April 28, 2017

FINAL REPORT

Pilot Boreal Caribou Habitat Restoration Program Year 1 (2017) Implementation Report

Submitted to:
Brian Thomson
BC OGRIS Research and Effectiveness Monitoring Board (REMB)
300, 398 Harbour Road
Victoria, BC V9A 0B7

REPORT

Report Number: 1668292

Distribution:

1 Copy BC OGRIS Research and Effectiveness Monitoring Board (REMB)
1 Copy Golder Associates Ltd.

Golder Associates

Executive Summary

A Parker Range Pilot Restoration Program Plan (the Program Plan) was developed in 2015 and 2016 (Golder 2016) as the first plan to propose application of habitat restoration techniques over an entire boreal caribou range in Canada. Oil and gas and forestry activities within the Parker Range are expected to be low over the coming decade, providing the opportunity to apply and monitor, with minimal expectation of human disturbance, the effectiveness of habitat restoration techniques over a caribou-range scale in relation to caribou population metrics. The overall objective of the Program Plan is to transition low quality boreal caribou habitat into higher quality habitat by reducing the benefits predators and their primary prey gain through linear corridor use, and establish a vegetation trajectory on these corridors that will in the long term increase boreal caribou habitat intactness. The Program Plan is designed to be implemented over a multi-year period, completing desktop disturbance mapping and implementation planning, implementing restoration treatments, and conducting post-treatment monitoring.

This Pilot Boreal Caribou Habitat Restoration Program Year 1 (2017) Implementation Report is a summary of the first year of implementing restoration treatments on a macro-scale within Zone 1, which was delineated in the Program Plan as the first area to be treated within the Parker caribou range (the Project).

Contained within this Report are detailed summaries of the authorizations acquired prior to the implementation of the restoration treatments, the primary access preparation, stakeholder consultation including First Nations, and treatment implementation. A section is also provided listing key project achievements and lessons learned.

Primary access preparation occurred January 5 to January 8, 2017. Less effort was required to create the primary access route than anticipated due to a requirement from the Ministry of Forests, Lands, and Natural Resource Operations (FLNRO) to only use tracked vehicles within the Project area. The use of tracked vehicles meant the primary access route would not require water to freeze-in sections for rubber-tired vehicles.

The Project treatment implementation occurred from January 13 to March 17, 2017. The Project treated 61 km of legacy linear corridors, 8 more kilometers than planned. An additional 105 km of legacy linear corridors were verified for Leave for Natural. Treatment types included tree-felling, mounding / Tree-felling, and Seedling Planting, Mounding / Seedling Planting, Tree-felling in combination with Coarse Woody Debris spreading, Scarification, and Mounding with no seedling planting. A total of 23,220 seedlings (primarily black spruce) were planted using winter seedling planting techniques. Production during the first few shifts was low as operators learned how to implement the treatments proficiently and travel time by ATV was relatively long because the Project started at the furthest end from the original staging point. As the Project progressed, measures were put in place to increase Project efficiency.

During the Project implementation, modifications were required to either add or drop treatment sites, based on a number of variables including no access to a site because of overgrown lines that may have been used for access, inaccurate vegetation heights and densities from the desktop exercise, and/or the majority of the low impact seismic lines had the same attributes as traditional seismic lines and therefore were treatment candidates. A plan amendment process was developed with Fort Nelson First Nation and FLNRO to address any modifications.

Monitoring plots were established at the mounding and seedling planted sites and are planned to be monitored in fall 2017 to document first year seedling survival.

Acknowledgments

Golder Associates Ltd. would like to express our gratitude to the Fort Nelson First Nation, who provided us with the opportunity to undertake this study in Fort Nelson First Nation traditional territory. In particular Katherine Capot-Blanc, Marilyn Norby, Lana Lowe, Eva Needlay and Chris Ball.

A special thank you also goes out to Fort Nelson First Nation, general contractor Eh-Cho Dene Enterprises GP and their manager Brendan Youb who provided access creation and construction support during the treatment phase of the Program. We also thank the field crews and machine operators for their hard work and contributions towards the successful and safe completion of the Program.

We are grateful for the support of the BC Oil and Gas Research and Innovation Society, and to the Research and Effectiveness Monitoring Board who recommended this Program for funding. In particular, we acknowledge the efforts of the Parker Pilot Team Charter group comprised of Jeanine Hudson, Brian Thomson, Chris Ritchie, Steve Wilson and Megan Waters (Ministry of Forests, Lands and Natural Resource Operations). Thanks also to Ben Rauscher, Shawn Williams, Lisa Helmer, and Trevor Hann for your guidance and advice. Your involvement, support and input into the Program on an ongoing basis provided the opportunity for implementation on the ground.

We are also grateful for the support of the community of Fort Nelson, Wayne Wheeler and other involved members of the snowmobile association and local businesses who provided services, as well as valuable feedback and input into the Program.

Table of Contents

1.0 INTRODUCTION 1

2.0 AUTHORIZATION AND AMENDMENTS 1

3.0 PRIMARY ACCESS PREPARATION 3

3.1 Primary Access Preparation 3

3.2 Secondary Access 3

4.0 TREATMENT IMPLEMENTATION 4

4.1 Tree-felling 5

4.2 Mounding and Seedling Planting 8

4.3 Frozen Seedling Planting 11

4.4 Mounding / Tree-felling / Seedling Planting 11

4.5 Tree-felling and Coarse Woody Debris 12

4.6 Tree-felling and Scarification (Hoe Rip) 12

4.7 Tree-felling / Mounding 12

4.8 Leave for Natural 12

4.9 Signage 12

5.0 MONITORING PLOTS 12

6.0 INDIGENOUS COMMUNITY AND LOCAL COMMUNITY PARTICIPATION AND ENGAGEMENT 13

6.1 Fort Nelson First Nation 13

6.2 Prophet River First Nation 13

6.3 Local Community Outreach 14

7.0 PROJECT ACHIEVEMENTS AND LESSONS LEARNED 14

8.0 CLOSURE 17

9.0 REFERENCES 19

TABLES

Table 1: Habitat Restoration Treatment Summary 5

FIGURES

Figure 1: Typical Spacing for Tree-felling In a Variable Density Treed Wetland 7

Figure 2: Typical Spacing for Mounding In a Variable Density Treed Wetland.....9

Figure 3: Typical Mounding with Berm and Trench 10

APPENDICES

APPENDIX A
As-built Treatment Mapbook

APPENDIX B
Habitat Restoration Photo Log

1.0 INTRODUCTION

The Boreal Caribou (Parker Range) Habitat Restoration Pilot Program Plan (the Program Plan) was initiated in April 2015 by the Research and Effectiveness Monitoring Board (REMB) of the Boreal Caribou Implementation Plan initiative, with funding for the Program Plan provided by the BC Oil and Gas Research and Innovation Society (BC OGRIS). The Program Plan (Golder 2016) was the first plan to propose application of restoration techniques over an entire boreal caribou range in Canada. The Program Plan was developed to guide a multi-year, range scale, restoration program, with field implementation beginning in Zone 1 in January 2017 (Golder 2016). The Program Plan was designed to guide the implementation of habitat restoration treatments along treatment areas identified during the desktop linear classification exercise and confirmed through ground-truthing, throughout the entire Parker Range.

