciated Northern Ogilvies and Eagle Plains in the north. Continuous permafrost in the north reflects lower mean annual temperatures while the continental climate of central Yukon results in extreme minimum and maximum temperatures in the low lying valleys. The Tintina Trench, a major fault zone, separates the metamorphic rocks of the Klondike Plateau from the mainly folded clastic and lime rich sediments of the Selwyn basin and the North American shelf.

Five ecoregions are found in the Dawson Planning Region. The Eagle Plains ecoregion is found in the extreme northeast, the North Ogilivie Mountains ecoregion is found in the northwest, the Mackenzie Mountains ecoregion is found in the center, the Yukon Plateau-North ecoregion is found in the center east and the Klondike Plateau in the southwest.

The Yukon River flows through the Dawson Planning Region from the south center to the west center. Other major rivers include the lower portions of the White and Stewart Rivers, and the Klondike, Sixty Mile, Fifteenmile, Tatonduk, Miner and Blackstone. All but the last two are tributaries of the Yukon, while the Miner and the Blackstone are tributaries of the Porcupine River.

Elevations range from under 300m where the Yukon River exits the territory to 2360m in the Tombstone Range.

Figure 1: Dawson Planning Region study area



2 Methods

This section describes the overall project process and approach that was implemented to complete the work. The procedures are presented in chronological order to the extent possible. For each of the main map products the process by which the final product was arrived at is described in more detail in combination with the results section to keep the rationale as close to the definitions as possible in the text.

For all map products the team endeavored to build on existing knowledge and work. All reasonable efforts were made to keep resultant map products consistent with existing work in adjoining planning regions.

The list below describes the main components of the project:

1. Review approaches in adjoining planning regions
2. Kickoff meeting
3. Review input data
4. Clarify issues with YG technical advisory group
5. Draft and document approach for the mapping
6. Solicit feedback on draft approach from YG technical advisory group
7. Implement final approach(s) on a representative area(s)
8. Discuss draft output(s) with YG technical advisory group
9. Make adjustments as required and implement approach to remainder of area
10. Document methods, results, and metadata and provide geospatial databases

Detailed methods are included within the results section for each map component.

3 Project Team – roles and responsibilities

The project team consists of Robert Albricht and Kevin Stehle of Silvatech Consulting Ltd. Tom Braumandl and Pamela Dykstra of Biome Ecological Consultants Ltd., Karen McKenna of [1]CryoGeographic Consulting, Rhonda Rosie and Adrian DeGroot.

Robert Albricht, M.Sc. is an experienced project manager with a focus on pragmatic and innovative applications of remote sensing relevant to clients facing the challenges of integrated resource management. He has been involved in applications of remote sensing and GIS for over 15 years and has designed and led a variety of projects, on several different continents, ranging from coarse satellite imagery for habitat suitability mapping in Africa, to the use of high resolution digital photography and lidar for the production of enhanced forest inventory attributes in Canada. Robert's roles on this project are:

- Organization of the project, reporting and meetings
- Identification of critical issues and resolution
- Contribute remote sensing expertise to troubleshoot imagery and inventory issues
- Communication with the client
- Contribute to report writing for input data, active riparian and wetland sections
- Overall editing

Tom Braumandl, RPF (BC), has 30 years experience in ecological land classification and mapping. Tom developed and extended the biogeoclimatic ecosystem classification for the Nelson Forest Region (approximately 8 million hectares) in British Columbia. He is the principal author of the ecological classification guide for the Nelson Forest Region. Tom has participated in ecological mapping at scales from 1:2,000,000 to 1:10,000. Tom roles on this project are:

- Technical lead, lead bioclimate mapping, review of ecodistrict, active riparian and wetland mapping
- Communication with the Client, regarding the desired product outcomes

- Main author of bioclimate report section, main editor of entire report

Karen McKenna has over 25 years experience in ecosystem classification, biophysical and soil mapping throughout the Yukon and has an outstanding understanding of Yukon tundra, alpine, boreal and wetland soils and ecosystems. Karen's roles on the project are:
- Lead ecodistrict, active riparian and wetlands mapping
- Review of bioclimate mapping
- Contribute to ecodistrict, active riparian and wetlands mapping sections of report

Rhonda Rosie has been botanizing and studying northern ecosystems for over 30 years, and has worked in most areas of the Yukon. Projects have included many vegetation surveys and classifications, aerial and ground surveys and classifications of wetlands, and invasive and rare plant surveys, along with ongoing collection and identification of northern vascular plants, lichens, and mosses. Rhonda's roles in this project are:
- Contribute to active riparian and wetlands mapping
- Review of bioclimate and ecodistrict mapping
- Contribute to active riparian and wetlands mapping sections of report

Kevin Stehle has over a decade of experience with GIS and is the Senior GIS analyst at Silvatech. Kevin has worked on several complex resource inventory projects and predictive ecosystem mapping projects incorporating a wide variety of input data sources to model soil moisture, soil texture and landform features. Kevin has worked in the Yukon on water mapping and contributed his geomatics expertise to the project Silvatech completed for the Yukon Government in 2007. Kevin's roles in this project are:
- Input layer acquisition, assessment and preparation
- Analysis and processing of all input layers to produce maps and attribute database
- Finalization of the maps and all digital deliverables
- Completion of the IDQ report and Quality Control report forms
- Contribute to input data section of report

Adrian DeGroot M.Sc., R.P.Bio (BC) has 15 years of experience in natural resource management, including 10 as a consulting ecologist in northern British Columbia. Adrian's work focus has been on ecological land management and inventory. He has been working on numerous projects that have involved Ecological classification, including QA on Predictive Ecosystem Mapping (PEM), conducting Terrestrial Ecosystem mapping, Sensitive Ecosystem Mapping, rare ecosystem mapping and installing Site Index using Biogeoclimatic Ecological Classification (SIBEC) plots. Adrian's role in this project is:
- Review of all components of mapping and report

4 Results

4.1 Input data review, selection and modification

The purpose of this step was to critically examine the data sets provided by YG and make a decision as to which data layers were the best to use as inputs to the derivation of the four main map products. In some cases input data layers were modified to address shortcomings identified in this review stage. In other cases alternative or additional data sets were identified to supplement the data provided by YG. These steps were time consuming, but critical to ensure familiarity with the data sets and resolve issues that could otherwise affect subsequent map products derived from the input data.

Two types of input data are recognized; the spatial files that were used directly to derive subsequent map layers and other files that informed the process or provided corroboration of the produced map products.

The spatial data layers that were directly used as inputs to GIS modeled layers for this project were:

- CanVec
- EOSD (modified for use in this project)
- Yukon Vegetation Inventory (incomplete coverage)
- Digitial Elevation Model (metric contours generated)
- Surficial geology (all available – incomplete coverage)
- Glacial limits
- 1961-1990 Climate data (modified)
- National Hydro Network

CanVec is the newest topographic base and currently is the best representation of the landscape available for the project area and it was decided that this should be the base for the mapping in this project. It was also confirmed that CanVec is the best source of information regarding waterbodies.

The EOSD dataset was modified prior to use in this project. The modifications involved three main steps; filling gaps/voids to create a complete seamless coverage consistent with the intended use for this project, generalization to remove very small units and a conversion from raster to vector to improve performance of subsequent GIS queries/processing. For large voids data from YVI was used to fill in the missing land cover information. The table below outlines the rule used to convert YVI to EOSD classes.

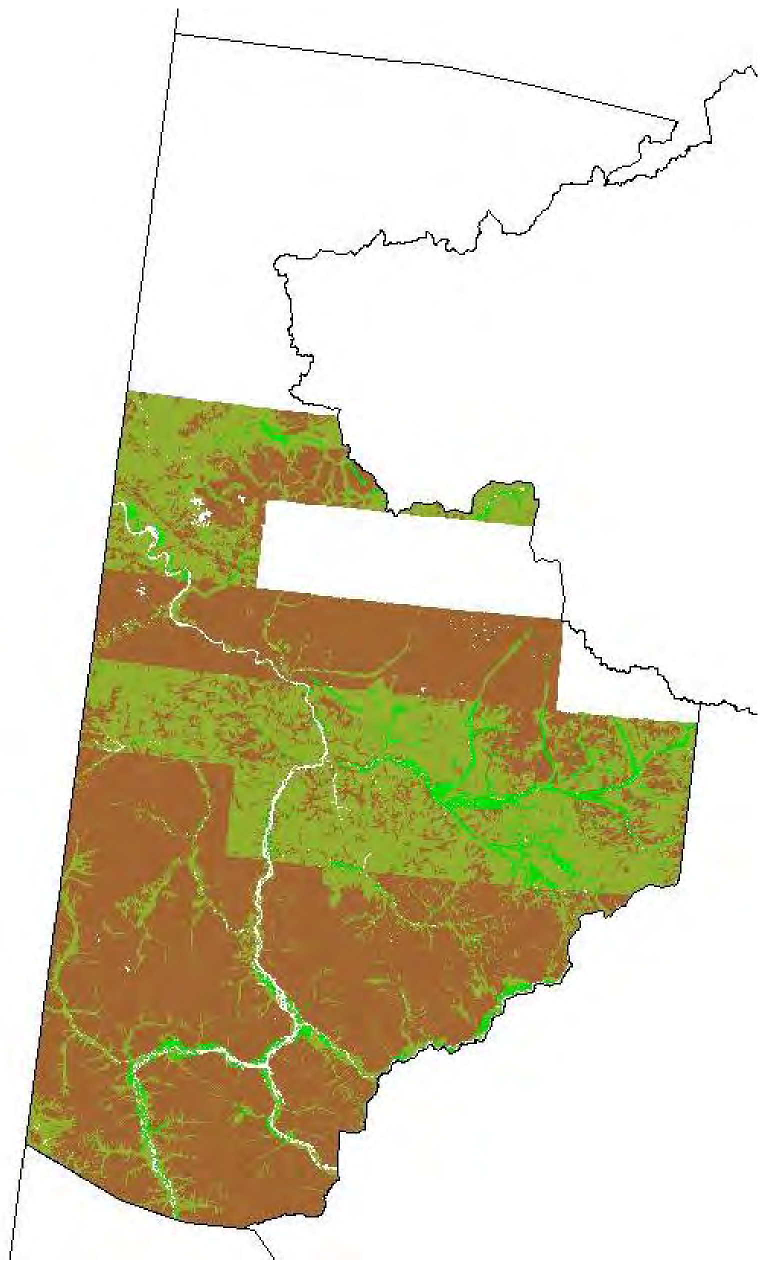
Table 1: Criteria to fill EOSD gaps utilizing YVI data

EOSD		Yukon Vegetation Inventory					
Class	Code	Type_LND	Class	soil moisture	crown closure	Species	Species Mix
Water	20	NW					
Snow/Ice	31	NS					
Rock/Rubble	32	NE	RR				
Exposed Land	33	NE	not RR				
Bryoids	40	VN	C				
Shrub Tall	51	VN	TSc & Tso	d, m			
Shrub Low	52	VN	LS & M	d, m			
Wetland-Treed	81	VF		a, w			
Wetland-Shrub	82	VN	TSc, Tso, LS & M	a, w			
Wetland-Herb	83	VN	H & C	a, w			
Herb	100	VN	H	d, m			
Coniferous Dense	211	VF		d, m	> 60%	F, L, P, SB, SW	Coniferous = 75% or more of total basal area.
Coniferous Open	212	VF		d, m	26-60%	F, L, P, SB, SW	Coniferous = 75% or more of total basal area.
Coniferous Sparse	213	VF		d, m	10-25%	F, L, P, SB, SW	Coniferous = 75% or more of total basal area.
Broadleaf Dense	221	VF		d, m	> 60%	A, B, W	Decid = 75% or more of total basal area.
Broadleaf Open	222	VF		d, m	26-60%	A, B, W	Decid = 75% or more of total basal area.
Broadleaf Sparse	223	VF		d, m	10-25%	A, B, W	Decid = 75% or more of total basal area.
Mixedwood Dense	231	VF		d, m	> 60%		Neither Con or Decid = 75% or more of total basal area.
Mixedwood Open	232	VF		d, m	26-60%		Neither Con or Decid = 75% or more of total basal area.
Mixedwood Sparse	233	VF		d, m	10-25%		Neither Con or Decid = 75% or more of total basal area.

Smaller voids (up to 0.25 ha) were filled by generalizing the gaps into the nearest EOSD unit. This may introduce some errors at operational map scales but should not adversely affect the intended use at a strategic level. To speed up subsequent processing the entire modified EOSD data set was converted to vector format. As mentioned above the CanVec double line water features were deemed the best source of information about water bodies so these were stamped into the EOSD file to augment the representation of waterbodies.

Use of the YVI data set was complicated by three main factors; incomplete coverage of the project area, positional offset with CanVec derived data (YVI is referenced to NTDB) and inconsistency between YVI projects. This is not surprising given that the YVI dataset spans the years 1988 – 2004. This information was kept at the forefront in using the YVI dataset and restricted its use in subsequent steps.

