

# Caribou Range Assessment and Technical Information

## APPENDIX A: Human Development Feature (Footprint) Mapping

### 1 Overview

An integrated GIS data set of human land use features/surface disturbances has been developed for the Bathurst Caribou Range Plan (BCRP) Planning Area (Figure 1). The human land use feature mapping was created by compiling and merging available GIS information including the GNWT CIMP database, the National Road Network, and mineral industry-provided information used to support project assessment and permitting activities. The information represents the current situation, and also contains two potential future mineral and transportation development scenarios that may occur in the coming 24-years. The purpose of the future scenarios is to support scenario-based planning as part of the BCRP exercise—they should not be interpreted as predictions of the future.



Figure 1. BCRP planning area.

## 1.1 User Notes

- Human feature mapping within the Bathurst range planning area has been developed iteratively since spring, 2015. The mapping has been guided by input from BCRP Working Group members, the NWT and Nunavut Chamber of Mines, and GNWT Department of Industry, Tourism and Investment. The current version of mapping is 5.0 and was last updated in May, 2016.
- While all attempts have been made to accurately represent and classify existing and future potential human land use features and surface disturbances, at this time individual features have not been checked for accuracy by GNWT staff or other users.
- The human feature mapping developed to support ranging planning within the Bathurst herd range contains not only existing human features, but also potential future developments in the coming 24-years (2016 to 2040). Three potential future Development Scenarios have been created to represent three potential situations: declining development (Case 1), continuing development (Case 2), and increasing development (Case 3). These Development Scenarios should be considered as hypothetical but ‘plausible’—they are not intended to ‘predict’ which mineral or transportation projects may or may not occur within the 24-year future scenario period. The potential future development scenarios generally follow those used by the Jay Project Developer’s Assessment Report (Dominion Diamond 2014) to examine the potential cumulative effects of human development on barren-ground caribou. The BCRP future Development Scenarios are fully described in a separate document.

## 2 Revised Human Feature Mapping

### 2.1 Methods

#### 2.1.1 Linear Features

Linear features are roads, trails, utility corridors, and similar. Linear features in the BCRP planning area were compiled using available linear feature GIS data sets, including the NWT Cumulative Impact Monitoring Program (CIMP) February 2015 linear feature mapping (*HumanDisturbances\_BA\_NS\_SS\_v2.gdb\Permit\_Data\_Lines*), spatial data used for the Jay Project Developer’s Assessment Report (developed by Golder Associates, *DevLyr\_REF\_BASE.gdb\DEVELOPMENT\_FOOTPRINT*), the National Road Network, GNWT Department of Transportation, and other information provided by mineral exploration and development projects. No single information source was adequate to provide a reasonable representation of human linear features in the Bathurst range planning area.

Linear feature mapping was initially compiled as a ‘master’ file of polylines. The polylines were then converted to polygon features by buffering each linear feature by an average width (see

Table 2) to represent the direct areal footprint of the linear feature. The buffered linear features were then merged with polygonal features to create a single human feature database for each of the three BCRP future Development Scenarios (Case 1-3).

### 2.1.2 Polygonal Features

Polygonal features are considered to be settlements, mine sites, camps, gravel pits, and similar. Polygonal features in the BCRP planning area were compiled using available polygon feature GIS data sets, with the CIMP February 2015 polygon feature mapping (*HumanDisturbances\_BA\_NS\_SS\_v2.gdb\Permit\_Data\_Polygons, Unvalidated\_Data\_Polygons*) being the most important. The CIMP 2015 mapping was used as the basis for the polygonal feature dataset.

The Bathurst range plan human polygonal feature updates were completed as follows:

1. The February, 2015 CIMP database was used as the starting point for most polygonal features.
2. All CIMP polygons were maintained, but additional polygons were added or where better information existed, were replaced with other data sets.
3. The Jay Project Developers Assessment Report (Dominion Diamonds 2014) footprint mapping was used to represent future mine site footprints, where available.
4. Where detailed project information was not available, generalized footprints were manually digitized to represent potential future minesite footprints.
5. Seven hypothetical advanced exploration projects were located in areas of high mineral potential (in specific Archean greenstone belts, as suggested by NWT and Nunavut Chamber of Mines).
6. A generalized feature classification was developed based on the detailed CIMP feature classes, and an attribute table was developed that would allow different queries to be performed for current or future direct footprints and their corresponding seasonal ZOI.

Completing the polygon human feature mapping updates was challenging for the following reasons:

1. The CIMP polygon feature mapping was generally derived from land use permit records (i.e., projects that received land use permits were included in the CIMP mapping, regardless of whether they represented an existing visible surface disturbance on the landscape).
2. It was difficult to discern whether many of the existing mineral exploration-related footprints are actively being used, or are historical.