A high-level tactical plan was included within the Program Plan to apply restoration treatments within the Parker Range. The tactical plan was based on treatment of zones within the Parker Range, numbered one to four, which were created and prioritized based on ecological and logistical considerations associated with each zone. The Zone 1 Implementation Plan (the Plan) was developed to focus on treating specific areas throughout Zone 1 of the four Zones identified in the Parker Range Program Plan (Golder 2016) (Figure 1).

Zone 1 is an area approximately 9,215 hectares (ha) in size, originally classified as containing approximately 143 kilometers (km) of traditional seismic line, with approximately 52 km originally designated for treatment and the remaining 91 km left for natural regeneration (Golder 2016). There is approximately 38 km of seismic or road that is considered as No Treatment because it is a provincially designated recreational trail, resource road, or forestry service road. The Zone 1 area was also noted as containing a network of Low Impact Seismic (LIS) lines classified in Oil and Gas Commission (OGC) spatial files obtained during initial linear classification mapping within the Parker Range. Confirmed and probable 3D Low Impact Seismic disturbances were considered to be of low priority for restoration treatments, given predator research results of Dickie (2015) which suggested that wolves, the main predator of caribou, do not utilize LIS lines during the summer months more than the surrounding forest (Golder 2016).

Several modifications were made to the Implementation Plan during field implementation for a variety of reasons, and are outlined in Section 2. During implementation the planned treatment area of 52 km was increased, primarily to account for treatment of LIS lines which were actually the same width as traditional seismic lines. From January to March 2017, 61 km of legacy linear disturbance were treated within Zone 1. An additional 105 km's of legacy linear disturbance was confirmed as 'Leave for Natural' revegetation.

This report provides a summary of the 2017 restoration implementation of Zone 1 (the Project), including: authorization and amendments; primary access preparation, treatment implementation, monitoring implementation, Indigenous and local community engagement, and key implementation learnings.

2.0 AUTHORIZATION AND AMENDMENTS

The Project work was completed under British Columbia Ministry of Forests, Lands and Natural Resource Operations (FLNRO) Forestry Licence to Cut A94341 (the Licence), pursuant to Section 52 of the *Forest and Range Practices Act* to allow Golder Associates (Golder), the licensee, to implement the Parker Caribou Habitat Restoration Plan. The Forestry License to Cut was received on October 7, 2016 and expires on April 15, 2018. The Licence was based on the restoration treatments which were provided both spatially and in report format for

the Parker Caribou Range Restoration Zone 1 Implementation Plan dated December 2015 (Golder 2015a). Conditions of the Licence included:

- The licensee must notify the Fort Nelson Natural Resource District one (1) week prior to commencement of on ground conditions.
- The licensee will notify the Fort Nelson Natural Resource District within one (1) week post completion of on ground operations.
- The licensee is not authorized to remove any timber from within Zone 1 of the treatment area.

The licensee will provide the Fort Nelson Natural Resource District with 'as-built' shapefiles of restoration activities that occurred on the ground.

During the Project, any field alterations to the Zone 1 Implementation Plan such as additions or removal of treatment areas, and deviations in access to sites, required approval from FLNRO. FLNRO would engage with Fort Nelson First Nation, on whose traditional territory lands the activities were conducted, prior to issuing the approval (Hudson, Jeanine, pers. comm. 2017).

In addition to the Licence, Golder obtained the following authorizations and conducted the following stakeholder engagement sessions prior to field implementation:

- Water permit: Required for water use from local water bodies if water is required to freeze-in access. For Zone 1, none was required.
- Watercourse crossings: FrontCounter BC notification of watercourses that may be crossed during the Project, including method of crossing recommended.
- Line locates, third party agreements:
  - No pipelines were crossed during the Project, therefore, no locates were required
  - A Road Use Agreement was obtained from Canfor to use their Pipeline Bypass Road
- Archeological Overview Assessment: An AOA was required as part of the Project, and was submitted to FLNRO on May 12, 2016.
- Trappers: Notification letters sent out on April 12, 2016.
- Public Open House in Fort Nelson, BC: Held May 2, 2016 at the Woodlands Hotel. Attendance consisted of local business people, trapper, interested citizens, and members of the local municipal district and provincial governments.
- Snowmobile club: Met with Wayne Wheeler, President of the Club, prior to the Open House, on-going discussions throughout the summer and throughout the implementation of the Project. Received communication with Trevor Hann, Fort Nelson branch of FLNRO Recreational Department regarding no use of rubber tired vehicles on the recreational trail, as the request of the Snowmobile Club (Hann, Trevor, pers. comm. via email from October 26, 2016).

- Sled Dog Race Organizer: Terry Streeper met with Caitlin Parker to discuss sled dog race routes in early January 2017.

3.0 PRIMARY ACCESS PREPARATION

3.1 Primary Access Preparation

As per Section 5.0 of the Zone 1 Implementation Plan, a winter access route was established in the Zone 1 Treatment area to transport heavy machinery required to complete the restoration treatments (Golder 2015a). The primary access route followed an existing provincially designated recreational trail, resource roads (Canfor pipeline by-pass road) within the area, and where possible, avoided watercourse crossings, drainages, mineral wetland crossings and well-vegetated historical seismic lines. The primary access route was approved within the Licence.

The Project began January 5, 2017 with ground-truthing and freezing-in the primary winter access route to ensure frost levels were sufficient to mobilize heavy equipment. Fifteen centimetres of frost was generally sufficient to move machines across the wetland areas. Areas of focus were previously identified problem areas such as mineral wetlands, fen drainages, and treeless fens. Snowmobiles and a snowcat were used to clear most of the snow from the corridors and to drive frost into the ground where necessary. The majority of the access had sufficient frost levels due to an early winter cold spell with little snow cover. Access creation took less time than originally planned because the original plan was to use water to freeze in problem areas for rubber-tired vehicle access. Since only tracked vehicles were allowed, following snowmobile club requests to FLNRO, the primary and all other access routes for the project did not require water.

Freezing-in the access focused on fen areas where it was anticipated there would be less frost and less organic material to withstand the weight of the larger machines. It was noted during access creation that the provincially designated recreation trail was not exactly the same route that was actively used by recreational users as per FLNRO's records, so modifications were made to the plan to reflect this. For example, as illustrated in Mapsheets A-9 and A-10 in the as-built Treatment Mapbook (Appendix A), a long treatment segment was removed from the Project since it was being used by the recreational users, and the area that was provincially designated as the recreational trail was overgrown with vegetation.

Primary Access preparation was completed in four days, from January 5 to January 8, 2017. As requested by Trevor Hann (pers. comm. 2016), a fence was installed at the beginning of the primary access corridor where it intersected with the Canfor pipeline bypass road.

3.2 Secondary Access

Areas that were used for access to the individual treatment sites which required the excavators to leave the primary access route, were scouted ahead of time each day to measure frost levels. Frost levels measured in the treed and non-treed wetland areas were assessed as sufficient frost depth when a minimum of 15 cm was measured. During the entire field Project, frost levels were maintained as sufficient, and there was no need to freeze in problem areas.

During treatment implementation, there were sufficient levels of frost to support access along the primary and secondary access lines throughout the Zone 1 area. There were a few smaller fen areas that, although able to support heavy machinery travel, were not treated since the frost levels weren't considered adequate to support a stationary heavy machine digging mounds. When this was evident, the machine would travel to the next adequate spot, and resume treatment.