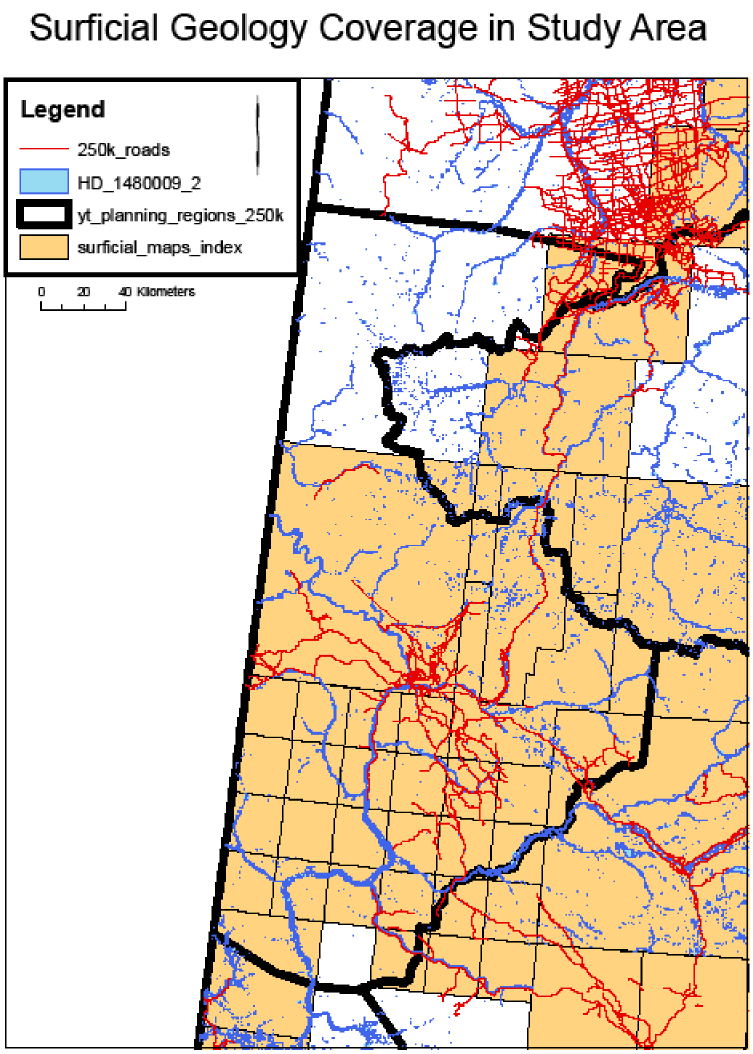
Figure 2: Overview of the Yukon Vegetation Inventory data set depicting soil moisture regime



(brown = dry, olive = moist light green = wet)

The surficial geology maps coverage is incomplete and from a variety of sources but was still considered to be of value to support wetlands and active riparian mapping.

Figure 3: Spatial extent of surficial geology mapping in Dawson Planning Region



Some additional data layers based on the DEM were created for use in this project. Metric contour lines were created to aid in the determination of suitable bioclimate boundaries and slope curvature classes were created to aid in the derivation of wetlands.

The spatial data layers that were used as inputs to guide manual interpretation and confirm modeled (GIS derived) outputs for this project were:

- Boreal-Taiga boundary (reviewed and modified by Rhonda Rosie)
- National Hydro Network
- Bedrock Geology
- Isotherms (UVic climate data)
- Agroclimate mapping (Eley and Findlay, 1978)
- Soil suitability mapping (Rostad et al 1979)
- Fire history
- Peel and North Yukon ELC maps
- NYRTM ver. 2
- Vegetation reports Yukon-Charley Rivers
- Ecoregions
- Peel regional terrain mapping
- Gridded Climate data 1961 - 1990

The gridded climate data for the years 1961 - 1990, acquired through the Canadian Institute for Climate Studies, was processed to create isotherms to aid primarily in determination and validation of bioclimate lines.

Image data were used as validation to confirm the appropriateness of boundary placement and attribution mainly. Image data were uses "as is" wherever the imagery was available (i.e no further processing was done to extract land cover related features)

- Indian Remote Sensing satellite imagery
- Landsat satellite imagery
- Google Earth including "streetview" photos
- Oblique YVI aerial photography

Table 2: Data used for this project listing source

Dataset	Data Holder	Scale	source	Comments	Extent
Digital Elevation Model	Canadian Digital Elevation Data	1:50,000	http://www.geobase.ca/geobase/en/find.do?produit=cded	could be improved with breaklines from CanVec	Full
Topographic base	CanVec	1:50,000	ftp://ftp2.cits.rncan.gc.ca/pub/CanVec/	best to use CanVec vs. NTDB	Full
Ecoregions	Government of Yukon	1:1,000,000	http://www.geomaticsyukon.ca/Yukon%20Coperate%20Spatial%20Data%20-%20page%201.html		Full
Regional Terrrain, Ecodistrict and Bioclimate mapping	Yukon Environment	1:100,000			75% North Part of area
Soil Landscapes (SLC)	Agriculture and Agri-Food Canada	1:1,000,000	http://sis.agr.gc.ca/cansis/nsdb/slc/v2.2/download_slc.html		Full

Revised Soil Landscapes and Ecodistricts, Yukon	Gartner Lee and CryoGeographic for AAFC	1:250,000	SLC_sep9_2009.zip	The 9 digit YT_SLC_NO is the unique number that has been updated since 2004 with province ="11" the next 4 numbers are the ecodistrict. The last 3 are the soil landscape within the ecodistrict.	Un-known
Watersheds	National Hydro Network	1:50,000	http://geobase.ca/geobase/en/data/nhn/index.html	NHN was considered best source for height of land	Full
Land Cover (EOSD)	Canadian Forest Service	25 metre	http://www4.saforah.org/eosdlcp/nts_prov.html CD	this map layer was modified for use in this project	90% Some gaps in image class
Bedrock Geology	EMR Yukon	Mixed (1:50,000 – 1:800,000)	http://www.geomaticsyukon.ca/Yukon%20Coperate%20Spatial%20Data%20-%20page%201.html geomatics		Full
Surficial Geology	EMR Yukon	mixed		incomplete coverage	Approx. 50%
Fire History	Government of Yukon	1:50,000		useful in bioclimate mapping	Full
Yukon Forest Cover	EMR- forest resources	1:50,000		YVI based on NTDB not CanVec	partial
NYRTM vers 2-regional terrain mapping	Yukon -Env		Environment		
Peel –ELC (elc-final)	Yukon env		ftpgeomaticsyukon.ca anonymous login \environment\ELC\ Peel_LUP		
NY-ELC (ny-lt-final)	Yukon Environment		ftpgeomaticsyukon.ca anonymous login \environment\ELC\NY_LUP		
Soil mapping-dawson		1:125,000	Dawsonaligned.zip		
Soil mapping-Klondike		1:20,000 Non digital	Karen McKenna		
Vpro arctic data		plot	Arctic data splinter .zip		
New biophs data base -veg and soil data-oracle		plot	2007 (80 plots or so)		
Cansis soil pedon data		plot data	useful for wetlands		
1961 – 1990 gridded climate data	Canadian Institute for Climate Studies	point data – (modified to create isotherms)	http://www.cics.uvic.ca/climate/CanadaGriddedClimateData/CanadaGriddedClimateData1961to1990.htm		Full

veg/landscape reports for the Yukon-Charley Rivers Preserve Alaska adjacent to the project area			2001 - Rhonda		
Glacial limits			glacial_limits_1000k.zip		
Soil Suitability maps			Eley and Findlay, 1978)		
Agroclimatic maps			(Rostad et al 1979)		

4.1.1 Issues of note

- EOSD data set was modified for use in this project to address data voids
- YVI dataset was used with caution due to limitations outlined above

4.1.2 Recommendations:

- CanVec double line water could be used to introduce breaklines to improve the DEM.

4.2 Bioclimate Zones

Six Bioclimate Zones were mapped following the definitions provided in the Request for Proposals document (Environment Yukon 2009; Francis and Yukon ELC Working Group 2008)). The zones mapped are the Boreal Low (BOL), Boreal High (BOH), and Subalpine (SUB) within the Boreal Cordillera Ecozone (Smith et al 2004) and Wooded Taiga (WTA) and Shrub Taiga (STA) within the Taiga Cordillera Ecozone. The Alpine (ALP) zone was mapped in both the Taiga and Boreal Cordillera ecozones at high elevation.

4.2.1 Definitions

Bioclimate zones are broad areas of similar regional climate that are characterized by distinctive vegetation communities and patterns of these communities on the landscape (Francis and Yukon ELC Working Group 2008). Bioclimate zones are roughly equivalent to biogeoclimatic zones of the British Columbia biogeoclimatic system (Pojar et al. 1987). Bioclimate zones are typically mapped at scales of 1:100,000 or smaller.

Table 3: Bioclimate zone definitions (modified from Request for Proposal (Environment Yukon 2009)

Bioclimate Zone	Code	Description
Boreal Low	BOL	Continuously forested areas at low elevations along major river valleys, below the BOH Much more restricted distribution than in southern and central Yukon. Winters are long and cold, with short, cool and moist summers. Forests are generally white spruce dominated with moderately developed understories. Black spruce and aspen are also commonly found. Vegetation is structurally similar to BOH above but the warmer climate results in much larger trees.
Boreal High	BOH	Middle to upper elevations of forested areas in all ecodistricts west and south of the Boreal/Taiga boundary formed by the height of land of the Mackenzie and North Oglivie Mountains. Found above the BOL in large valleys. Characterized by steep slopes in Mackenzie and North Ogilvie Mountains ecoregions and gentle rolling plateaus in the Yukon Plateau-North and Klondike Plateau ecoregions. Summers are brief, cool and moist, with long cold winters. Forests are dominated by black or white spruce with black spruce, birch and to a lesser extent aspen common.
Subalpine	SUB	Sparsely forested areas at moderate to higher elevations on steep slopes above the BOH. Subalpine areas form a transitional zone between forested Boreal and the higher elevation non-forested, Alpine bioclimate zones. Open canopy conifer forests (tree cover < 20%) and shrub communities are characteristic vegetation conditions. Tree heights are below 10 meters and vegetation is not considered forested by Yukon Vegetation Inventory. White spruce and black spruce are the dominant tree species. Winters are long and cold, while summers are short and cool.
Wooded Taiga	WTA	Coniferous or mixedwood forested areas with an open canopy in Fishing Branch Uplands, Nahoni Range, Miner River North, Miner River, Blackstone River Uplands and Whitestone River Uplands ecodistricts. Wooded Taiga occurs in valley bottoms and lower slopes of mountain valleys, or on plateaus and plains. Slope position, aspect and the distribution and depth of permafrost are major influences on vegetation distribution and dynamics. In steep terrain, active slope processes (rock slides, slumps, talus cones) play a major role in the distribution of forests. The zone is dominated by shrub and herbaceous vegetation types but trees are common and well distributed when compared to the Shrub Taiga.
Shrub Taiga	STA	High elevation Shrub Taiga within the Taiga ecozone is akin to the Subalpine bioclimate zone in the Boreal ecozone These areas are tall or low shrub-dominated, with sparse or sporadic tree cover. Shrub Taiga generally occurs at high elevations in northern mountain systems.
Alpine	ALP	High elevations associated with mountainous conditions throughout Yukon. Dwarf shrubs, herb/cryptograms and low-growing and scattered krummholtz trees are the dominant vegetation condition. In very high elevation areas, bare rock, colluvium or ice/snow may be the dominant conditions.

4.2.2 Description of bioclimate mapping process

The following data, supplied by Environment Yukon, were examined to map bioclimate zones.

1. Land cover - Earth observation for sustainable development of forest (EOSD) (Canadian Forest Service)[1] 25m resolution raster data
2. Yukon Vegetation Inventory (YVI) (Yukon Government, Forest Management Branch 2006)
3. 100m interval contour information generated from CanVec (1:50,000 scale) data
4. Water features from CanVec (1:50,000 scale) data
5. Landsat 5 satelite imagery
6. Google Earth™ imagery
7. Yukon fire history (1:50,000 scale) polygon data
8. North Yukon Regional Terrain, ecodistrict and bioclimate mapping (1:100,000 scale)
9. National Hydrographic Network (NHN) watershed boundaries

In addition, Canadian Gridded Climate Data (available at http://www.cics.uvic.ca/climate/data.htm) and Agroclimate mapping (Eley and Findlay, 1978) and soil suitability mapping (Rostad et al 1979) were also consulted in mapping bioclimate zones.

Internal review by the project team occurred throughout the bioclimate zone mapping.

Initially the Taiga/Boreal boundary was refined by observing broad patterns of tree distribution, known occurrence of permafrost and the concept that the Boreal forest is subject to influence of Pacific weather systems while the Taiga is subject to greater influence of Arctic weather systems. Portions of the existing Taiga/Boreal boundary closely coincided with the height of land in the Mackenzie Mountains. The NHN watershed boundaries (Nhn_workunit_limit_2) were used to map the height of land for this boundary.

Upon mapping the Taiga/Boreal boundary, criteria to distinguish the various zones with the available input data (Table 4) were delineated.