In order to complete the polygon feature updates, a number of decisions regarding the status of each polygon were therefore required.

### Existing Surface Disturbances

The following decision rules were used to determine if polygons included in the CIMP database represented existing surface disturbances:

- Much of the diamond exploration activity in the late-1990s and early-2000s occurred during the winter period, and was focused on or around frozen waterbodies. If the exploration drill holes

recorded in the CIMP database occurred on waterbodies (as represented by 1:50,000 CanVec hydrology features), they were not included as existing surface disturbance.

- If comments in the CIMP database indicated that no visible disturbance was observed during the data capture process, the CIMP polygon features were not included as existing surface disturbance.
- 'Large polygons' of non-specific exploration areas were maintained in the feature mapping but were not included as existing surface disturbance.
- In some situations, professional judgement was required to determine if CIMP polygons represented existing surface disturbances. However, the area affected by polygons subject to these determinations is very small.

#### Human Activities Associated with Surface Disturbances

The following decision rules were used to determine if polygons represented in the CIMP database are currently active or are active as part of the potential future development scenarios—human ZOI is only applied to active polygons:

- Existing surface disturbance polygons occurring on active mineral claims or leases (July, 2014 update) were generally considered to be active, unless specified in the CIMP database that drill programs were completed, etc.
- Known advanced exploration projects and or projects undergoing or recently completed environmental assessments were considered to be active both current, and as part of the potential future development scenarios.
- Past minesites under care and maintenance, or being actively reclaimed, were considered as active features in both the current and potential future development scenarios. In some situations, where mine remediation of old minesites is planned to be completed prior to 24 years future (e.g., Rayrock mine site), these were not included as active features in the potential future situation.

#### Seasonality of Human Activities

While recognizing there can be a large amount of variability, assumptions regarding the seasonal nature of activities associated with each active polygon feature were required:

- Most mineral exploration activities were assumed to occur during the summer period (May-October).
- Settlements, active minesites, and past minesites undergoing care and maintenance, or that are being remediated, were assumed to be active during all seasons.
- Camps and other features associated with the Tibbit-Contwoyto Lake Winter Road were assumed to be active during the winter period only.

#### 2.1.3 Attribute Tables and Feature Codes

Table 1 and Table 2 describe the attribute table structure and feature codes included in the BCRP human feature mapping GIS dataset, respectively. The attribute table contains information for both the current situation and features considered in the potential future development scenarios, the general season when they are present, and their potential zone of influence (ZOI) on barren-ground caribou. The

scenario period is 24 years into the future. The attribute table contains five reporting years (T1 to T5) as follows:

- **T1 = year 2016 (current)**
- **T2 = year 2022**
- **T3 = year 2028**
- **T4 = year 2034**
- **T5 = year 2040**

*Table 1. File attribute table.*

FIELD	Field Properties	Description
<b>ID</b>	Long Integer, 6	Feature segment ID
<b>SOURCE</b>	String, 50	Source for feature representation (named GIS file or other).
<b>FEATURE_ID</b>	String, 10	Unique feature identifier, created through combination of SOURCE and ID: <ul style="list-style-type: none"> <li>• <b>L1234</b> = Linear Feature + ID</li> <li>• <b>P1234</b> = Polygonal Feature + ID</li> </ul> Purpose of field is to create relational link to earlier versions of CIMP-based feature mapping.
<b>FEATURE</b>	String, 10	Field identifying feature type: <ul style="list-style-type: none"> <li>• <b>LINEAR</b> (roads, trails and utility corridors)</li> <li>• <b>POLYGON</b> (mine sites, settlements, camps and similar)</li> </ul>
<b>PROJECT</b>	String, 50	<b>General description of feature</b> , either a specific project name (e.g., Ekati Diamond Mine, Back River Project) or geographic/populated place name (e.g., Gamètì Winter Road). Some features are unnamed.
<b>T1</b>	String, 5	Field identifying if the feature exists at reporting year T1: <ul style="list-style-type: none"> <li>• <b>N</b> = No</li> <li>• <b>Y</b> = Yes</li> </ul>
<b>T1_FCODE</b>	String, 10	2 to 10 letter feature code. <i>See Table 2 below for feature codes and descriptions.</i>
<b>T1_SEASON</b>	String, 5	<b>General season of year the feature is present:</b> <ul style="list-style-type: none"> <li>• <b>A</b> = All-season (used for all features other than winter roads).</li> <li>• <b>W</b> = Winter (January – April, used only for winter roads).</li> </ul>
<b>T1_ZOI</b>	Long Integer, 6	<b>Estimated zone of influence (ZOI)</b> , in metres, associated with each land use feature at T1. <i>See Table 2 below for estimated ZOI extents.</i> If the feature is inactive (a footprint does not receive human use) then ZOI = 0m
Repeat T1, T1_FCODE, T1_SEASON and T1_ZOI for <b>T2 to T5</b> reporting years.		