4.0 TREATMENT IMPLEMENTATION

Restoration treatments within Zone 1 of the Project occurred from January 13 to March 17, 2017. The total planned physical treatment of 52 linear km was exceeded, with a total of 62.08 linear km of linear disturbance treated.

The restoration treatment implementation began with a kick-off meeting which was held on January 13, 2017 in Fort Nelson, BC. The Project kick-off meeting included members of FLNRO, the Fort Nelson First Nation, the local Snowmobile Club, Eh-Cho-Dene Enterprises General Partnership (Eh-Cho-Dene) (excavator and field support contractor) and Golder. The field implementation strategy and rationale, and the site-specific safety plan were covered during the meeting.

From January 13 to January 15, two excavator machines were mobilized to the initial staging area and then traveled into the farthest end of the Zone 1 treatment sites using the Primary Winter Access route. It took almost two days to reach the far end of the site and start treatment. The excavators travelled along secondary access to reach the individual treatment sites and treated back towards the area they came from in most cases. In some cases, due to logistical efficiencies, machines were able to start treating their way down a line if there was an exit point off the line that ensured the machine would not treat itself into the end of a line with no way to exit without traveling over the treatments.

The Project was implemented over 8 field shifts, with a set six-days-on and two-days-off work schedule. A total of two unscheduled days were taken off by the crew due to cold weather when temperatures dipped below -30. There were seven days where an excavator broke down over the course of the program, resulting in only one machine operating on the Project those days. The other 40 days of treatment there were two excavators on site, for a total of 87 machine days for the Project. The Project's treatment implementation phase ended on March 17, when both machines were demobilized from Zone 1.

The excavator operators were local employees of Eh-Cho-Dene, the contractor retained to complete the excavator and field support component of the Project. Five operators were trained over the course of the program, generally requiring a shift to become proficient implementing the treatments.

Consistent with the Zone 1 Implementation Plan, treatments included tree-felling, spreading of coarse woody debris, mounding with frozen seedling planting, or a combination of these treatments. Refer to the Treatment Mapbook located in Appendix A for an illustrated version of the final as-built treatments within Zone 1.

Modifications from the Zone 1 Implementation Plan were made during the field implementation based on the following field conditions:

- Previously identified access routes based on Provincial spatial data were overgrown with target tree species;
- The treatment site had greater heights and densities than what was estimated during the desktop exercise and was reclassified as Leave for Natural recovery;
- Previously mapped Leave for Natural sites did not have sufficient vegetation;
- Previously mapped LIS lines from OGC base-layers were not designated for treatment with the Zone 1 treatment plan but required treatment upon field verification where the lines were similar width to traditional seismic lines (> 5 m), had little to no natural revegetation, and had fresh wolf tracks;

- High potential archeological sites could not have ground disturbance; the Zone 1 Implementation Plan considered known archeological sites, but not high potential sites since the Archeological Overview Assessment had not yet been completed; and
- Provincially registered recreational trails were inaccurate, or local recreational groups were using the line for either snowmobiling or other purposes. For example, it was requested by the sled dog race organizer to leave certain corridors open for their annual March race, however, the shapefile provided of the route was inaccurate and adjustments were made in the field to avoid treating the sled dog race areas that overlapped with treatment sites.

When modifications were required to add additional sites, both FLNRO and Fort Nelson First Nation's consultation leads were contacted to discuss the recommended treatment. Fort Nelson First Nation provided their approval to treat sites that were not part of the original Implementation Plan. Once approval was granted, FLNRO was sent a copy of the approval for provincial government approval. The engagement between Fort Nelson First Nation and FLNRO was done in a timely manner and therefore there were no negative impacts to the Project time or production wise.

Over the course of the Project, 61 km of historical linear disturbances were treated with heavy equipment with the length and percentage of each treatment type outlined in Table 1. An additional 104.85 km were confirmed as Leave for Natural recovery. The treatments are illustrated in the Treatment Mapbook located in Appendix A, as an as-built of the final treatments.

Table 1: Habitat Restoration Treatment Summary

Treatment Method	Length Treated (km)	Average Width (m)[(a)]	Percentage of Treatment
Tree-felling	26.37	6	43%
Mounding / Seedling Planting	13.02	6	21%
Mounding / Tree-felling and Seedling Planting	16.34	6	27%
Tree-felling / Coarse Woody Debris	1.38	6	2.5%
Tree-felling / Scarification	0.4	6	1%
Tree-felling / Mounding	3.24	6	5.5%
Total	61	-	-

[(a)] The average width of the seismic lines was calculated during the desktop exercise during the Program Plan development as ~ 6 m.

Note: Numbers are rounded for presentation purposes; therefore, it may appear that the totals do not equal the sum of the individual values.