Table 4: Identification characteristics for bioclimate zones in the Dawson Planning Region

Zone	Characteristic features	Spatial data used to distinguish upper boundary
Boreal (BOH)	Relatively widespread closed to open forest,	EOSD open forest(26%-60% CC) goes to rare; Yukon Vegetation Inventory no productive forest mapped above upper boundary
Subalpine (SUB)	Sparse forest <20% CC where present	EOSD sparse forest, tall and low shrub goes to rare,
Wooded Taiga (WTA)	Forest with more open canopy and less widely distributed than in Boreal	EOSD open forest(26%-60% CC) goes to rare[2],
Shrub Taiga (STA)	Shrub/herb dominated but occasional sparse trees	EOSD sparse forest , tall and low shrub goes to rare,
Alpine (ALP)	No erect trees, vegetation dominated by herb, dwarf shrubs and bryoid vegetation	

[1] Described at http://cfs.nrcan.gc.ca/subsite/eosd/mapping.
[2] Overall amount of EOSD open forest less in wooded Taiga relative to Boreal, no YVI data available for Taiga

The reliability of the EOSD data was checked using Landsat and Google Earth™ imagery. In general, the resolution was not sufficient to make reliable calls on treed versus shrub dominated terrain. In a few areas (along the Dempster Highway) some high resolution Google Earth imagery was available. In these areas, the EOSD tree classes were reasonably well mapped.

For these areas, the highest elevation that EOSD tree classes (particularly the open class) consistently become rare determined the BOH/SUB and the WTA/STA boundaries. For the SUB/ALP and STA/ALP boundaries, the consistent highest elevation of EOSD mapped sparse tree or EOSD shrub classes were found.

In areas with YVI data it appeared that the upper 200 meters of elevation where the EOSD mapped tree classes (generally Conifer open or sparse), the landscape is comprised of short trees (<10 meters tall) and non-productive forest (subalpine conditions). The observation that the upper elevation EOSD forest classes should be considered subalpine was corroborated by local experts (Karen McKenna and Rhonda Rosie). In areas without YVI data, the Boreal/Subalpine and Taiga Wooded/ Shrub Taiga boundaries were mapped about 200 meters below the highest elevation where the EOSD consistently mapped open and sparse treed classes in areas greater than about 5 hectares.

The patterns of tree and shrub distribution were observed on different aspects to determine if aspect influenced the upper limits of these distributions. No consistent aspect effect was noted.

Elevation rules were derived from the observations of the consistent elevation where distinguishing features of the upper zone boundaries (Table 4) were seen. The approach of using the highest consistent elevation of distinguishing characteristics of the bioclimate zone (widespread > 10m high trees in the example of the BOH/SUB boundary) to predict bioclimate zone boundaries is appropriate because the most important driver of regional climate, within a relatively restricted range of latitude, is generally elevation (Eng and Meidinger 1999). There are many other determinants of tree distribution on the landscape such as disturbance history (e.g. recent or repeated fires) and soil conditions (e.g. very coarse or shallow soils). When interpreting the EOSD or YVI data, the fire history data was checked to ensure that this was not influencing the data. The highest consistent elevation of tree or shrub occurrence reflects the regional climatic potential of the site rather than transitory disturbance influences, soil influences or local climate effects on vegetation distribution. Elevation rules were created for each zone (Table 5).

With the exception of the BOL/BOH, two elevation rules for all zone boundaries based on a latitude split were created. The southern boundary of the Tatonduk Mountains ecodistrict delineated the location of the rule changes. Zone boundaries were 100 to 200m lower in the northern most portion of the study area, hence the rule changes.

Table 5: Elevation rules for bioclimate zone boundaries

Geographic Location	Bioclimate Zone boundaries	Elevation (m)
South of Tatonduk Mtn. ecodistrict	BOL/BOH	450
South of Tatonduk Mtn. ecodistrict	BOH/SUB	1100
South of Tatonduk Mtn. ecodistrict	SUB/ALP	1500
South of Tatonduk Mtn. ecodistrict	WTA/STA	No WTA mapped in south
South of Tatonduk Mtn. ecodistrict	STA/ALP	1500
Tatonduk Mtn. ecodistrict and north	BOL/BOH	450
Tatonduk Mtn. ecodistrict and north	BOH/SUB	1000
Tatonduk Mtn. ecodistrict and north	SUB/ALP	1300
Tatonduk Mtn. ecodistrict and north	WTA/STA	900
Tatonduk Mtn. ecodistrict and north	STA/ALP	1300

Existing bioclimate zone mapping from adjacent planning areas was also examined. These helped confirm elevation rules in some instances. The existing bioclimate zone mapping appears to have mapped existing vegetation, in large part, rather than regional climate, as zone boundaries often varied in elevation by several hundred meters over a few kilometers. The existing bioclimate mapping of the Taiga, wooded and shrub zones did not show a pattern that could be interpreted as related to regional climate (very patchy distributions and inconsistent elevational sequences).

In initial discussions with Yukon Government staff, it was suggested that the entire Boreal zone within the Dawson Planning Region was Boreal High. However, Karen McKenna noted that valleys of the Central Yukon have warm continental summers with long days that result in large timber and more rapid growth than in adjacent upland areas. As well, the growth of grain crops, hay and vegetables also reflects the warmer regional climate of these valleys. After examining climate data and tree productivity, An unpublished agroclimatic capability report (Eley and Findlay, 1978) and Soil Suitability and Land Evaluation of the Yukon Territory (Rostad et al 1979) identify those parts of the valleys which have class 3-5 climatic ratings (forage to grain crops possible).

As the class 5 and better climate areas correlate fairly well with the extent of the BOL bioclimate zone mapped in the Regional Ecosystem Classification and Mapping of the Yukon Southern Lakes and Pelly Mountains (EBA 2003), the extent of class 5 agroclimate was used to map the Boreal Low.

Once the elevation rules were applied to map bioclimate zones, all resultant polygons that were smaller than 250ha were removed. Although 250ha is a larger minimum polygon size than commonly suggested ($1cm^2$ or 100ha at 1:100,000 scale) (RIC 1996), 250ha is the minimum polygon size considered to represent "regional" climate by the British Columbia biogeoclimatic classification (Eng and Meidinger 1999).

4.2.3 Description of bioclimate zones

4.2.3.1 Boreal Low (BOL)

The BOL is a narrow elevation band from 300 to 450m along the major rivers covering 269,855 hectares or 6% of the study area.

The dominant EOSD classes found in the Boreal Low are:

- treed classes - 39% of total area (mostly conifer open and sparse)

- low shrub - 28% of total area
- water – 15% of total area

The definition provided in the RFP document (Environment Yukon 2009) describes the BOL as continuously forested. The EOSD data for BOL in the Dawson Planning Region indicates that there are substantial areas that are not forested and that trees cover no more area in the BOL than in the BOH in the Dawson Planning Region. The most widespread tree species found is White Spruce, with black spruce being almost as abundant. Aspen is the next most abundant species with Balsam Poplar and birch being relatively uncommon. Grasslands occur on warm aspects. The BOL has the highest concentration of wetlands in the Dawson Planning Region; 33% of the BOL is covered in wetlands. Active riparian zones are also very widespread in the BOL accounting for 38% of the zone.

4.2.3.2 Boreal High (BOH)

The BOH is by far the largest of the bioclimate zones found in the Dawson Planning Region covering 62% (2,799,469 ha.) of the region. The BOH is found between the Boreal Low and the Subalpine ranging from 450m to 1100m in the southern and central portion of the Dawson Planning Region and up to 1000m in the northern portion of the Dawson Planning Region. The southern boundary of the Tatonduk Mountains ecodistrict marks the change in the mapped upper elevation for the BOH in the Dawson Planning Region.

The dominant vegetation is comprised of low shrubs covering 42% of the zone (EOSD data) while the next most abundant EOSD class is sparse conifer at 24% with open conifer covering 13% (all treed classes total 40% of the zone.) Black and white spruce are the dominant trees and equally abundant within the area that YVI data covers. Birch is also common, while aspen is infrequent. The BOH is characterized by shrubby vegetation on warm aspects while cool aspects are often tree dominated. Active riparian and wetlands are uncommon covering 2 and 4% respectively of the zone.

4.2.3.3 Subalpine (SUB)

The Subalpine zone, the second largest bioclimate zone mapped, covers 14% (623,833ha) of the Dawson Planning Region. The SUB is found above the BOH and below the alpine zone. It is found at elevations of 1100m to 1500m in the south and central parts of the planning region and between 1000m and 1300m in north (again using the same southern boundary of the Tatonduk Mountains ecodistrict for the change in elevation rules).

The dominant vegetation (based on EOSD data) is herbaceous covering 37% of the zone with low shrubs covering 36%. The next most abundant EOSD class is exposed land at 10%. The short-stature, generally sparse trees cover 11% of the zone (Conifers sparse class cover 6% while conifer open covers 5%). Tree species are either white or black spruce Active riparian and wetlands are essentially absent from this zone.

4.2.3.4 Wooded Taiga (WTA)

The Wooded Taiga zone is found in extreme north eastern portion of the Dawson Planning Region. The WTA covers 313,480ha. or 7% of the study area. It is found between about 450m to 900m below the Shrub Taiga.

The dominant EOSD cover types are low shrub covering 46% of the zone, herbs cover 22%, while sparse trees cover 18% (all treed classes total 26%). Although no YVI data exists for the WTA, the dominant trees are likely white and black spruce, given that mixed wood stands are rare in the EOSD data and spruces are noted as dominant trees in the WTA of the adjoining Peel Watershed Planning

Region (Meikle and Waterreus 2008). Wetlands are quite common covering 16% of the zone. Active riparian zones cover 8% of the WTA.

4.2.3.5 Shrub Taiga (STA)

The Shrub Taiga zone is found in the Dawson Planning Region along the Dempster Highway north of North Fork Pass and on the Arctic side of the height of land in the North Ogilivie Mountains. The STA covers 323,532ha or 7% of the Dawson Planning Region. The STA is found above the WTA and below the Alpine bioclimate zone at elevations between 900m and 1300m.

The dominant EOSD land cover classes are herb covering 46%, low shrubs covering 29%, exposed land covering 10% and rock and rubble covering 7% of the zone. All treed classes cover only 4% of the STA. Wetlands are found on 12% of the STA. Active riparian zones only cover 2% of the STA.

4.2.3.6 Alpine (ALP)

The Alpine zone is found at the highest elevations throughout the Dawson Planning Region. In the south and central Dawson Planning Region it is found above 1500m and in the north above 1300m. The ALP covers 198,581ha or 4% of the Dawson Planning Region.

The dominant EOSD land cover classes in the ALP are exposed land covering 35%, herbs covering 34% and rock and rubble covering 16%. Wetlands and active riparian zones are absent from the ALP.

Table 6. Area of bioclimate zones

Bioclimate Zone	Area (hectares)	% of Study Area
Boreal Low (BOL)	269,430	6
Boreal High (BOH)	2,781,005	61
Subalpine (SUB)	633,242	14
Wooded Taiga (WTA)	310,125	7
Shrub Taiga (STA)	317,722	7
Alpine (ALP)	203,939	5

4.2.4 Issues of note

The following issues with the mapping of bioclimate zones have been recognized.

1. The resolution and accuracy of the input data (e.g. EOSD, imagery, YVI) was at times questionable for mapping bioclimate at 1:100,000 scale. For example, there are apparently numerous instances where, on steep north aspects, the EOSD has overestimated tree cover. The YVI data has not been edge-matched between projects and differs dramatically between certain map sheets, for example, map sheets north of 116B01 show dramatically less forest than those to the south.
2. The BOL appears to be climatically distinct from the BOH in the Dawson Planning Region. However, vegetation composition, given our input data, is similar to the BOH. The major distinction is tree size. Also the BOL in the Dawson Planning Region is different from BOL further south (very few tree species and little mixed wood in the Dawson Planning Region). Given that bioclimate zones should be both climatically and floristically distinct, the appropriateness of mapping the BOL in the Dawson Planning Region should be reviewed.

3. Edge matching has not been done to adjoining planning area already mapped, i.e North Yukon and Peel Watershed Planning Regions. The Dawson Planning Region approach was different from previous approaches as elevation boundaries were followed much more closely than in adjoining regions.
4. The Boreal/Taiga boundary was moved and this boundary now bisects the existing Mackenzie Mountains and North Ogilivie Mountains ecoregions. As well, the Boreal/Taiga line runs very close to the planning region boundary, where the Peel Region reaches its most westerly extent. This results in numerous small slivers along the boundary that have been retained as they likely continue into the Peel Region.
5. Numerous bioclimate polygons of less than 250ha have been dissolved into the adjoining polygons (primarily hilltops). This is based on experience from British Columbia where these hilltops often do not reflect the trends of regional climate. These small polygons may be retained down to minimum legible size of 100ha.
6. There are several areas where hilltops are at elevations slightly below the elevation at which a change in zones would occur. The vegetation on these hilltops resembles the zone found at higher elevations. For example, in the south east corner of King Solomon's Dome ecodistrict there are many hilltops at just over 1100m, however the top 200m or so of these hilltops appears subalpine like (shrubby). This is likely the result of soil factors (shallow soils on ridges) and local climate (wind exposure) rather than a regional climate effect. On nearby hills that rise to higher elevations, the BOH/SUB boundary is again found at 1100m. Another example of this is in the Nahoni Range ecodistrict in the north eastern corner of the Dawson Planning Region, where numerous ridges rise to less than 1300m and alpine vegetation is found to elevations of 900m. Again this may be largely due to very coarse and shallow soil conditions. Again in adjacent areas, shrubs and trees can be found consistently although uncommonly to elevations of 1300m. This point is made to provide rationale for retaining the elevation rules for mapping the bioclimate zones in these hilltop situations.
7. In mountainous terrain, cold air effects are often seen and may be mappable at 1:100,000 scale (particularly for the BOH/SUB boundary). Cold air effects have not been mapped as this was beyond resolution of the input data to accurately identify these boundaries. Cold air mapping may require higher resolution remote sensing data or field observation.