*Table 2. Bathurst human feature codes, descriptions and estimated zones of influence (ZOI) on barren-ground caribou.*

<b>Feature Type</b>	<b>FCODE</b>	<b>Description</b>	<b>ZOI (m)</b>
<b>LINEAR FEATURES</b> (roads, trails and utility corridors)	<b>AR</b>	<b>All-season Access Road</b> (average 10m width)  Any all-season road, including roads in Settlements.	5,000
	<b>EC</b>	<b>Major Electrical Transmission Corridor</b> (average 30m width)  Any major electrical utility corridor (e.g., Snare River).	4,000
	<b>HW</b>	<b>Public All-season Paved Highway</b> (average 60m width)  Any all-season paved highway (e.g., NWT Highway #3 and #4).	5,000
	<b>MAR</b>	<b>Mainline All-season Access (Haul) Road</b> (average 20m width)  Any major all-season access or haul road (e.g., current Ekati Misery Road or future Izok Corridor road).	5,000
	<b>WR</b>	<b>Winter Road</b> (average 12m width)  All winter roads (excluding main Tibbit-Contwoyto Winter Road).	1,000
	<b>WR_TC</b>	<b>Main Tibbitt to Contwoyto Winter Road</b> (average 40m width)  Mainline Tibbit to Contwoyto Winter Road.	4,000
<b>POLYGONAL FEATURES **</b> (mine sites, settlements, camps and similar)	<b>AIRSTRIP</b>	<b>Airstrip</b> Active airstrip with paved or unpaved surfaces.  <u>CIMP Feature Class:</u> Runway <u>Note:</u> Many runways associated with CAMP may be missing. The Runway feature class in the CIMP database may be under-reported. Where known, additional AIRSTRIP features were added to the CIMP database.	5,000
	<b>CAMP</b>	<b>Camp</b> Mineral exploration camps, lodges and similar.  <u>CIMP Feature Class:</u> Camp <u>Note:</u> This feature class includes a variety of different camp types – lodges, outfitting, highway, research, etc. The most common type of CAMP appears to be mineral exploration camp (the same ZOI has therefore been applied as MIN_EXPL).	5,000
	<b>COMM</b>	<b>Communication Tower</b>  <u>CIMP Feature Class:</u> Communications <u>Note:</u> Only a few communications towers are contained in the CIMP database; these features may be under-reported.	1,000
	<b>GEN_IND</b>	<b>General Industrial</b> A variety of general industrial disturbances.	1,000



Feature Type	FCODE	Description	ZOI (m)
		<p><u>CIMP Feature Class:</u> General Industrial is a “catch-all” category of several CIMP features: <b>Industrial, Culvert Replacement, Fuel Storage, Geotechnical, Oil and Gas, Road Private, Road Public, Staging Area, Woods / Forestry Operations</b></p> <p><u>Note:</u> Most Road Private and Road Public appear to be gravel pits or clearings associated with the major highways (Highway # 3 and #4).</p>	
	MIN_EXPL	<p><b>Mineral Exploration</b> Mineral exploration-related infrastructure and disturbances.</p> <p><u>CIMP Feature Class:</u> Mineral Exploration is comprised of several CIMP features, including selected <b>Mining Exploration, Mining and Milling – Water, Mining Exploration – Mine Shaft</b>.</p> <p><u>Note:</u> There was no single CIMP feature available to represent Mineral Exploration. Many Camp features are also associated with Mineral Exploration activities.</p>	5,000
	MINE_ACTIV	<p><b>Minesite (Active)</b> Minesites under construction or in production.</p> <p><u>CIMP Feature Class:</u> Selected <b>Mining Exploration</b> and <b>Mining and Milling – Water</b> features to represent active mines (i.e., Ekati, Diavik, and Gahcho Kué).</p> <p><u>Note:</u> Several other data sources were used to supplement the CIMP features, as required.</p>	14,000
	MINE_PAST	<p><b>Minesite (Past or Closed)</b> Past or closed minesites, either abandoned or under active reclamation.</p> <p><u>CIMP Feature Class:</u> Closed or past mines are represented by selected <b>Mining Exploration</b> or <b>Miscellaneous</b> features from the CIMP database (e.g., Lupin, Jericho, Tundra, Rayrock, etc.).</p> <p><u>Note:</u> In CIMP database, many past mine footprints were classified as Miscellaneous features; where known, they have been re-classified as MINE_PAST.</p>	5,000
	MISC	<p><b>Miscellaneous</b> A variety of industrial and non-industrial surface disturbances or infrastructure.</p> <p><u>CIMP Feature Class:</u> Miscellaneous features are represented by several CIMP feature classes, including <b>Miscellaneous, Research Projects, and Unknown</b>.</p> <p><u>Note:</u> Some Miscellaneous features in CIMP database are old mine sites, quarries, mineral exploration, communications, etc. Where possible, obvious features were classified as a more accurate feature category. Most CIMP database Miscellaneous features are located along Hwy #3 and #4.</p>	1,000
	PORT	<p><b>Marine Port</b> Future proposed or conceptual marine port facilities in Nunavut on the Arctic coastline (e.g., Grays Bay, Bathurst Inlet).</p> <p><u>CIMP Feature Class:</u> No equivalent in CIMP database.</p>	5,000