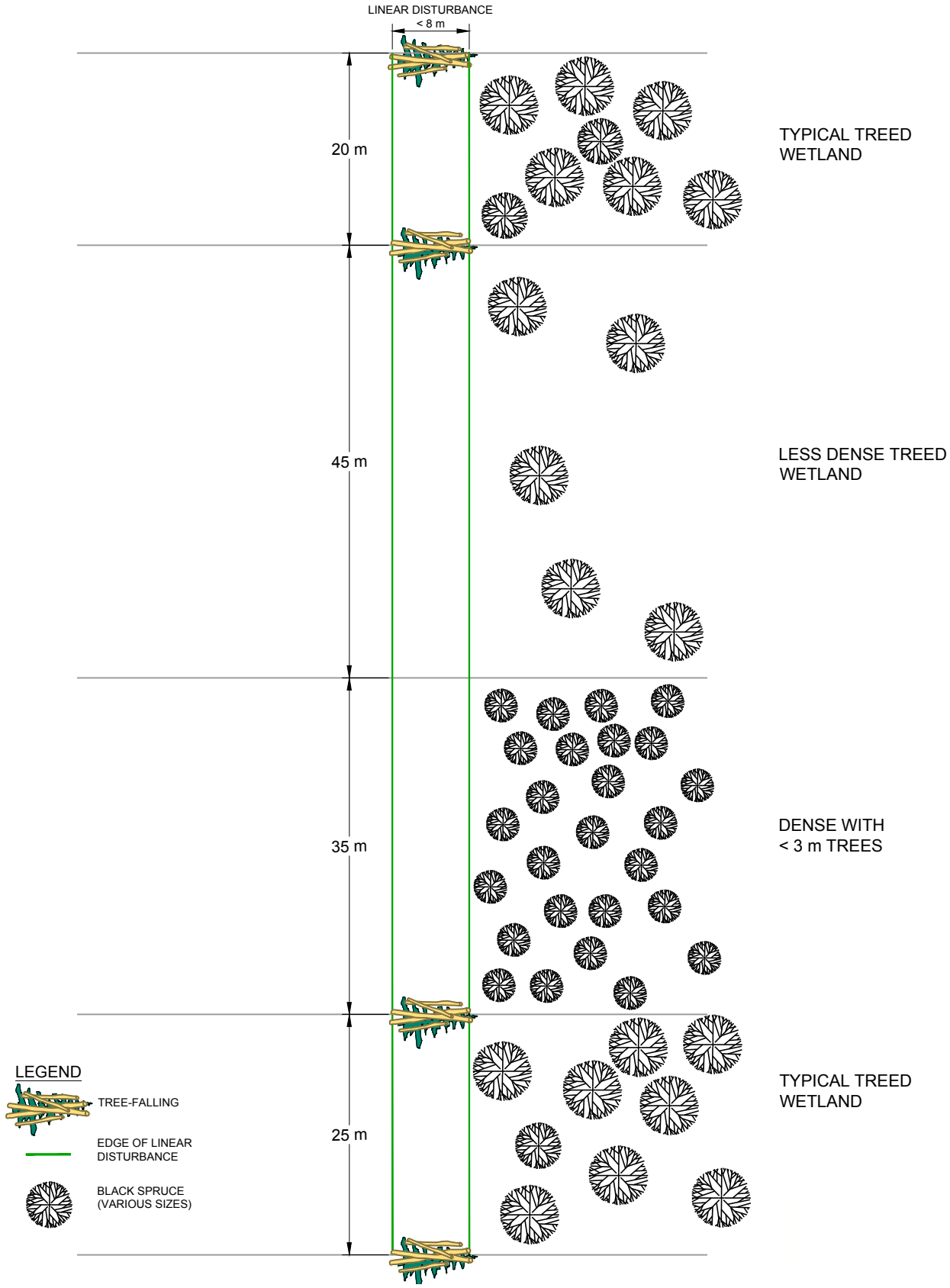
4.1 Tree-felling

A total of 26.4 km (42% of total treatment length) were treated with tree-felling.

Sites treated with tree-felling were completed predominantly with a Caterpillar 325 excavator, with a small percentage hand-cut. The excavator would push the tree over with the bucket. Tree-felling by hand was limited to access control sites adjacent to main access corridors due to health and safety concerns with treating remote sites which were difficult to access and treat because of deep snow and dense vegetation. As per the Zone 1 Implementation Plan, tree-felling sites had trees knocked over in clumps approximately 20 m apart, with the number of stems knocked over directly related to the average Diameter at Breast Height (DBH) of the adjacent cover type. Typical example of tree-felling on a variable density treed wetland is shown in Photo 1 and Photo 2

(Appendix B). Upland sites with wider DBH had approximately 5 stems knocked over at each site, while lowland sites could have up to 20 stems or more due to the small DBH of sufficient trees. In the lowland areas, trees were only felled approximately 20 m apart when sufficient trees were available, and the distance between treatment sites was determined by the availability of sufficient trees to form an adequate access control barrier. Under these circumstances, distance between treatments was site specific and determined at the time of treatment. The majority of the trees felled were on transitional and lowland areas, and were predominantly non-merchantable black spruce (Sb).

Figure 1 illustrates the strategy employed depending on the available trees to drop.



CLIENT
BC OGRIS

PROJECT
PARKER CARIBOU RANGE HABITAT RESTORATION ZONE 1 FIELD IMPLEMENTATION

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-28
DESIGNED	BC
PREPARED	RFM
REVIEWED	BC
APPROVED	PB

TITLE
TYPICAL SPACING FOR TREE FELLING IN A VARIABLE DENSITY TREED WETLAND

PROJECT NO.	CONTROL	REV.	FIGURE
1668292	7000-RL-0002	0	1

4.2 Mounding and Seedling Planting

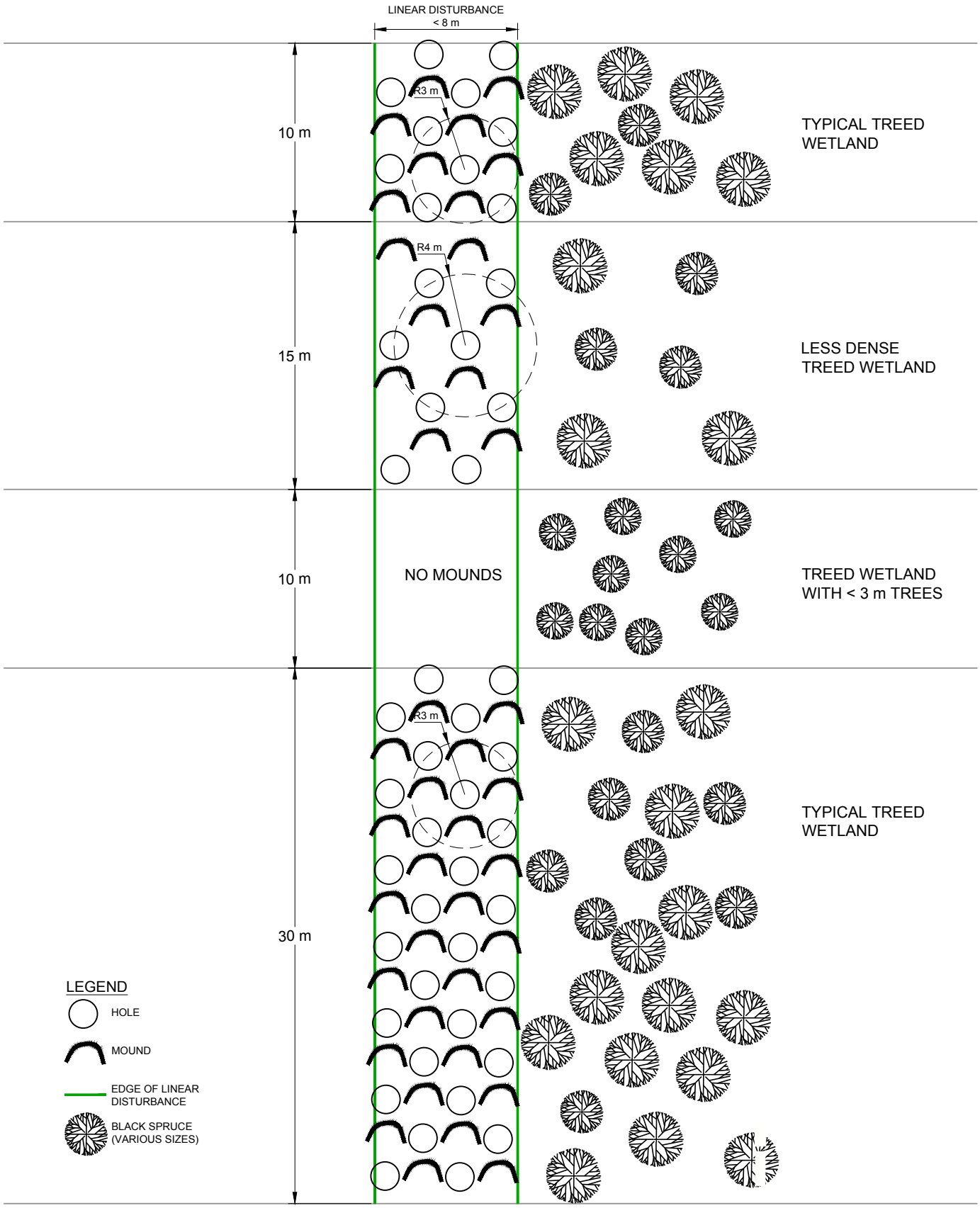
A total of 13.02 km (21%) was treated with mounding and frozen seedling planting.