4.2.5 Recommendations

1. The issues outlined above are taken into consideration when interpreting the mapping.
2. The bioclimate mapping should be considered a first approximation that may be refined through field verification or as more accurate digital data become available.
3. Explore the use of climate data to generate isolines for the Yukon for growing degree days, Mean Annual temperatures, frost free days and other parameters which could be correlated to the extents and location of bioclimate zones.

4.3 Ecodistricts

4.3.1 Definitions

Ecodistricts are the level in the National Ecological Framework defined as subdivisions of ecoregions due to "distinctive climate, landforms and vegetation associations". Ecodistricts are discrete polygons which nest within ecoregions. The differentiating characteristics of ecodistricts are: regional landform, local surface form, permafrost distribution, soil development, textural group, vegetation cover/land use classes, range of annual precipitation, and mean temperature. Ecodistrict size is a function of regional variability of these defining attributes, and the minimum size is approximately 100,000ha.

4.3.1 Description of Ecodistricts

Ecodistricts are described in terms of ecoregion, physiography, bedrock, glacial history, surficial materials, bioclimate zones and occurrence of permafrost in Table 7 (Boreal) and

Table 8 (Taiga).

Table 7: Ecodistrict definitions – Boreal

ecodistrict name	ecodistrict number	ecoregion	physiography	bedrock	glacial history	surficial geology	Bioclimate zone (Tree spp.)	permafrost
Tatonduk Mountains	865	North Ogilivie Mtns.	lower dissected mountains	NA shelf; clastic+limestone	unglaciated	colluviums, bedrock	ALP-SUB-BOR-(taiga)	Clm
King Solomon's Dome	881	Klondike Plateau	dissected plateau	Yukon-Tanana; metamorphic clastic and igneous	unglaciated	colluvium, morainal deposits	BOH, BOL to just into subalpine	Elm
Top of the World	882	Klondike Plateau	dissected plateau, higher than rest of Klondike Plateau	Yukon-Tanana; metamorphic volcanic, ultramafics	unglaciated except for upper 60mile River	colluvium, morainal deposits,Rock	BOR, SUB	Elm, most has pfst.
Dawson Range	883	Klondike Plateau	Mountains	Yukon-Tanana; igneous clastic	unglaciated	colluvium, morainal deposits/ Rock	SUB-ALP-BOH	Elm
Scottie Creek	884	Klondike Plateau	ponded thermokarst valleys	Yukon-Tanana; clastic	pliocene-early pleistocene	Fluvial, morainal deposits	BOH	Elm
Flat Top Mountain	896	Klondike Plateau	dissected plateau	Yukon-Tanana; some ultramafics	pliocene-early pleistocene	colluvium, morainal deposits	BOH, (Sb, Sw)	Elm
Stewart Plateau	899	Yukon Plateau North	plateau	Selwyn Basin; limestone+clastic	pliocene-early pleistocene	morainal deposits/ colluvium, morainal deposits	BOH, BOL (Sb,Sw)	Elm
Tintina North	900	Yukon Plateau North	plateau	Selwyn Basin; clastic	pliocene-mid pleistocene	morainal deposits	BOH, BOL (Sb, Sw, birch, At)	Elm
Tombstone Range	9109	Mackenzie Mountains	rugged north-south trending mountains, cirque valleys	Selwyn Basin; Cretaceous hornblende/ biotite syenite controls form of the mountains	late-mid pleistocene	Rock, colluvium, morainal deposits	ALP, SUB, BOR	Elm
Kandik River Uplands	9126	North Ogilivie Mtns.	dissected by R valleys flowing west to Yukon	Triassic Jurassic and Cretaceous sediments; clastic+ some limestone	unglaciated-a few valley glaciers	colluvium, morainal deposits// Rock	BOR, SUB, ALP	Clm
Brewery Creek Mtns	9300	Yukon Plateau North	mountains	Selwyn Basin; limestone	mainly unglaciated	colluvium, morainal deposits/ Rock	SUB-ALP	Elm
Tintina_ Gravel Lake	9302	Yukon Plateau North	dissected plateau	Yukon Tanana; clastic	pliocene-early pleistocene	morainal deposits\ Rock	BOH, BOL: (Sb, Sw, At, birch)	Elm
Mt Klotz	9303	North Ogilivie Mtns.	mountains	NA shelf; limestone/clastic	Mountain glaciation-pleistocene and earlier	colluvium, morainal deposits/ Rock	SUB, ALP, BOH	Clm

ecodistrict name	ecodistrict number	ecoregion	physiography	bedrock	glacial history	surficial geology	Bioclimate zone (Tree spp.)	permafrost
Mt. Gibben	9306	Mackenzie Mountains	rugged mtns, cirques	NA shelf; limestone +	mid-late pleistocene	colluviums, morainal deposits, bedrock	STA- ALP-SUB	Clm
Klondike Plateau West	9307	Klondike Plateau	dissected plateau	Yukon-Tanana	unglaciated	colluvium, morainal deposits// Rock	BOR, SUB	Elm
Ladue River Mountains	9308	Klondike Plateau	dissected plateau	Yukon Tanana; plutonic, metamorphic	unglaciated	colluvium, morainal deposits// Rock	BOH	Elm
Antimony Mountain	9311	Mackenzie Mountains	rugged mountains	Selwyn Basin; sediments, clastic, limestone	late to early pleistocene, pliocene	Rock/ colluvium, morainal deposits/morainal deposits	SUB, ALP	Elm
Fifteen Mile Mountains	9312	Mackenzie Mountains	dissected mountains and plateau	Selwyn Basin; mixed sedimentary clastic, limestone and basalt	some glaciated western part unglaciated	colluvium, rock, fluvial	BOR, SUB	Elm
West Chandindu Range	9313	Mackenzie Mountains	rugged mountains	Selwyn Basin; mixed sedimentary clastic, limestone and basalt	mainly unglaciated, pliocene to early pleistoce in east part	colluvium, rock	BOR, SUB, ALP	Elm

Bioclimate zone
Bioclimate abbreviations as per Table 4 – additional information regarding tree species characteristics important for each ecodistrict are described in brackets.

Permafrost
Clm = continuous permafrost with low to medium ice content
Cmh = continuous permafrost with medium to high ice content
Elm = extensive discontinuous permafrost with low to medium ice content

Table 8: Ecodistrict definitions - Taiga

ecodistrict name	ecodistrict number	ecoregion	physiography	bedrock	glacial history	surficial geology	Bioclimate zone	permafrost
Keele Range	864	North Oglivie Mtns.		NA shelf;			taiga -ALP	
Tatonduk Mountains	865	North Oglivie Mtns.	mountains	NA shelf; clastic+limestone	unglaciated	colluviums, bedrock	STA, WTA, ALP	Clm
Hart River Mountains	866	Mackenzie Mtns.	mountains	NA shelf;	mainly unglaciated	bedrock, colluviums, morainal deposits	STA, WTA, ALP	Clm
Blackstone River Uplands	867	North Oglivie Mtns.	intermontaine basin, broad valley	NA shelf; clastic+(limestone)	mid pleistocene-piedmont glaciers	Organic veneer, morainal deposits	STA: sedge tussocks	Cmh , ice wed ge poly gons
South Ogilvie Taiga	872	Mackenzie Mtns.	mountains	NA shelf; limestone+clastic	pliocene-early pleistocene	colluvium/bedrock /morainal deposits	ALP-STA w/sparse trees	Elm
Peel River Lowland	9108	Peel River Plateau	broad valley-lakes, ponds	clastic/(limestone)	Laurentide glaciation/pro glacial Lake/unglacia ted	morainal deposits/L/colluvi um	WTA	Clm
Fishing Branch Uplands	9118	North Oglivie Mtns.	intermontane basin	Triassic Jurassic and Cretaceous sedimentary;	unglaciated	colluvium, fluvial, //bedrock	STA, WTA, ALP	Clm
Lord Creek	9120	North Oglivie Mtns.			unglaciated		taiga-ALP	
Nahoni Range	9122	North Oglivie Mtns.	rugged mountains	NA shelf; limestone-clastic	unglaciated	colluvium/bedrock	STA, WTA, ALP	Clm
Whitestone River-Cathedral Rocks	9123	Eagle Plains	high relief dissected plateau with larger valleys	clastic	unglaciated	colluvium	WTA, STA	Clm
Hart Blackstone Basin	9301	Mackenzie Mtns.	intermontane basin	NA shelf; Limestone/clastic	mainly unglaciated; some pliocene-early pleistocene.	colluvium, morainal deposits	WTA, STA	Clm
Miner Rver Mountains	9304	North Oglivie Mtns.	rugged mountains, cirques	NA shelf, Triassic Jurassic and Cretaceous sedimentary;	mountain glaciation pleistocene-pliocene	colluvium/bedrock / morainal deposits	STA-ALP-some WTA	Clm

ecodistrict name	ecodistrict number	ecoregion	physiography	bedrock	glacial history	surficial geology	Bioclimate zone	permafrost
Miner River Mountains North	9305	North Oglivie Mtns.	mountains and valleys	Triassic Jurassic and Cretaceous sedimentary; clastic	unglaciated	colluvium, bedrock	STA, ALP	Clm
Ogilvie River Basin	9309	North Oglivie Mtns.	intermontane basin	NA shelf; clastic	part glaciated late pleistocene to pliocene.	colluvium/bedrock	STA, WTA	Cmh

Bioclimate zone
Bioclimate abbreviations as per Table 4 – additional information regarding tree species characteristics important for each ecodistrict are described in brackets.

Permafrost
Clm = continuous permafrost with low to medium ice content
Cmh = continuous permafrost with medium to high ice content
Elm = extensive discontinuous permafrost with low to medium ice content

4.3.2 Description of ecodistrict mapping process

The following outlines the process used to map ecodistricts.

1. The following factors were examined independently to determine major controlling factors:

- Examine climate data for patterns.
- Examine physiography for dominant patterns. Region includes the Klondike plateau, Ogilvie Mountains and Yukon Plateau.
- Examine bedrock geology to determine the most significant patterns. Identify major chemical provinces, distribution of lime rich, clastic and ultramafic rock.
- Examine surficial geology and glacial history: In this region there are unglaciated parts, at least 4 stages of mountain glaciation, and pre Reid cordilleran ice sheet glaciation; non glaciated and old glacial coverage are dominated by colluvium//fluvial deposits. Glaciated parts are more rounded with till deposits.
- Examine drainage patterns.
- Examine patterns in vegetation (from EOSD and YVI) and bioclimate delineations.

2. Assess the significance of any patterns that occur in the above data.

3. Draft ecodistrict boundaries representing the best options where patterns are most distinct using 1:50,000 contours, CanVec hydro layer and contours, and Landsat and Indian Remote Sensing (IRS)

satellite images. In areas where NHN derived height of land is close to boundary ensure consistency with NHN lintework.

4. Number and name ecodistricts similarly to previous North Yukon Regional Terrain Mapping (NYRTM) and SLC mapping where possible.

5. Complete ecodistrict description table.

6. Check each polygon and its neighbours with respect to the different input data: previous mapping, climate, physiography, relief, bedrock geology, glacial limits, vegetation patterns, numbers, and names.