Feature Type	FCODE	Description	ZOI (m)
		<u>Note:</u> This feature class was added to represent proposed future port facilities to support mineral development in Nunavut (e.g., Grays Bay as part of Izok Road Corridor, Bathurst Inlet as part of BIPAR concept).	
	<b>POWR_GEN</b>	<b>Power Generation Facility</b> Hydro power generation facilities (dams, spillways, powerhouses, and associated)  <u>CIMP Feature Class:</u> <b>Power Generation Facility</b> (i.e., Snare River, Bluefish, Taltson). <u>Note:</u> associated transmission line clearings and infrastructure is classified as EC (electrical transmission corridor).	5,000
	<b>QUARRY</b>	<b>Quarry</b> Any excavation site used for purpose of developing aggregate, sand, crushed rock, etc.  <u>CIMP Feature Class:</u> <b>Quarrying</b> <u>Note:</u> Quarry features are likely under-reported in CIMP database. Most occur along existing all-season roads and highways.	5,000
	<b>SETTLEMENT</b>	<b>Settlement</b> Any permanent settlement with a recognized municipal boundary (e.g., City of Yellowknife, Whatì, Gameti, etc.)  <u>CIMP Feature Class:</u> <b>Community, Municipal</b> <u>Note:</u> Some settlement areas were manually digitized to better represent direct footprints and built up areas.	15,000



### 3 GIS Files

Three .shp files, named by BCRP Development Scenario, contain the updated version 5.0 BCRP human feature mapping (Table 3). Each has been intersected with the Range Assessment Areas.

*Table 3. Bathurst range plan revised human feature file names.*

FILE	DESCRIPTION
<b>LINEAR FEATURES</b>	
<b>Bathurst_CASE1_human_features_v5_RAA_may2016.shp</b>	Direct footprint of human land use features associated with BCRP Development Scenario CASE 1. <u>Feature Type:</u> Polygon
<b>Bathurst_CASE2_human_features_v5_RAA_may2016.shp</b>	Direct footprint of human land use features associated with BCRP Development Scenario CASE 2. <u>Feature Type:</u> Polygon
<b>Bathurst_CASE3_human_features_v5_RAA_may2016.shp</b>	Direct footprint of human land use features associated with BCRP Development Scenario CASE 3. <u>Feature Type:</u> Polygon

#### 3.1 Projection Parameters

Projected Coordinate System: Canada\_Lambert\_Conformal\_Conic  
Projection: Lambert\_Conformal\_Conic  
False\_Easting: 0.00000000  
False\_Northing: 0.00000000  
Central\_Meridian: -96.00000000  
Standard\_Parallel\_1: 50.00000000  
Standard\_Parallel\_2: 70.00000000  
Latitude\_Of\_Origin: 40.00000000  
Linear Unit: Meter

Geographic Coordinate System: GCS\_North\_American\_1983  
Datum: D\_North\_American\_1983  
Prime Meridian: Greenwich  
Angular Unit: Degree

## 4 Suggested Use

Each of the development scenario cases (CASE 1, 2 and 3) can be queried or symbolized to represent changes in human development features (i.e., direct footprint) or zone of influence at each reporting year over the duration of the 24-year scenario. For example:

- Selecting [T1] = 'Y' identifies which human features are on the landscape in reporting year 1 (2016).
- [T1\_ZOI] identifies the estimated zone of influence associated with a specific feature.
- Selecting [T1] = 'Y' AND [RAA] = 'Area 4' will identify which features are within Bathurst Range Plan Range Assessment Area 4.

## 5 References

Cumulative Impact Monitoring Program (CIMP). 2015. Human disturbance mapping (Bathurst caribou range). Prepared for GNWT CIMP by Caslys Consulting Ltd. Report and ArcGIS geodatabase. February 2015.

Dominion Diamond. 2014. Jay Project Developer's Assessment Report: Section 12, Barren-ground Caribou, and Section 17, Cumulative Effects Summary. Prepared for Dominion Diamond by Golder Associates. October 2014.