Sites treated with mounding and frozen seedling planting were completed with a Caterpillar 325 excavator with a 1.5 m wide bucket with frost breaking teeth attached. The mounds targeted 1,200 microsites/ha suitable for seedling planting, using a traditional mounding style of leaving undisturbed space between mounds (Figure 2). However, given the deep frost conditions which occurred during the Project, many of the treated sites were completed using a modified mounding method, by creating a trench across the line, compared to the traditional mounding style (Figure 3). In these cases, the number of suitable microsites was estimated by measuring how many microsites were within the 3.99 m radial plot circle used to determine mound density. In order to provide at least 1,200 suitable microsites the distance between the centers of the suitable microsites was 3 m. Figures 2 and 3 illustrate the method employed on the treatment sites. Both methods targeted approximately 1200 suitable microsites. Figure 2 is a standard silviculture method for mounding, and Figure 3 illustrates a modified version the field crews started to employ since the organic material was coming out in large frozen chunks.

To ensure organic material could be used to prepare proper planting microsites, the field crew leads determined that this modified method not only met the objective of microsite creation, but also was likely more effective at discouraging human and wildlife use than the traditional style of mounding which leaves an area between the mounds to walk by. It is anticipated there will not be any difference in seedling survival and growth between the separate mounding strategies. Examples of mounding using a berm and trench style and the traditional silviculture style is shown in Photo 3 and Photo 4 (Appendix B), respectively. Quality Assurance/Quality Control (QA/QC) density checks were completed randomly on each line, several times per day, to ensure the target number of suitable microsites was being achieved at each different site series along the linear disturbance.

The excavator operators left undisturbed, to the extent possible, existing target naturally occurring trees, and would leave areas undisturbed when there was sufficient naturally occurring target species. Note the naturally occurring Sb tree left undisturbed in Photo 5 (Appendix B) near the bottom right of the photo.

Efforts were made during the treatment to leave as much organic material on the top of the mound as possible, since this is the ideal planting medium for frozen seedlings. Example of planting frozen seedlings on a berm style mounding treatment is shown in Photo 6 (Appendix B). Some areas had relatively little organic material, with clay located just underneath a thin organic layer. These areas were planted in what organic material was available, or within the clay if it was considered that the seedling roots would be able to penetrate the clay layer down into the organic layer. See Figure 3 for an example of a typical treatment site and the different layers of organics and soil as represented by the color change in the soil.



CLIENT
BC OGRIS

PROJECT
PARKER CARIBOU RANGE HABITAT RESTORATION ZONE 1 FIELD IMPLEMENTATION

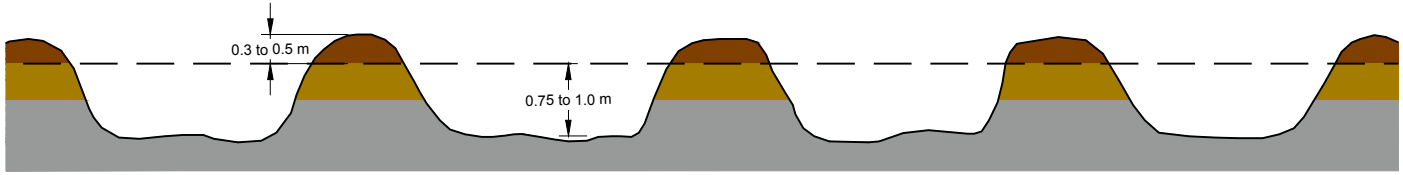
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-28
DESIGNED	BC
PREPARED	RFM
REVIEWED	BC
APPROVED	PB

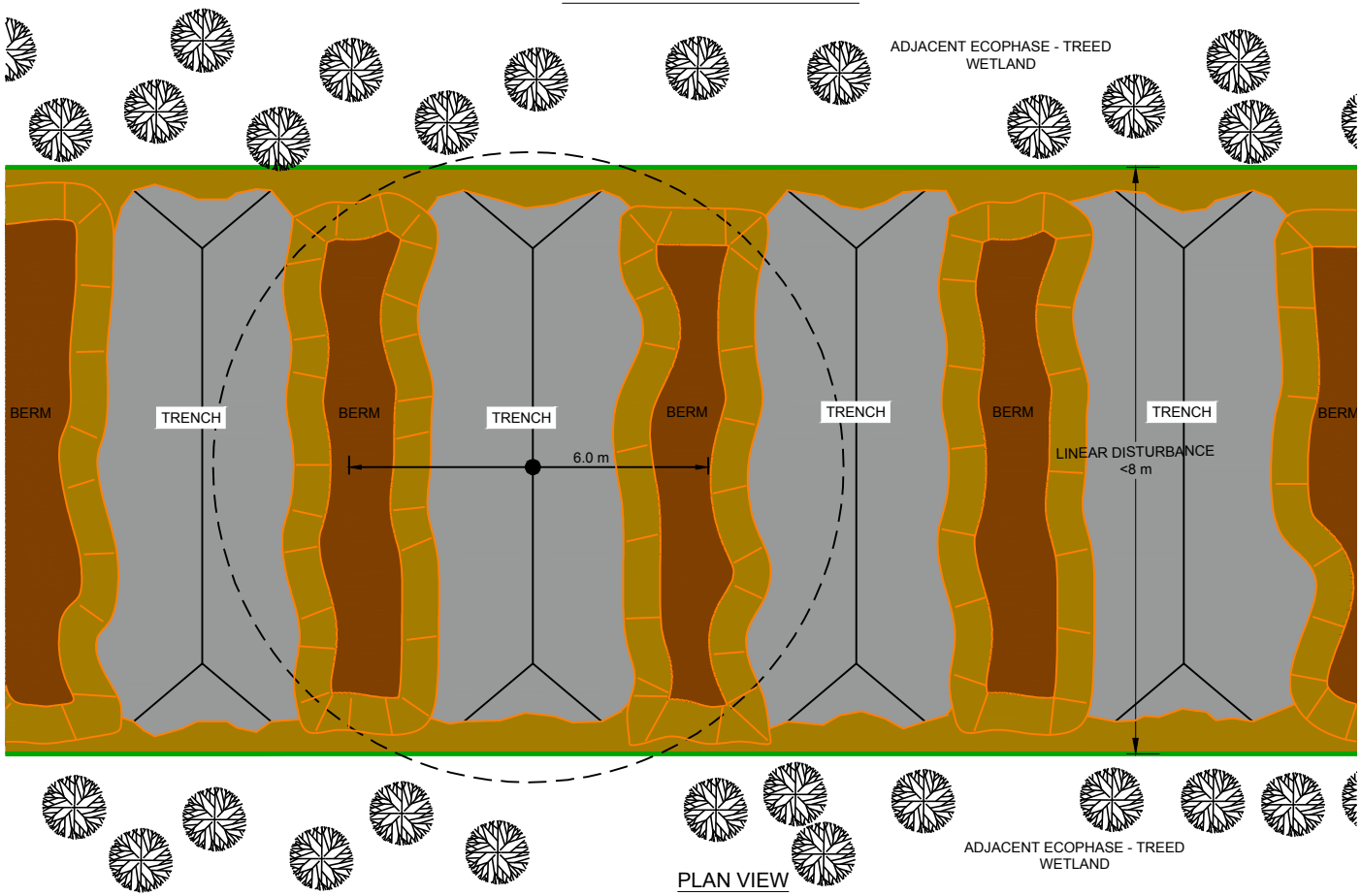
TITLE
TYPICAL SPACING FOR MOUNDING IN A VARIABLE DENSITY TREED WETLAND

PROJECT NO.	CONTROL	REV.	FIGURE
1668292	7000-RL-0001	0	2

Last Edited By: bmcdonald Date: 2017-04-24 Time:4:09:56 PM | Printed By: AMagheran Date: 2017-04-28 Time:4:19:26 PM
Path: \\golder.gds\CALIM\CAD\BC_OGRIS\BC_Victoria\99_PROJECTS\1668292\02_PRODUCTION\7000\DWG\ | File Name: 1668292-7000-RL-0003.dwg