7. Review of draft ecodistricts by other team members and Charlie Roots (GSC geologist Whitehorse Yukon).

4.3.3 Issues of note

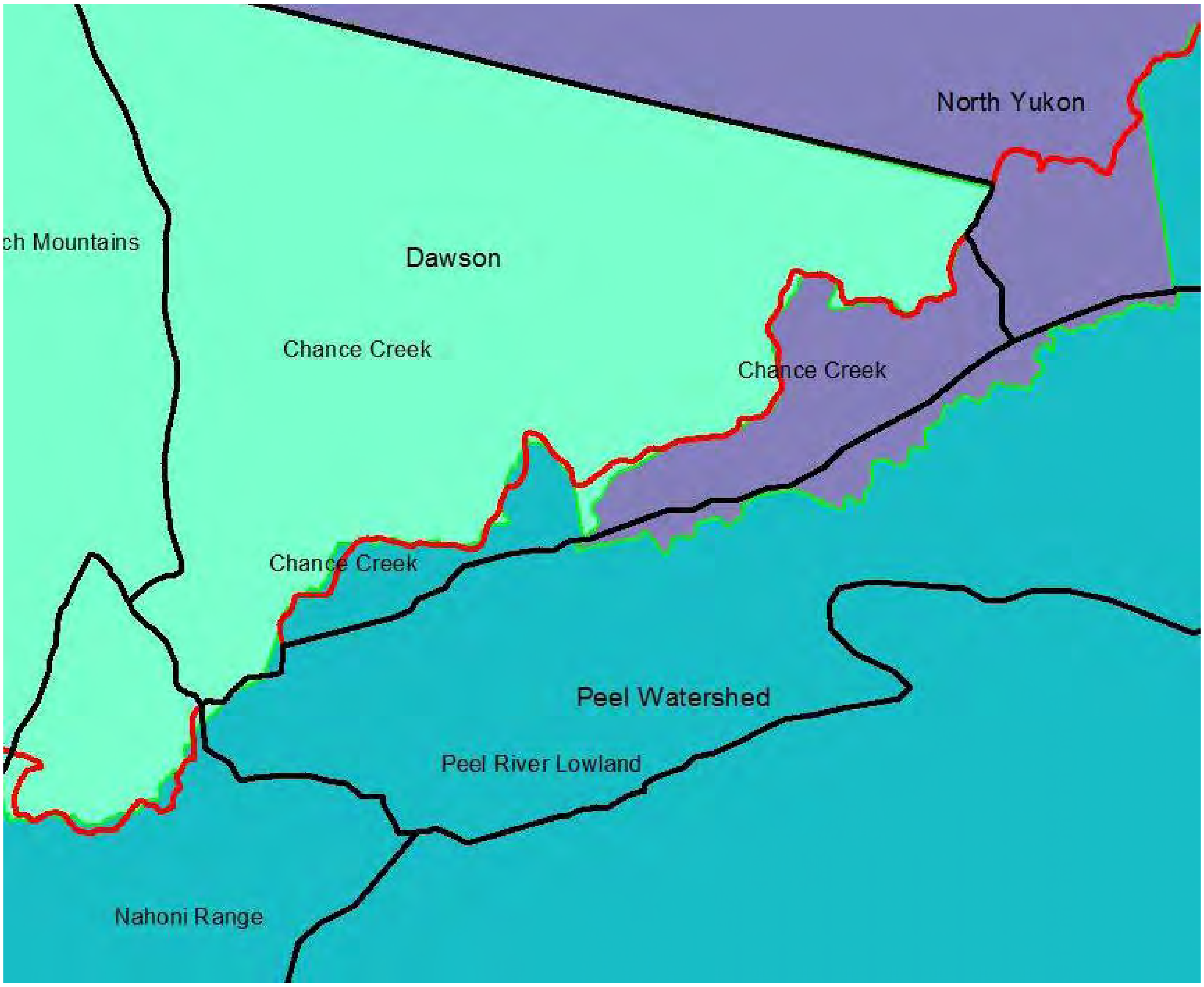
1. The Dawson project area overlaps both the North Yukon and Yukon Plateau north ecological mapping projects. This project's ecodistrict boundaries vary somewhat from previous work.
2. Boundaries have been extended beyond the boundaries of the Dawson Planning Area so that extent and concept of the different ecodistricts can be better understood. These lines are often a bit rough and/or truncated (see Figure 5). An interim ecodistrict map that has not been clipped to the Dawson Region shows roughly where the ecodistricts extend into adjoining planning regions. These should be reviewed for future work on adjoining regions.
3. The ecodistricts nest within the concept of the existing ecoregions. Because exact line locations are determined using 1:50,000 CanVec topography it is understandable that lines do not line up exactly, as ecoregion linework used another topographic base.
4. The ecodistricts are similar to those of the North Yukon project but many ecodistricts have been subdivided based on different bedrock geology, the taiga-boreal bioclimate line, and glacial limits and the associated physiography and vegetation patterns.
5. Attempts were made to ensure two or more of the above factors were distinctly different in adjacent ecodistricts.
6. Changes in vegetation, relief, glacial limits and bedrock don't always coincide exactly so a compromise boundary is often required.
7. Ecodistrict boundaries attempt to follow the height of land according to NHN watersheds wherever possible.
8. Brewery Creek Mountains (9300) polygon is less 100,000 ha. (53,664ha). This polygon consists of unglaciated, rugged mountains similar in geology to the much more rounded, subdued topography to the east. Adjoining ecodistricts are glaciated. The unglaciated nature has resulted in the presence of mineral deposits (gold) mined at the Brewery Creek not found in neighboring areas. Brewery Creek Mountains (9300) while sharing similar topography with the adjacent Antimony Mountain (9311) the bedrock is dissimilar. While 9300 shares similar bedrock with the adjacent Stewart Plateau (899), Brewery Creek Mountains (9300) is far more mountainous.

9. Fifteen Mile Mountains ecodistrict (9312) is also smaller than 100,000 ha (51,207ha). It is largely unglaciated. Though of similar bedrock composition to West Chandindu Range (9313) it is lower in elevation and is not as rugged. Grasslands containing Beringian refugium species are common on its south facing slopes.
10. An ecodistrict called Ogilvie River Mountains was originally drawn between ecodistricts 9301 Hart River Mountains and 865 Tatonduk Mountains which was smaller than 100,000 hectares (68,963 ha). Though it differed from adjacent polygons it was very small. It was therefore split between 866 Hart River Mountains 866 and Tatonduk Mountains 865 based on bedrock and physiography even though according to our ht of land rules it should all be in the Taiga bioclimate zone.The Tatonduk ecodistrict therefore straddles the taiga-boreal boundary. Similar decisions related to the taiga boreal line were part of the Peel and North Yukon Projects.
11. The Dawson planning region boundaries roughly follow the NHN height of land line in some places but do not coincide perfectly.

4.3.4 Recommendations

1. Ecodistrict boundaries have been truncated at the planning region boundary. These are not necessarily the true extents of the ecodistricts. Areas outside The Dawson planning region area should be looked at in more detail when ecodistricts are mapped in adjacent areas.
2. Determine if it is appropriate to delineate ecodistricts that are below the present minimum size criterion (100,000ha). If this is deemed appropriate, then utilize the ecodistricts as presented.
3. If the small ecodistricts are deemed too small. Brewery Creek Mountains ecodistrict (9300) should be joined with Stewart Plateau (899). Fifteen Mile Mountains(9312) should be joined with West Chandindu Range (9313)
4. Consideration should be given to reviewing the Dawson Planning Region boundaries in areas where the height of land is meant to be the actual regional boundary. In the Northeast for example the Dawson boundary follows the NHN height of land closely (as does the Dempster Highway) but the boundaries do not coincide with each other. This creates a large number of sliver polygons along the study area boundary. If the study area boundary is re-defined as the height of land as per NHN rather than the existing lines this would reconcile the ecodistrict and planning region boundaries where height of land is the actual boundary (see Figure 5).

Figure 4: Reconciling Planning region boundaries with NHN height of land



NHN height of land in red, Planning region boundaries in green & Ecodistrict boundaries (resulting from this project) in black.

4.4 Wetlands

4.4.1 Definitions

Five wetland classes are recognized by the Canadian Wetland Classification System (National Wetlands Working Group, 1997), namely bogs, fens, swamps, marshes, and shallow open water (lakes, ponds, streams). All five types occur in the project area, often forming wetland complexes.

Initially fourteen wetland types were initially mapped. These included the five CWCS classes listed above and seven CWCS form/subform levels and two wetland classes not part of the CWCS unique to permafrost terrain. The more detailed types were mapped where this was feasible. Forms mapped include the, bog veneers and swamp drainageways of the Klondike Plateau and Eagle Plains, and riparian shrub swamps. The two classes not found in CWCS are the sedge tussock swamp and upland polygon trench (found in the Blackstone Uplands ecodistrict). In many other cases only the five classes were mapped (bogs, fens, marshes, swamps and shallow water). In other areas complexes were mapped where several classes such as bogs, fens and swamps may be found. Complexes were mapped due to limits of the input data or scale issues. Table 9 describes the 14 wetland types that were initially mapped.

Table 9: Wetland class and form descriptions (initial mapping)

Map label	Map label description	Description	Location
B	bog	sparsely treed or shrub peatland with near surface permafrost.	thin peat veneers on lower slopes or infilling wetlands near fens lakes and ponds.
Bv	veneer bog	thin peat layer with shallow permafrost	on lower slopes throughout Klondike plateau and some parts of Ogilvie Mountains
F	fen	herb, shrub or treed peatland with some water flow.	often adjacent to ponds and lakes; infilling oxbows on floodplains
M	marsh	herb and and partially exposed gravel and soil adjacent to ponds, rivers and streams	throughout
Mr	riparian marsh	herb and and partially exposed gravel and soil adjacent to rivers and streams	throughout
S	swamp	tall to medium shrubs along flowing stream or in drainage, pediment slope with near surface permafrost	throughout
Sd	drainageway swamp	drainageways in veneer bogs on level to gentle slopes; slightly taller shrubs or trees, may have hydrophytic species in addition to bog species.	widespread in Taiga bioclimate zone
Sp	upland polygon trench	mini swamps, fens, standing water in trenches of upland polygons	extensive in Blackstone uplands
Sr	riparian swamp	tall to medium shrubs along flowing stream	along creeks throughout the planning area
Ss	sedge tussock swamp	very shallow peat overlying shallow permafrost; seepage occurs along the permafrost table	on pediment slopes throughout the Klondike Plateau, and through the Ogilvie Mountains and Eagle Plains.
W	shallow open water	any standing water, ponds	throughout
Wb	basin water	lakes and ponds	found most commonly in glaciated areas; many are tarns in cirque valleys
Wo	oxbow water	ponds in oxbows on river floodplains	river floodplains throughout planning area
Wt	thermokarst water	ponds with collapsing banks formed by melting high ice permafrost	widespread in the blackstone River Uplands on floodplains, forming beaded drainage found throughout the taiga bioclimate zone and associated with permafrost in all parts of the planning area

Upon review by the Yukon Environment it was decided that the number of wetland classes should be reduced. For the final mapping, five wetland classes were defined as per Table 10. In addition lakes larger than 50 hectare and rivers were added from CanVec to complete the final wetlands layer.

Table 10: Final wetland classes and descriptions

wetland map code	Wetlands	description
D	Depressional wetlands	wetland complexes infilling depressions of the landscape. They may be adjacent to open water and may include marshes, fens, bogs, peat plateaus bogs, palsas and swamp wetlands
Lakes	Lakes > 50 ha	taken directly from CanVec
P	Polygonal wetlands	wetlands complexes associated with upland ice wedge polygons; about 10% of polygon is likely wetland
R	Riparian wetlands	includes swamps and other wetlands infilling oxbows and other depressions along creeks and rivers)
Rivers	Rivers	taken directly from CanVec
S	Toe and gentle slope wetlands	includes bog veneers, sedge tussock fens, swamp drainageways and other wetlands on gentle slopes of pediments, fans, aprons and toe slopes)
W	Open water	all lakes, ponds <=50ha

4.4.2 Description of wetland mapping process

The wetlands captured in previous mapping projects based on topography and satellite imagery were used as a starting point for the derivation of this map layer. These wetlands situated primarily on flatter terrain and usually associated with open water bodies were extracted from the CanVec and EOSD datasets using a set of queries. (EOSD = Water, Wetland-Tree, Wetland-Shrub, Wetland-Herb, or CanVec = Polygonal Water features or YVI Soil Moisture Regime = “w” or “a” and YVI land type = non-vegetated water)

The resultant map was carefully examined and it was felt that this product would be insufficient to fully support the needs of planners in the Dawson Planning Region. The use of the YVI data as a soel source of wetland information was complicated by three main factors; incomplete coverage of the project area, inconsistency in representation and an offset in relation to CanVec derived layers as the older NTDB base map underpins the YVI. For this reason any queries developed based on YVI “fell apart” as the result only worked in some areas where wetlands were accurately interpreted. Along the edges the offsets due to the different basemap created “ghost” images of actual wetlands when compared to the CanVec derived data layers. The EOSD wetlands alone tend to under-represent the actual extent of wetlands especially those on more sloping terrain.

As the landscape varies between ecoregions and ecodistricts, so do the types of wetlands found and their distribution on the landscape. As wetlands are different and occur in different parts of the landscape, different methods were used for identifying different kinds of wetlands.

To ensure the best possible representation, given the available input data layers, customized queries were developed on an ecodistrict basis or more frequently for a group of ecodistricts utilizing the EOSD, CanVec, DEM, Slope Curvature classes and the active riparian map. The latter two input layers are new data layers created for this project. Due to the positional offsets of the YVI data set (NTDB vs. CAnVec) it was determined that the YVI should not be used directly in the wetland model as this created "ghosting" effects and did not accurately reflect the position of wetland boundaries in relation to CanVec based data layers.

Curvature modeling similar to that used in the North Yukon and Peel Ecosystem Mapping projects was an appropriate approach to identifying additional wetlands. Table 11 describes the slope curvature classes used as inputs to the wetland mapping process.

Table 11: Slope Curvature classes

Class	Description	Details
1	Convex	>0.333
2	Concave	<-.333 and <8 degree slope
3	Flat (slightly concave)	-0.333-0
4	Flat (slightly convex)	0-0.333
5	Straight inclined	-0.333-0.333 and >5 degree slope
6	Concave, inclined	<0.333 and >8 degree slope

The active riparian layer (see "Active Riparian" -section 4.5 for more details) was used to help identify the kind of potential wetland as per Table 11.

The process ensured that the previously mapped wetlands that were accurately mapped (EOSD & CanVec) were utilized as fully as possible and the shortcomings of previous attempts were augmented by the modeled approach using additional data sources. Using local knowledge to calibrate the model it was possible to extrapolate the process to map the 14 different interim wetland classes. Table 9includes descriptions to the CWCS class and form levels when possible. Table 10 summarizes the criteria used to define the initial wetlands map. Table 13 describes the conversion of the detailed, initial classes to the final mapped classes.