SCHEMATIC CROSS-SECTION



PLAN VIEW

SITE PHOTOGRAPH

SITE PHOTOGRAPH

LEGEND

- EDGE OF LINEAR DISTURBANCE
- PLOT CENTRE
- BLACK SPRUCE (VARIOUS SIZES)

CLIENT
BC OGRIS

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-28
DESIGNED	BC
PREPARED	AM
REVIEWED	BC
APPROVED	PB

PROJECT
PARKER CARIBOU RANGE HABITAT RESTORATION ZONE 1 FIELD IMPLEMENTATION

TITLE
TYPICAL MOUNDING WITH BERM AND TRENCH

PROJECT NO.	CONTROL	REV.	FIGURE
1668292	7000-RL-0003	0	3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

0 25 mm

4.3 Frozen Seedling Planting

Twenty-three thousand and forty (23,040) black spruce (Sb) and 1,800 white spruce (Sw) seedlings were grown at Tree Time's Little Smoky nursery, individually wrapped (I-wrapped), and then frozen and put into cold storage beginning in November 2016. The frozen seedlings were transported via a temperature-controlled storage truck to Fort Nelson, BC on January 13, 2017 and placed into a snow cache in order to provide an insulating layer to reduce temperature fluctuations within the cache. Temperature data recorders were placed into a handful of boxes to track the temperature of the seedlings from the time they were shipped till the time they were taken out into the field for planting.

The frozen seedlings were planted on mounded areas immediately following mounding (Photo 7, Appendix B). Twenty-three thousand and forty (23,040) Sb seedlings were planted, and 180 Sw, for a total of 23,220 seedlings, where mounding was completed. Mean seedling density was 1271 seedlings per hectare, with the density varying due to the density of the mounds, how many seedlings were planted on the available microsites, and the amount of line segment left untreated due to low levels of frost, naturally occurring openings in the line, or existing naturally occurring tree species were avoided. At the beginning of the program the seedlings were planted at a density of 1 per mound or per available micro-sites, with density varying by the density of the mounds or available micro-sites. Fewer mounds were made at areas with lower density of adjacent trees, reducing the number of seedlings required. More planting on lines that were treated with mounding occurred in the latter half of the treatment program to utilize the seedlings but also to adjust to the mounding with berm and trench technique. Mounds and suitable micro-sites often had 4 or 5 seedlings planted in these cases.

It was originally planned to plant Sw experimentally on transitional and upland sites, by either using a drill to create holes or scarifying the site with scrapping, and planting the seedling within the available frozen organics and top soil. Prior to the Project beginning, the majority of the upland sites were removed as mounding or scarification candidates since they were considered as relatively high potential for archeological sites and therefore no ground disturbance was completed. Two areas illustrated in the Treatment Mapbook (Appendix A: Mapsheets A-8; A-14) were planted with Sw, with only one box of 180 Sw seedlings planted. The remaining 9 boxes containing 1,629 seedlings were donated to Fort Nelson First Nation to plant in the spring of 2017 at some of their habitat restoration sites. The remaining seedlings were left in Fort Nelson in their boxes from the nursery in the original snow cache to ensure seedlings would not desiccate and would stay frozen until May when they can be planted.

4.4 Mounding / Tree-felling / Seedling Planting

A total of 16.34 linear km (27%) of linear disturbance were treated using the tree-felling, mounding and seedling planting in combination.

In some areas with relatively greater variability in adjacent stand type, both mounding / tree-felling and seedling planting were implemented (Photo 5; Appendix B). Due to the relatively high number of changes between site series', and the short lengths of many of these treatments, the treatment was often lumped into this category instead of designating a series of small treatments splitting up the line multiple times into either tree-felling or mounding and seedling planting.

4.5 Tree-felling and Coarse Woody Debris

There were a small number of areas where there was sufficient coarse woody debris piled along the seismic line to be picked up and spread evenly across the line. A total of 1.38 km of linear disturbance was treated using the tree-felling and coarse woody debris treatment type (Photo 8, Appendix B). This technique was used in conjunction with tree-felling to increase the effectiveness of the treatment as an access control for both human and predator access.

4.6 Tree-felling and Scarification (Hoe Rip)

Some transitional and upland areas that weren't considered high potential archeological sites were tree-felled and scarified (Photo 9, Appendix B). Scarification was completed by scrapping up the organic and top layers, forming microsites for seed to settle into. Only 0.4 km were treated with this method.

4.7 Tree-felling / Mounding

There is one area that was completed without seedling planting, on a secondary access corridor into the northwest of Zone 1. Tree-felling and mounding were implemented to control human and wildlife access, and no seedlings were planted due to sufficient levels of existing regeneration on the upland areas, and none on the lowland areas due to uncertainty whether there would be enough seedlings to treat this line that was added to the Project. This segment was 3.24 km long.

4.8 Leave for Natural

Original desk top analyses indicated there were approximately 90 km of historical seismic lines that could be considered Leave for Natural based on current vegetation cover and heights as interpreted through remote sensing and a ground-truthing field exercise (Photo 10; Appendix B). During the Project implementation, some sites were reclassified as either a treatment candidate or Leave for Natural. It was also discovered that many of the LIS lines were the same width as traditional seismic lines and they were then classified as either treatment candidates or Leave for Natural. The as-built Treatment Mapbook in Appendix A illustrate areas that were either originally designated as Leave for Natural, or added as Leave for Natural. The total Leave for Natural increased from 90 km to 104.85 km. The additional Leave for Natural sites resulted in a total of 165.85 km of legacy linear disturbance either being treated (61 km) or Leave for Natural recovery (104.85 km) within Zone 1.

4.9 Signage

Signs providing notification (Photo 11, Appendix B) of the work completed were posted at most of the intersections with recreational trails. The locations of the signs are illustrated in the Treatment Mapbook located in Appendix A.

5.0 MONITORING PLOTS

Restoration treatment monitoring plots were established at seedling planted sites (Photo 12, Appendix B), using the Zone 1 Implementation Plan as a guide to where the plots should be located (Golder 2015b). Monitoring plots that were scheduled for implementation at sites that had no seedling planting were dropped as vegetation monitoring sites since the intent of the monitoring plots is to monitoring seedling survival. The tree-felling sites may continue to be monitored by remote camera to monitor wildlife and human response to the treatments. The Treatment Mapbook located in Appendix A illustrate where the monitoring plots are located. In total, there were 25 long-term monitoring plots established during the Project in Zone 1.

Monitoring plots were established following protocols as outlined within the Boreal Caribou Habitat Restoration Monitoring Framework (Golder 2015c).

The restoration treatment monitoring plots are planned to be revisited in late summer / fall 2017, primarily to evaluate Year 1 frozen seedling survival and growth.

Wildlife monitoring for access and use of disturbances within the Parker Caribou Range is currently being conducted by Matrix Solutions. Wildlife remote camera locations from the Matrix program are included within the as-built Treatment Mapbook (Appendix A).

6.0 INDIGENOUS COMMUNITY AND LOCAL COMMUNITY PARTICIPATION AND ENGAGEMENT

Engagement on the Program Plan and Zone 1 Implementation Plan began in December 2015. For Zone 1, Fort Nelson First Nation and Prophet River First Nation were identified by FLNRO as key stakeholders. Refer to Section 8.1 for the contracting process with Indigenous community companies and participation. Project communications and engagement with Indigenous communities were logged, maintained by Golder and provided to the BC OGRIS Program Manager and FLNRO at the end of the implementation program.

6.1 Fort Nelson First Nation

Fort Nelson First Nation responded to the Statement of Interest (SOI's) positions, including recommending a contractor, Eh-Cho-Dene, for the heavy machinery work, and a Field Technician to support the seedling planting and data-collection. Through the Licence authorization process, Fort Nelson First Nation recommended that an observer be on site once per week during the field implementation to review the treatments and the field plans in support of adding and dropping treatments from the Project.

Eh-Cho-Dene, a Fort Nelson First Nation wholly owned enterprise, provided two Caterpillar 325 excavators to complete the heavy machinery component of the treatments, five operators who rotated in and out of the Project as required, snow-cat operators to transport fuel to site when required, and hand-fallers to tree-fell some of the easier to access sites. Eh-Cho-Dene also provided compound space to store the snowmobiles, Argos, and UTVs each night for security purposes, and so they could thaw out as required, as well as the space to create the snow cache to store the frozen tree seedlings.

An environmental technologist was provided full-time by Fort Nelson First Nation, who helped plant frozen tree seedlings, collect treatment data, and establish monitoring plots. An observer was provided on a part-time basis by Fort Nelson First Nation, who reviewed the treatment sites and progress and who completed the same tasks as the environmental technologist while on site.

6.2 Prophet River First Nation

On March 15, 2017, two Prophet River First Nation observers attended a site visit with Golder field staff to view the restoration treatments and were invited to ask questions about the Zone 1 Implementation Project. The overall Program was discussed and a map of the area was reviewed to show the current status and location of treatments prior to commencement of the site visit. Active treatment areas and locations recently treated this winter were visited. Photos were taken by the community members during the site visit and they inquired about the treatment strategy (e.g., why mounding wasn't appropriate in certain areas). The representatives from Prophet River First Nation were very interested in the work being completed.

6.3 Local Community Outreach

In addition to engaging Indigenous Communities for the majority of the services required to implement the Project, efforts were made to engage and support the local community and local businesses of Fort Nelson, BC as much as possible by purchasing or renting required materials and services locally, such as:

- Purchasing the signs and posts for the Project from local provider Logo-Tech Professional Signs and Designs;
- Equipment and equipment operators provided by Eh-Cho-Dene;
- Rental of Argos, trailers, snow machines from Normandeau Rentals;
- Purchasing material goods such as field supplies;
- Truck rental from Driving Force;
- Hotel conference room rental for the kick-off meeting;
- Supporting local restaurants and grocery stores;
- Apartment rental for field staff; and
- Trail maintenance from the Fort Nelson Snowmobile Club.

7.0 PROJECT ACHIEVEMENTS AND LESSONS LEARNED

During the course of the three-month restoration program, the following achievements and learnings were made. The following lessons learned and keys achievements are recommended for inclusion within future Zone's Implementation Plans.

- The key achievements of the Pilot restoration program in Zone 1 include:
  - 61 km of historical linear disturbance was physically treated, and 105 km of linear disturbance left to natural recovery to meet the short-term objectives of blocking human/predator access and to accelerate the rate of vegetation recovery;
  - No reported injuries during the three month field program.
  - Local operators and field technicians/observers were trained in the restoration treatment techniques in an effort to build local capacity in the community of Fort Nelson; and
  - Local businesses were used for all aspects of the Project to the extent possible to ensure funding benefited the local community.
- An adaptive management procedure was put in place with FLNRO and identified Indigenous Communities to respond efficiently to Implementation Plan field modifications.
  - FLNRO authorization requires the Ministry to consult with appropriate Indigenous Communities where activities are occurring. The overall authorization process took approximately 10 months. Any deviation in Implementation Plans, including access or treatment locations, requires FLNRO to provide updates to the Indigenous Communities for feedback into the revised Plan. During the course of the Zone 1 field implementation, it was necessary to clarify the process to deviate from the submitted Zone 1

Implementation Plan during field implementation due to field changes requiring authorizations on a very timely basis. For deviations or changes, FLRNO must seek input from affected Indigenous Communities into any revisions to the Plan. During Zone 1 implementation, Fort Nelson First Nation's weekly observers and consultation lead was proactively involved in the Project and supported field changes in a timely manner. This may not always be the case in future programs in BC, however having local Indigenous communities part of the restoration program will be critical to ensure that field modifications to implementation plans can be made.

- The Zone 1 Implementation successfully utilized local operators and equipment. Time and budget was taken on the front end of the field implementation to train local operators and build local capacity in the treatment types and methods. As a result, the funding focused on Indigenous Community owned business and local businesses for all contractor and rental requirements. In addition, community monitors provided opportunities for the local communities to visit the field treatments and ask questions about the objectives and anticipated outcomes. Use of the local community is believed to have built support for the restoration program. This approach is recommended for future restoration implementation programs in BC.
- It is recommended to maintain a transparent procurement process for provision of services by local Indigenous communities in future programs to ensure equal opportunities are available.
- A public service announcement was posted via radio on January 6, 2017 for the duration of the field program. Fort Nelson is a small, tight-knit community and with field crews working in the area for extended periods of time, they are aware of feedback from local community members who question the approach and objectives as well as the high cost the Province is spending on these programs. It is recommended that FLRNO or the BC Ministry of Environment (MoE) complete community outreach ahead of such future restoration programs to explain why the work is being completed and what other management approaches are being applied by the Province for caribou conservation. It is also recommended that a local community information session on the revised Boreal Caribou Implementation Plan may be valuable ahead of Zone 2 implementation or other restoration implementation programs to increase the understanding of how habitat restoration is one management lever for boreal caribou, with other levers such as wolf management, also being part of the management tool box.
- The recreational users within the Parker Caribou Range (local snowmobile Club, dog sledder) had variable levels of engagement prior to field implementation commencement. For example, the dog sledder contacted FLNRO in December 2016, and did not communicate concerns during the Public Open House. This resulted in a quick logistical change to the Implementation Plan to avoid a conflict which was not anticipated.
- The Snowmobile club members were invaluable in providing logistical support to the Project. However, incorporating the use of tracked vehicles only created long field mobilization and demobilization travel times to each treatment site, which increased the overall length of the Project, reduced field efficiencies and increased subsequent costs. This request by the Snowmobile club was made in November 2016, not during the public open house in the spring of 2016; resulting in logistical changes to the field implementation and budget considerations. No impact to the approved budget was necessary, as access creation costs were much lower than originally anticipated. However, it is felt that this change overinflated the cost per km within Zone 1.