Table 12: Criteria defining wetlands in the Dawson Planning Region

MAP LABEL	CWCS CLASS	ECOREGION	ECODISTRICT #	CanVec_	ELEV	RIPARIAN	CURVATURE CLASSES	YVI CLASS	EOSD GRIDCODE	LANDSCAPE POSITION	VEG DESCRIPTION
Lake	lake	ALL	ALL	HD permanency=1, and Lake >=50ha							
River	river	ALL	ALL	HD permanency=1, River							
M	marsh	ALL	ALL	HD permanency=2,							
W	shallow water	Klondike Plateau, Yukon Plateau North	ALL	permanency=1, L <=50ha		yes				riparian floodplain oxbows; and ponds in tailings	
Wt	thermokarst water	Ogilvie, Mountains, Eagle Plains	881, 882,883, 9126, 9300, 9307, 9308, 9312, 865, 866, 868, 9118, 9122, 9123, 9301, 9305, 9310	permanency=1, L <=50ha	<4300'	no				thermokarst ponds along larger valleys	
Wtb	thermokarst water and shallow basin water	Ogilvie, Mountains, Eagle Plains	884, 896,899, 900, 9109, 9302, 9303, 9311, 867, 872, 9304, 9306, 9309	permanency=1, L <=50ha	<4300'	no				thermokarst ponds along larger valleys; and moraine controlled ponds	
Wb	shallow basin water	Ogilvie Mountains	all	HD permanency=1, L <=50ha	>4300'	no				ponds/lakes in glacial moraine in cirques and mountain valleys	
Sr	riparian swamp	Ogilvie Mountains	867			yes	3,4		51 or 52 or other	floodplains swamps	
Mr	riverine marsh	Ogilvie Mountains	867			yes	3,4		33	floodplain marsh	
Mr	riverine marsh	Ogilvie Mountains	867			yes	3,4		100	floodplain marsh	

MAP LABEL	CWCS CLASS	ECOREGION	ECODISTRICT #	CanVec_	ELEV	RIPARIAN	CURVATURE CLASSES	YVI CLASS	EOSD GRIDCODE	LANDSCAPE POSITION	VEG DESCRIPTION
Sp25	mixed: swamp, water, fen,	Ogilvie Mountains	867			no	3			lower slopes old fluvial and glaciofluvial terraces-wetlands in trenches associated with upland polygons on slight concavities of low-gradient pediment slopes in major valleys	
Sp5	mixed: swamp, water, fen,	Ogilvie Mountains	867			no	4			lower slopes old fluvial and glaciofluvial terraces-wetlands in trenches associated with upland polygons on slight concavities of low-gradient pediment slopes in major valleys	
Mr	riverine marsh	Ogilvie Mountains	864, 865, 866, 872, 9109, 9126, 9300, 9301, 9303, 9304, 9305, 9306, 9309, 9310, 9311, 9308	SS=1							marsh along rivers and large creeks largely unvegetated
MS	marsh, swamp	Ogilvie Mountains	864, 865, 866, 872, 9109, 9126, 9300, 9301, 9303, 9304, 9305, 9306, 9309, 9310, 9311, 9309	no		anywh ere		R or L		adjacent to rivers, ponds	
MS	marsh, swamp	Ogilvie Mountains	864, 865, 866, 872, 9109, 9126, 9300, 9301, 9303, 9304, 9305, 9306, 9309, 9310, 9311, 9310	no		anywh ere			and GRIDCODE=20	adjacent to rivers, ponds	

MAP LABEL	CWCS CLASS	ECOREGION	ECODISTRICT #	CanVec_	ELEV	RIPARIAN	CURVATURE CLASSES	YVI CLASS	EOSD GRIDCODE	LANDSCAPE POSITION	VEG DESCRIPTION
Mr	riverine marsh	Ogilvie Mountains	864, 865, 866, 872, 9109, 9126, 9300, 9301, 9303, 9304, 9305, 9306, 9309, 9310, 9311, 9311	no		yes		RS	OR gridcode=33		
Sr	riparian swamps	Ogilvie Mountains	864, 865, 866, 872, 9109, 9126, 9300, 9301, 9303, 9304, 9305, 9306, 9309, 9310, 9311, 9312	no		yes			if GRIDCODE=51, 52, 81, 82, 232	riparian riverine swamps	swamps along rivers and large creeks dominated by shrubs, and some balsam poplar
St	swamp/marsh/ bog	Ogilvie Mountains	864, 865, 866, 872, 9109, 9126, 9300, 9301, 9303, 9304, 9305, 9306, 9309, 9310, 9311, 9313	no		yes			if GRIDCODE= 83 or 100 or 40	riparian marsh	sedge tussock swamps or Sb sedge tussock swamps
	NOT A WETLAND	Ogilvie Mountains	864, 865, 866, 872, 9109, 9126, 9300, 9301, 9303, 9304, 9305, 9306, 9309, 9310, 9311, 9314	no		yes			other		
Ss	swamp/bog	Ogilvie Mountains	864, 865, 866, 872, 9109, 9126, 9300, 9301, 9303, 9304, 9305, 9306, 9309, 9310, 9311, 9315	no		non riparia n	2, 3		if GRIDCODE=52 or 83 or 100 or 40	gentle slopes and terraces	sedge tussock swamps or Sb-sedge tussock swamps
Sd	Drainageway swamp	Ogilvie Mountains	864, 865, 866, 872, 9109, 9126, 9300, 9301, 9303, 9304, 9305, 9306, 9309, 9310, 9311, 9316	no		no	2,3		if GRIDCODE=51,	drainageways on gentle slopes and terraces	

MAP LABEL	CWCS CLASS	ECOREGION	ECODISTRICT #	CanVec_	ELEV	RIPARIAN	CURVATURE CLASSES	YVI CLASS	EOSD GRIDCODE	LANDSCAPE POSITION	VEG DESCRIPTION
SFB	swamp, fen, bog	Ogilvie Mountains	864, 865, 866, 872, 9109, 9126, 9300, 9301, 9303, 9304, 9305, 9306, 9309, 9310, 9311, 9317	no		no	2,3		if GRIDCODE= 81, 82	gentle slopes and terraces	
Sr	Riparian swamp	Ogilvie Mountains	864, 865, 866, 872, 9109, 9126, 9300, 9301, 9303, 9304, 9305, 9306, 9309, 9310, 9311, 9318	no		no	2				tall-med willow swamps along smaller drainages
	NOT A WETLAND	Ogilvie Mountains	864, 865, 866, 872, 9109, 9126, 9300, 9301, 9303, 9304, 9305, 9306, 9309, 9310, 9311, 9319	no		no	2,3		if GRIDCODE=other		
BvSF	Veneer bog-swamp/ fen	Klondike Plateau, Yukon Plateau North	9308, 9307, 9302, 900, 899, 896, 883, 882, 881			yes	2,3		81-Wetland Treed,	Older parts of inactive floodplains along major rivers, and along meandering creeks on broad valley floors	Stunted Black Spruce with a shrub understory and thick Sphagnum moss ground cover; organic soils; permafrost present; often associated with fens and thermokarst ponds; also likely includes some riparian white spruce

MAP LABEL	CWCS CLASS	ECOREGION	ECODISTRICT #	CanVec_	ELEV	RIPARIAN	CURVATURE CLASSES	YVI CLASS	EOSD GRIDCODE	LANDSCAPE POSITION	VEG DESCRIPTION
FBvS	fen/veneer bog/ swamp	Klondike Plateau, Yukon Plateau North	9308, 9307, 9302, 900, 899, 896, 883, 882, 882			yes	2,3		82	Inactive floodplains, in depressional sites and bordering ponds, old oxbows; often associated with Black Spruce bogs; Older parts of inactive floodplains along major rivers, and along meandering creeks on broad valley floors	Usually dominated by shrubs and but often with scattered Black Spruce as well; wet organic soils; permafrost may be present
MF	marsh; fen	Klondike Plateau, Yukon Plateau North	9308, 9307, 9302, 900, 899, 896, 883, 882, 883			yes	2,3		83	Along creeks and bordering ponds; in depressional sites on floodplains; Inactive floodplains, in depressional sites and bordering ponds, old oxbows; often associated with Black Spruce bogs	Grasses, sedges, and forbs dominate, on wet mineral soils; permafrost absent; Usually dominated by shrubs and/or sedges, but often with scattered Black Spruce as well; wet organic soils; permafrost may be present
BvS	veneer bogs, swamps	Klondike Plateau, Yukon Plateau North	9308, 9307, 9302, 900, 899, 896, 883, 882, 884			no	2,3		and 52, 100, and 81, 82, 83	1)Lower slopes and slope toes along valleys and base of narrow gulches; 2) Active and inactive floodplains, along sluggish drainages and small creeks in uplands	1) Stunted sparse to open Black Spruce with shrubs and thick moss and sedge tussock ground cover; swamp right along creek; sometimes with trees, shrubs, sedge tussocks, organic soils and permafrost present; 2) Mainly shrub-dominated swamps (Willows, Alders), on wet mineral or sometimes organic soils;

MAP LABEL	CWCS CLASS	ECOREGION	ECODISTRICT #	CanVec_	ELEV	RIPARIAN	CURVATURE CLASSES	YVI CLASS	EOSD GRIDCODE	LANDSCAPE POSITION	VEG DESCRIPTION
	not wetland	Klondike Plateau, Yukon Plateau North	9308, 9307, 9302, 900, 899, 896, 883, 882, 884			no	2,3		33, 32	1)Lower slopes and slope toes along valleys and base of narrow gulches; 2) Active and inactive floodplains, along sluggish drainages and small creeks in uplands	gravel mine tailings
	not wetland	Klondike Plateau, Yukon Plateau North	9308, 9307, 9302, 900, 899, 896, 883, 882, 885			no	2,3		other treed		
	????	Klondike Plateau, Yukon Plateau North	9308, 9307, 9302, 900, 899, 896, 883, 882, 886			no	2,3		any other classes		
Wo	oxboow water	Eagle Plains	9123, 9118			yes		-	20+	old oxbows	
FMS	likely fen or marsh or swamp	Eagle Plains	9123, 9118	no		yes		-	83, 82, 81		
	NOT WETLAND	Eagle Plains	9123, 9118	no		yes		-	other		
Ss	sedge tussock swamps,	Eagle Plains	9123, 9118	no		no	3	-	52, 40,100		sedge tussock swamps,
FS	likely fen, swamp?	Eagle Plains	9123, 9118			no	2,3		82		
S	likely swamp,	Eagle Plains	9123, 9118			no	2,3		81		
FM	likely fen or marsh?	Eagle Plains	9123, 9118			no	2,3		83		
	NOT WETLAND	Eagle Plains	9123, 9118			no	3		gridcode=other		
Sr	riparian swamp	Eagle Plains	9123, 9118			no	2		any other codes		shrub swamp along small creek

Table 13: Generalization of interim wetlands to final wetland classes

Interim map label	Riparian	final map label
BvS	no	S
BVS and Riparian = Yes then --> R	yes	R
FBS	all	D
FM	no	D
FMS	yes	D
FS	no	D
M	all	R
Mr	riparian	R
MS	all	R
S	no	D
Sd	no	S
SFM	yes	R
Sp(Sp25, Sp5)	all	P
Sr	all	R
Srs	yes	R
Ss	yes	R
Ss	no	S
SsMF	yes	R
W	all	W
Wb	all	W
Wt	all	W
Wtb	all	W

The actual GIS programming was accomplished in one step using the input data layers and the combined logic from Table 12 and Table 13.

4.4.3 Description of mapped wetlands

Wetlands in the Dawson Planning Region occur mainly in poorly drained depressional sites, on floodplains, and on valley bottoms and lower slopes. In the Taiga Ecozone, they also occur on low-gradient pediment slopes along the valleys.

Lakes and ponds in the project area are generally scattered and small, and are mainly found in valleys, on floodplains, or in depressions in morainal deposits (where present), and in cirques in mountainous terrain. Many are the result of thermokarst. Several major rivers traverse the project area, and smaller meandering streams are common in low elevation valleys. Numerous small higher-gradient tributary streams in narrow valleys drain the uplands and mountainous areas. Beaded streams resulting from thermokarst are common features in the Taiga Ecozone.

Bog/fen complexes are common on older deposits of inactive floodplains. Permafrost underlies bogs and some fens, and thermokarst ponds and lakes are common features of these wetlands. Soils of bogs and fens are thick organic (>40cm) deposits.

Black Spruce is the typical bog tree species, with sparse to open cover. Bogs support ericaceous shrubs such as Labrador Tea (*Ledum groenlandicum*) and Blueberry (*Vaccinium uliginosum*), as well as some non-ericaceous Shrub Birch (*Betula glandulosa*) and Willow (*Salix* spp.), with dwarf shrubs and often lichen growing on thick hummocks of *Sphagnum* moss. Bog forms in the project area noted by Oswald and Senyk (1977) include peat plateaus, palsas and string bogs.

Fens may also support Black Spruce, as well as Willows, Shrub Birch, and sedges (*Carex* spp.) or Cottongrass (*Eriophorum* spp.) tussocks. Dwarf shrubs and a few forbs grow over a thick hummocky layer of mosses such as *Tomenthypnum nitens, Aulacomnium* spp., and *Sphagnum* spp. The water table is often at or above the surface in fens, with Willows and *Carex* spp. dominant in the wettest sites. Fens may be flat and relatively featureless, or be highly patterned. In the Taiga Ecozone along the Dempster Highway, patterned fens are associated with thermokarst ponds and lakes on the pediment slopes bordering the valley and along meandering streams. Polygons are also present on the pediment slopes, with a small fen-like wetland component where ice wedges have thawed.

Poorly-drained organic veneer blankets many valley bottoms and lower slopes in the Klondike Plateau Ecoregion, and supports complexes of fens and bogs. On north-facing lower slopes, stunted Black Spruce bogs are common features.

Bog-fen complexes also occur in the Flat Creek area near Gravel Lake along the Klondike Highway, as well as at the north end of the Scottie Creek drainage at the extreme southwestern part of the project area, where thermokarst ponds and lakes, beaded streams, and fens and bogs are common features.

Swamps may occur on mineral or organic soils, and those not adjacent to rivers and streams are commonly underlain by permafrost. Swamps may be tree or shrub-dominated, with Black or White Spruce, Willows, or Alders (Alnus spp.) forming open to dense cover, with variable ground cover. In the Taiga Ecozone, shrub swamps often occur in runnels on the pediment slopes. Marshes mainly occur along streams or lakes, on mineral soil, and lack permafrost. Grasses, sedges, and a variety of forbs dominate these sites.

Sedge tussock swamps/fensare often found on lower pediment slopes or fans. Shallow peat usually 20-30 cm overlies shallow permafrost. Water seeps downslope in the active layer on top of the permafrost table. Where the depth of peat is greater than 40cm often art higher elevations these wetlands would be classified as fens Fs. Vegetation is dominated by Eriophorum tussocks, with Betula glandulosa, Ledum groenlandicum, Rubus chamaemorus and ericaceous shrubs, and Sphagnum. Sedge tussock fens comprise a significant proportion of the Toe and gentle slope wetland (S) class mapped.

Upland ice wedge polygon trenches (Polygonal wetland class (P)) are found along the trenches which overlie the ice wedges of upland ice wedge polygons. These polygons occur in old unglaciated or not recently glaciated landscapes in the Blackstone uplands in the Dawson Planning area as well as many parts of the Yukon North Slope and Herschel Island. While the centre of the polygons is generally not wetland colonized by ericaceous shrubs, sedge tussocks, mosses and lichens, the trenches marking the ice wedges ar eoften wetter dominated by willow species, Carex and mosses. They may be swamps, open water or fens.

Wetlands cover 289,391 ha or 6% of the study area (Table 14). This is a dramatic decrease from the initial mapping when 590,839ha were mapped. This is due to removing polygons smaller than 25ha, that were widespread in the initial mapping. Over half of the wetlands mapped are non-riparian toe and gentle slope wetlands. The next most abundant class (20% of the wetlands mapped) are riparian wetlands. The bioclimate zone with the greatest area of wetlands is the Boreal High (BOH) with 107,337ha (37% of all wetlands mapped). However, this area accounts for only 4% of the BOH zone. The Boreal (BOL) which covers a tenth of the area of the BOH has a similar area of wetland

89,324ha (31% of all wetlands mapped). Wetlands are common in the BOL accounting for 33% of the bioclimate zone. Within the Wooded Taiga (WTA) and Shrub Taiga (STA wetlands are also quite common (16% and 12% of the zones respectively). Wetlands are rare features in the SUB and are essentially absent from the ALP.

Table 14. Area of wetland classes summarized by Bioclimate zone

Bioclimate Zone	Toe and gentle slope wetlands (S) (ha)	Riparian wetlands (R) (ha)	Depressional wetlands (D) (ha)	Polygonal wetlands (P) (ha)	River (ha)	Open Water (W) (ha)	Lake (ha)	Grand Total (ha)	% of all wetlands	% of bioclimate zone mapped wetland
BOH	83,620	13,285	8,031	0	1,684	717	1	107,337	37%	4%
BOL	16,710	26,981	11,077	0	34,116	366	73	89,324	31%	33%
WTA	35,295	12,294	347	0	848	66	0	48,849	17%	16%
STA	13,639	4,966	303	19,548	172	666	138	39,431	14%	12%
SUB	3,911	279	3	84	0	130	0	4,406	2%	1%
ALP	0	2	0	0	0	42	0	44	0%	0%
Total	153,175	57,807	19,761	19,631	36,819	1,986	211	289,391	100%	
% of all wetlands	53%	20%	7%	7%	13%	1%	0%	100%		

Table 15. Area of wetland classes summarized by Ecodistrict

	Wetland class							
Ecodistrict name	Depressional wetlands (D) (ha)	Lake (ha)	Polygonal wetlands (P) (ha)	Riparian wetlands (R) (ha)	River (ha)	Toe and gentle slope wetlands (S) (ha)	Open Water (W) (ha)	**Grand Total (ha)**
Antimony Mountain				215		1501	24	1740
Blackstone River Uplands	233	138	19548	2694	172	15	477	23277
Brewery Creek Mountains				8	2	174		184
Chance Creek	39			2020	76	8620	31	10785
Dawson Range	1			89	3	1035	0	1127
Fifteen Mile Mountains	345			263	48	300		956
Fishing Branch Mountains	117			1671	175	13830	21	15814
Flat Top Mountain	1845			3685	3055	2582	74	11241
Kandik River Uplands	20			2019	42	4033	1	6115
King Solomon's Dome	4115	74		7948	18861	13114	220	44332
Ladue River Mountains	3780			6969	3410	7609	165	21933
Miner River Mountains	41			5122	188	9103	35	14489
Miner River Mountains North	0			141		919	0	1060
Mt Gibben			35	232	16	1860	11	2155
Mt Klotz	44			2234	222	4608	9	7118
Nahoni Range	154			3180	387	7967	10	11697
Ogilvie River Basin	5			1186	22	2954	1	4169
Peel River Lowland						22		22
Scottie Creek	742			73	4	534	110	1464
South Ogilvie Taiga	60		0	1254		6122	200	7635
Stewart Plateau	60			570	315	4562	7	5514
Tatonduk Mountains	69		48	1209	421	4690	28	6465
Thistle Creek Mountains	3097			7650	7649	4242	27	22666
Tintina North	240			1325	429	11686	31	13712
Tintina_Gravel Lake	2656			2592	602	27074	331	33255
Tombstone Range	3			673	34	1434	78	2222
Top of the World	2094			2202	573	10880	70	15818
West Chandindu Range				583	114	1703	24	2424
Grand Total	19761	211	19632	57807	36819	153175	1986	289391

4.4.4 Issues of note

1. A huge area of wetlands have been eliminated due to removal of small polygons (minimum polygon size of 25ha). There is a potential to "recapture" these wetlands as there are many instances where a polygon containing a complex of >80% wetland and <20% non-wetland

would exceed 25ha. Time and budget did not allow for delineation of these complex polygons.
2. CanVec does a good job of representing water bodies.
3. Mis-registration of up to several hundred meters between YVI and CanVec.
4. YVI representation of wetlands is inconsistent. The YVI did identify many wetlands that were not identified by EOSD. It did a much better job than the EOSD in estimating the broad extent of the wetlands especially in the Klondike Plateau ecoregion. However it did not work well to classify wetlands. The airphoto interpretation for forest cover mapping in an ideal world identifies uniform stands of trees. In reality, Sw70 Sb20 B10 may indicate 70 % fluvial Sw and 20% poorly drained Sb forest and 10% riparian balsam poplar. This limits the usefulness of the data. Many riparian corridors were mapped as wet soil moisture regime, however this often include riparian spruce forest as well as mixed spruce-balsam poplar forest in addition to actual wetlands. No one class or standard selection criteria could tease out the wetlands. YVI is also based on NTDB which is offset form data layers that are based on CanVec. This creates a "ghosting" effect with offsets between datasets.
5. The EOSD representation of wetlands is largely incomplete.

4.4.5 Recommendations

1. Pursue the "recapture" of wetlands in wetland/non-wetland complexes through GIS modeling. It is recommended that some of the wetlands lost in this cleaning of small polygons be retrieved by mapping areas dominated by many small wetlands as wetland/non-wetland complexes.
2. Field checking of the mapped wetlands would assist in refining and improving the mapping process.

4.5 Active Riparian

4.5.1 Definitions

"Active" riparian refers to those areas along rivers and streams which are periodically flooded by flowing water. Surficial geology datasets map these sites as active floodplains, and the types of parent material and frequency of flooding interact to determine the types of vegetation communities which may develop.

For the purposes of this project, the active riparian zone can be characterized by 5 different flooding regimes (classes 0-4), progressing sequentially from the river channel through a series of low terraces representing increasing depths of alluvial sediment deposition. A sixth class was added to cover areas for which there is no or insufficient data to determine the flooding regime.

The flood regime classes correlate with stages in succession from open water and barren river deposits to mature forests and organic wetlands. Most of these classes are similar to those used in the Ecosystems of the Peel Watershed (Meikle and Wattereus 2008), but due to the scale of mapping for the Dawson project area, and inconsistencies of the available datasets, two of the Peel Watershed classes were combined. In addition, two classes were added.

The Yukon Vegetation Inventory (YVI) and the EOSD land cover classification were used to extract the land and vegetation types which represent the various flood regimes, and are listed in Table 16 and Table 17.

Classes used for mapping the active riparian for the project area, and their correlation to the Peel Watershed classes follow.

Class 0: Permanent water: This is the open water of the river or stream. While levels may fluctuate, water continues to flow in the main channels throughout the year. Also included in this class is permanent water in oxbows and cutoff channels, and small ponds on the floodplain in which water levels fluctuate with stream levels. This class is not included as an active riparian class in the Peel Watershed report.

Class 1: Strong annual flooding: These sites border the river channels, and during high water are inundated for long periods. Substrates may consist of gravel, sand, cobbles, and silt. They are subject both to erosion and deposition by the river, and while a few pioneer willow shrubs and herbaceous species may establish sparsely on them during extended low water periods, they are usually scoured away or covered by silt during the next high-water event. This class correlates to the Gravel/Sand Bars class in the Peel Watershed.

Class 2: Annual flooding: Sites farther away from the river channels gradually attain sufficient height to escape scouring, and support a wider variety of species, some of which may survive annual flooding and silting and begin to colonize the terraces. On these sites, forbs, graminoids, willows and young Balsam Poplar are common. Farther inland, willow, alder, and young Balsam Poplar form dense stands, with a variety of understory species. A leaf litter layer may accumulate in these stands, but may be covered by silt during flood periods. Riparian Herb and Riparian Shrub of the Peel Watershed classification were combined to form Class 2, due to the generally small area of Riparian Herb communities, too small to map separately at the project scale.

Class 3: Occasional to frequent flooding – 2-5 year intervals: These sites lay farther inland from and higher than the Class 2 sites, and are dominated by Balsam Poplar trees and often White Spruce as well during this phase. Leaf litter layers accumulate on these sites, but may be covered with silt when flooding does occur. This class is similar to the Riparian Mixedwood/Broadleaf Forest of the Peel Watershed.

Class 4: Occasional to rare flooding - >5 year intervals: This class may occupy sites well away from the river channel or lie adjacent to a shifted river channel, and may be flooded during exceptionally high water. Stands of White Spruce and mixes of White and Black Spruce, with variable amounts of Balsam Poplar and/or aspen or birch, are more likely to be flooded only occasionally, while Black Spruce stands, wetlands, and all areas underlain by permafrost may experience only very rare flooding. Thick moss groundcover is common on these sites. This class corresponds to the Riparian Spruce Forest of the Peel Watershed, but also includes very rarely flooded sites which occur on floodplains.

Class 5: Unclassified: This class includes areas for which there is no YVI or EOSD coverage, or where shadow and cloud on the original satellite imagery prevented interpretation. A similar class for the active riparian was not included for the Peel Watershed.

It was noted during the mapping process that flooding events may not affect interior parts of some vegetation types, such as dense poplar and spruce forests on islands and bordering rivers. A 30m buffer was mapped in the active riparian to delineate the probable extent of flooding in these forests along the river, as well as around ponds subject to water table fluctuation related to river flooding.

4.5.2 Description of active riparian mapping process

The surficial geology maps (see Figure 3 for extents) provided the most useful starting point for extracting active riparian areas throughout the project area. An initial set of queries was developed to pull out landforms identified as active riparian. In areas where there was no surficial geology mapping available attempts were made to model a similar extent of active riparian based on the DEM.

Feedback from experts (both internal and YG staff) indicated that, initially, too much area was being mapped as active riparian. Additionally some active riparian areas (e.g. rivers) were being partially excluded. The results based on the DEM were deemed inconsistent and highly suspect. This was linked to the input data for the DEM which was produced at a coarser scale than the attempted application.

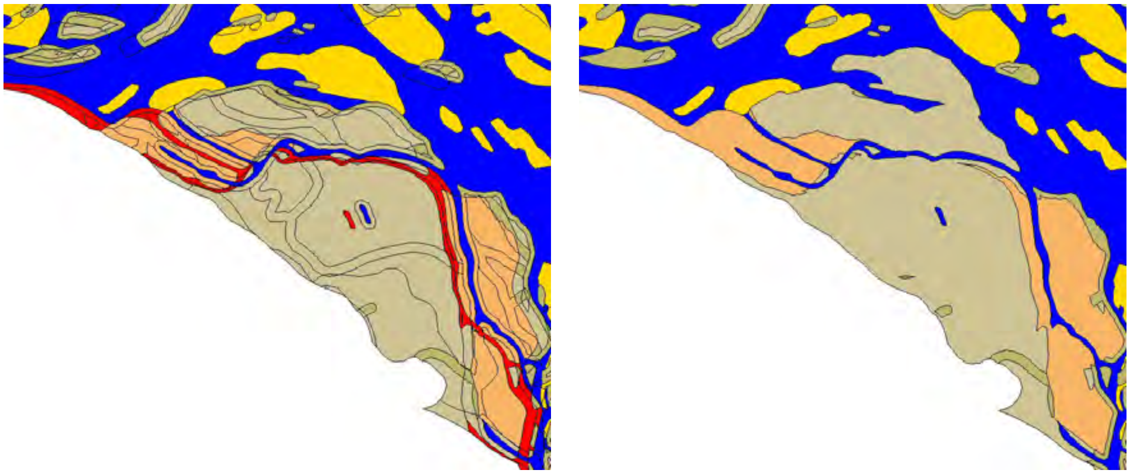
In order to more accurately delineate active riparian areas than the initial attempts, the following steps were taken.

1. The surficial geology queries were made more restrictive (see Appendix) to reduce the area of and better represent active riparian. Due to the non-standardized surficial maps (the standardization process is still ongoing) different selection criteria had to be applied to the data from different surficial geology projects. In areas where there was overlap from two or more maps, the less useful delineation was manually deleted. In areas with no surficial mapping, active riparian was manually interpreted using 1:50,000 contours, hydrological layers (CanVec), satellite images and north Yukon regional terrain mapping and Yukon vegetation inventory (where available).
2. The extent of double line rivers from CanVec were added to the riparian where they extended beyond the active riparian mapped from other sources.
3. Due to the scale of some input layers some manual editing was completed at this stage.

Riparian areas were further classified according to the frequency of flooding based on the vegetation using the YVI where possible and the EOSD (see Table 16 and Table 17 below). This involved several iterations in order to identify all classes as best as possible.

To minimize the impacts of the 'ghosting effect' due to the offset between YVI and CanVec data layers tied to CanVec, a series of controlled eliminates were done where YVI water (based on NTDB) was merged into its adjacent polygons that are not CanVec Water. The images below illustrate how this was accomplished. The red polygons are YVI water and the blue polygons are CanVec Water, YVI water is merged into adjacent polygons that are not CanVec Water. This effectively removes the VYI water (and the ghost effect) without affecting the location of water as per CanVec.

Figure 5: Yukon Vegetation Inventory vs. CanVec offset



Red shows waterbodies from YVI. Blue shows waterbodies fom CanVec.

4.5.3 Detailed methods including GIS query text where applicable

4.5.3.1 115ON_Jackson Active Riparian Queries:

Actual ArcMap Query: ("COMP_A" = 'A' AND "LABEL" = 'm') OR("QUALIFIERB" = 'A' AND "EXPRSN1_B" = 'p') OR("QUALIFIERC" = 'A' AND "EXPRSN1_C" = 'p') OR("LABEL" = 'Ap')

4.5.3.2 116BC_DukRodkin Active Riparian Queries:

Actual ArcMap Query: ("LABEL" = 'h2o') OR (“MATERIAL_A”=’F’ AND "QUALIFIERA" = 'A' AND "EXPRSN1_A" = 'p' AND “AGE_A”=’ ‘) OR ("MATERIAL_B"='F' AND "QUALIFIERB" = 'A' AND "EXPRSN1_B" = 'p' AND "AGE_B"=' ') OR("LABEL" = 'Ap')

4.5.3.3 Thomas_Rampton_1982 Active Riparian Queries

Actual ArcMap Query: "COMP_A" = 'Ap'

4.5.3.4 Rampton_1980 115B, F, G, K

It was decided that for the small area included in the study area, a more accurate representation could be achieved by manual interpretation.

4.5.3.5 Bond_115P

This coverage is non digital at the moment in the study area. 1:50,000 maps exist for part of the mapsheet. Riparian was identified manually.

4.5.3.6 Non mapped areas

These were mapped manually using existing north Yukon regional terrain mapping, 1:50,000 CanVec contours and hydro layers, 15m satellite image and the Klondike IRS image where available.

Table 16: YVI data used in determining active riparian flood regime classes

Cover Type (TYPE)	Cover Type Class (CLASS)	other	Primary, secondary, tertiary tree species (SP1, SP2, SP3)	Flood regime class
NW	R or L	In CanVec Hydro		0
NW	R or L	CanVec: not in HD layer		1
VN	RS			1
VN	H	AND In 30m buffer of Yukon , White and Stewart Rivers. (Surrounded by water i.e. islands on Yukon river. Maybe within tight buffer such as 30m along Yukon White and Stewart Rivers)		2
VN	H	AND not in 30m buffer zone - The rest		4
VN	M	AND in 30m buffer of rivers and creeks		2
VN	M	rest		4
VN	S	AND in 30m buffer of rivers and creeks		2
VN	S	rest		4
NU	T			4
NE	O			4
VN	B, C, E, G, or RD,			4
VF			SP1 or SP2 =B	3
VF			SP3=B and within 30m buffer of any stream	3
VF			Rest of VF	4
	RR	rock		Delete from riparian

YVI TYPE: NE = Non-vegetated exposed land, NU = Non-vegetation urban/industrial, NW = Non-vegetated, water, VF = Vegetated, forested, VN = Vegetated, non-forested

CLASS: B=Burned Area, C=Cryptogam, E=Exposed, G=Gravel Pit, H=Herb, L=Lake, M=Mixed, O=Other, R=River, RD=Road, RR=Rock and Rubble, RS=River Sediments, S=Shrub, T=Tailings

SP1, SP2, SP3: B= Balsam Poplar

Table 17: EOSD data used in determining active riparian flood regime classes

EOSD Classes	Other input data	Flood regime class
	in CanVec HD, permanency=1	0
20	not in CanVec HD	1
	In CanVec permanency=2	1
33		1
100, 83	And within 30m buffer of streams	2
100, 83	Not in 30m buffer	4
51, 52, 82	Within 30m buffer of rivers and streams	2
51, 52, 82	Not within 30m buffer of streams	4
>213		3
		4
81, 211, 212, 213, 40		4
32		Delete from riparian
Unclassified, shadow, cloud		unclassified
Snow, ice	I assume if there is some it is aufeis in valley bottom	2

EOSD classes: 20=Water, 32=Rock/Rubble, 33=Exposed Land, 40=Bryoid, 51=Shrub Tall, 52=Shrub Low, 81=Wetland Treed, 82=Wetland Shrub, 83=Wetland Herb, 100=Herb, 211=Coniferous Dense, 212=Coniferous Open, 213=Coniferous Sparse

Following the generation of the interim active riparian layer using the criteria based on surficial geology, YVI, EOSD, and manual edits, a minimum size criterion was applied in a similar fashion as with wetlands. Isolated polygons that were not at least 25ha in size were removed. Polygons that were larger than 25 ha were retained as were adjacent polygons that together summed to at least 25 ha even though individually they would be too small to retain.

4.5.4 Description of active riparian zones

Three major rivers flow through the Boreal Ecozone in the project area, namely the Yukon River and its two major tributaries, the White and Stewart Rivers. These rivers flow through wide flat valleys mostly confined on both sides by steep bedrock slopes.

Most of the floodplain of the White River consists of a maze of constantly shifting braided channels and temporary islands of exposed sediments. Along the sinuous Yukon River, vegetated islands are common in the southern part of the project area, and few terraces above flood level are present along the river course. Downstream from Dawson City, there are few islands or exposed floodplain except near the Alaska boundary. The Stewart River channel is narrower and mostly straight, with a few islands and meanders.

These rivers have relatively little inactive floodplain, mostly occurring where tributary creeks flowing from the uplands have formed alluvial fans and aprons in the river valley, or where the main channel has shifted to the other side of the valley, leaving vegetation on the abandoned floodplain to develop successionally into a variety of forests and wetlands.

Smaller low-gradient, tortuously meandering tributary streams are common throughout the project area, and are the most common stream type in the Taiga Ecozone. The active riparian zone along these streams is mapped as the width between the outermost parts of the meanders on either side.

Active riparian zones cover 191,455ha or 4% of the Dawson Planning Region. Half of this area is found in the occasional to rare flood regime class (>5 years between flood events). The largest area of active riparian 103,739ha (or 54% of all active riparian mapped) and largest proportion of a bioclimate zone mapped as active riparian (38%) is found in the BOL.

Small polygons (<25ha) were eliminated from the initial area mapped however this had a very small impact on total active riparian mapped. A lot of the isolated ponds outside of main active riparian corridors were lost although the impact was not as severe as with the wetlands layer. A reduction of 1.5% or just under 3,000ha was seen due to the removal of small active riparian polygons.

Table 18 Area of active riparian flood regime classes summarized by Bioclimate zones

Bioclimate Zone	Permanent water (0) (ha)	Strong annual flooding (1) (ha)	Annual flooding (2) (ha)	Occasional to frequent flooding (3) (ha)	Occasional to rare flooding (4) (ha)	Unclassified (ha)	Grand Total (ha)	%of all active riparian	% of bioclimate zone
ALP	42	0	0	0	0	0	42	0%	0%
BOH	2,204	1,402	7,052	7,163	36,596	74	54,490	28%	2%
BOL	34,796	9,057	4,069	19,895	35,910	12	103,739	54%	38%
STA	453	506	1,677	1	4,248	0	6,884	4%	2%
SUB	39	21	125	0	275	0	460	0%	0%
WTA	905	991	5,167	254	18,521	2	25,840	13%	8%
Grand Total	38,438	11,977	18,090	27,313	95,549	88	191,455	100%	
%of all active riparian	20%	6%	9%	14%	50%	0%	100%		

Table 19 Area of active riparian flood regime classes summarized by Ecodistrict

	Active Riparian class						
Ecodistrict Name	Permanent water (0) (ha)	Strong annual flooding (1) (ha)	Annual flooding (2) (ha)	Occasional to frequent flooding – 2-5 year intervals (3) (ha)	Occasional to rare flooding - >5 year intervals (4) (ha)	Unclassified	**Grand Total**
Antimony Mountain	4	45	183	55	1097	51	1434
Blackstone River Uplands	403	262	858		1904		3426
Brewery Creek Mountains	2	0	10	344	912		1269
Chance Creek	110	97	1028	39	2330		3605
Dawson Range	3	0	177	0	274		454
Fifteen Mile Mountains	61	31	38	132	768		1030
Fishing Branch Mountains	186	214	844	33	3795	0	5072
Flat Top Mountain	3151	716	691	2238	6807	5	13609
Kandik River Uplands	42	88	913	223	3717	6	4989
King Solomon's Dome	19374	1744	2017	5360	14662	5	43162
Ladue River Mountains	3562	3614	873	3159	7146	0	18354
Miner River Mountains	196	91	2080	90	7268		9725
Miner River Mountains North	0		44	16	156		217
Mt Gibben	17	102	49	65	407		640
Mt Klotz	222	286	1457	162	6157	7	8293
Nahoni Range	394	495	1259	73	4560	2	6783
Ogilvie River Basin	22	96	353	4	1536		2012
Scottie Creek	86	19	126		253		484
South Ogilvie Taiga	88	242	378		1219		1926
Stewart Plateau	315	219	12	1873	2744	0	5163
Tatonduk Mountains	448	297	688	1176	3820	10	6439
Thistle Creek Mountains	7679	2630	1400	4501	9138	1	25348
Tintina North	436	96	307	2306	3144		6288
Tintina_Gravel Lake	820	224	98	4407	2569		8117
Tombstone Range	74	31	338	275	1527		2245
Top of the World	614	272	1728	342	5083	0	8039
West Chandindu Range	128	67	142	439	2557	0	3333
Grand Total	38438	11977	18090	27313	95549	88	191455

4.5.5 Issues of note:

1. Various map layers do not line up perfectly due to different scales at which maps were produced, the time lag between when the various maps were produced and how the maps were produced. The YVI uses the National Topographic Data Base (NTDB) as does the EOSD. Most of the surficial maps were transferred to NTDB topographic maps and then digitized from that.

2. Because CanVec is the newest topographic base and currently is the best representation of the landscape available for the study it is the basis for the mapping in this project.

3. Because the layers do not line up, classifying the flood classes was complicated. For example: rivers in YVI did not line up with those in CanVec. Rules were established to deal with this such that the extent of rivers in YVI that did not fall within the limits of the CanVec rivers were designated flood class=1. (See Table 16 above for all the details)

4. As well, YVI data were unavailable for the northern part of the project area. Where coverage is available, it is less detailed for some map sheets than for others, and some labels differ from one sheet to another. Classes such as Mixedwood, Shrub, and Herb may actually represent a variety of ecosystem types, and need to be interpreted in a landscape context.

5. EOSD classes are very broad and do not indicate dominant species, and, similarly to the YVI classes, often require interpretation in a landscape context.

6. In addition EOSD and YVI do not always agree on cover types.

4.5.6 Recommendations:

1. Complete the standardization of existing surficial geology mapping (in process by Yukon Geological Survey (YGS)).
2. Encourage filling gaps in surficial (geology mapping YGS is working on this).
3. With more time, additional manual editing could be completed to increase accuracy and detail of the product.
4. Reconcile YVI to CanVec before incorporating YVI derived variable into future GIS models

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