- The Licensee conducting habitat restoration programs within implementation plan development should be provided details on the role that recreational users and stakeholders will play in the authorization process. Specific requests such as use of tracked vehicles, can then be adequately considered within scheduling and budgeting processes.
- The length of time required to obtain a Water permit authorization was not accounted for in the original Project schedule. Restoration program schedules involving winter access and freezing in of access, need to account for a minimum of 90 days prior to program start for authorization of water use if water is required for freezing-in access. Water source(s) must be known prior to permit application.
- Classified Low Impact Seismic (LIS) lines through the Oil and Gas Commission (OGC) spatial files obtained during initial linear classification mapping within the Parker Range are inaccurate and these lines need to be ground-truthed in the other Zones within the Parker Range during the development of the respective Implementation Plans for each Zone. The majority of the LIS lines were the width of the traditional seismic lines.
- Snow caches are difficult to use in the winter since snow often piles on them, making it difficult to take the boxes from them. Removing the snow to access the boxes also reduces the insulating effect the snow cache provides, leading to temperature fluctuations in the cache. Cold storage facility availability for frozen seedling storage should be investigated such as at a grocer or wholesaler that stores frozen goods.
- Recommended to investigate the capacity for the local nursery or other local/regional Indigenous community owned greenhouses to grow seedlings that can be then lifted and frozen in November of each year. The nursery was closed this winter.
- Zone 1 was based out of the community of Fort Nelson. More remote Zones (Zone 2 and 4) should investigate use of a remote camp (trailers) to minimize mobilization and demobilization times for crews and a focus to use of snowmobiles to access remote sites.
- Consider flying in fuel by the barrel at staging sites, with use of fuel containment sleds to transport barrels of fuel on site, reducing the need for a snowcat. The snowcat used for Zone 1 increased Project costs due to the daily cost of having the machine on site, whether in use or not. The snowcat also did considerable damage to existing vegetation due to the width and type of track it has.
- In future Zones, some access may need to be opened up by walking down some revegetating sections of lines, for program efficiency and to access remote and open sites targeted for treatment.
- Recommend work shifts of 5 days on and 2 days off, Monday to Friday. This would allow local community members crew members better flexibility and life balance to minimize potential Project fatigue.
- Renting an apartment in Fort Nelson for the Golder crew was ideal to minimize costs and increase ability of crew to be well rested during Zone 1 field implementation.
- Communication in Zone 1 was through the use of cell phones and handheld radios between the crew members and equipment operators and worked very well. Consideration for the use of satellite phones will need to be made prior to working in more remote Zones.

- Amphibious Argos are not the preferred machine for transporting field staff for these programs. Working in extreme cold temperatures is likely one of the issues that led to several breakdowns.
  - Recommend using a metal tracked, hard cab Argo CENTAUR 950 DT 8X8s:
    - 22" snowtracks
    - Same cost or cheaper than the amphibious Argo
    - Durable
    - Heated and hard cab with seatbelts
    - Can pull fuel tanks
    - Can put a snow blade on the front
  - Recommend one centaur for each operator to transport the operators to their machines, bringing fuel with them when required
- UTVs with tracks are not the ideal machine for these jobs: recommend Centaurs and snowmobiles only
  - Despite hard cab, when temperature drops, heater doesn't keep the inside warm
  - Lack of protection from existing regeneration is a liability for damage to plastic, particularly when very cold
  - Several issues with tracks and repairs with them
- Snowmobile is ideal machine for site supervisor to use
  - Relatively fast, good for scouting ahead
  - Can navigate overgrown lines quite well
  - Can tow a plastic skid for gear

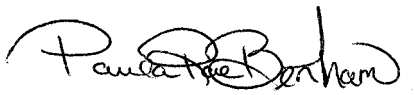
8.0 CLOSURE

We trust that the Pilot Boreal Caribou Habitat Restoration Program Year 1 (2017) Implementation Report as described meets the REMB's requirements to summarize the 2017 Zone 1 field implementation component of the Parker Caribou Range Boreal Caribou Restoration Pilot Program Plan.

Please contact Brian Coupal at (403) 532-5715 or Paula Bentham at (780) 930-8661 with any questions or comments.

Report Signature Page

GOLDER ASSOCIATES LTD.



Brian Coupal, B.A., B.Sc., P.Ag.
Habitat Restoration Specialist

Paula Bentham, M.Sc., P.Biol.
Principal, Senior Wildlife Ecologist

https://capws.golder.com/sites/1529978bcborealcaribouhabrestpilotprogram/1668292_implementation/7000_yr1_reporting/1668292_implementation_report.docx

9.0 REFERENCES

Dickie, M. 2015. The Use of Anthropogenic Linear Features by Wolves in Northeastern Alberta. M.Sc. thesis. University of Alberta, Edmonton, Alberta. 80 pp.

Golder (Golder Associates Ltd.). 2015a. Parker Range Restoration: Zone 1 Implementation Plan. Submitted to BC OGRIS REMB. December 2015.

Golder. 2015b. Boreal Caribou Habitat Restoration Operational Toolkit for British Columbia. Prepared for BC Science and Community Environmental Knowledge Fund's Research and Effectiveness Monitoring Board. Report number 1313720037. Available at: http://scek.ca/sites/default/files/bcip-2015-05-restoration-toolkit-28final29-jan-2115.pdf. Accessed July 6, 2015.

Golder. 2015c. Boreal Caribou Habitat Restoration Monitoring Framework: Project Profile. BCIP-2016-02. Available online at: http://www.scek.ca/sites/default/files/bc-ogris-project-profile-habitat-restoration-monitor-framework-28bcip-2016-0229.pdf. Accessed September 21, 2015.

Golder. 2016. Boreal Caribou Restoration Pilot Program Plan. Submitted to the British Colombia Oil and Gas Research and Innovation Society's Research and Environmental Monitoring Board. January, 2016.

Hann, Trevor . Ministry of Forests, Lands, Natural Resource Operations (FLNRO). Personal communication email. October 26, 2016.

Hudson, Jeanine. FLNRO. Personal communication with Caitlin Parker and Paula Bentham. January 30, 2017.

APPENDIX A

As-built Treatment Mapbook

513000 514000 515000 516000

6515000 6514000 6513000

SITE: 135

ID47

Camera187

bing

LEGEND

- CARIBOU HABITAT RESTORATION SIGN
- CAMERA LOCATION
- PARKER CARIBOU RANGE
- TACTICAL PLAN TREATMENT ZONE 1

TREATMENT TYPE

- TREE FELLING
- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING
- TREE FELLING / MOUNDING
- TREE FELLING / SCARIFICATION
- TREE FELLING / COARSE WOODY DEBRIS

OTHER

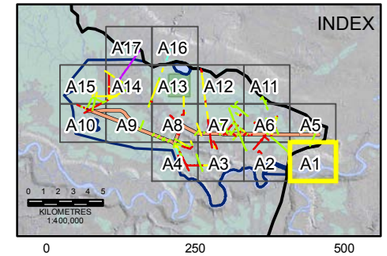
- LEAVE FOR NATURAL
- NATURAL REVEGETATION >3m : NO ACCESS
- SLED DOG TRAIL
- PARKER LAKE ECOLOGICAL RESERVE
- WATERBODY
- WETLAND
- WATERCOURSE

WINTER ACCESS

- ACTUAL RECREATIONAL TRAIL / PRIMARY WINTER ACCESS
- CANFOR PIPELINE BYPASS ROAD
- ORIGINALLY EXCLUDED LINEAR DISTURBANCES
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RESOURCE ROAD
- UNCLASSIFIED ROAD
- BC OGC PETROLEUM DEVELOPMENT ROAD
- BC OGC PETROLEUM ACCESS ROAD
- FORESTRY SERVICE ROAD / ROAD PERMIT
- RECREATIONAL TRAIL DESIGNATION

PREDICTED CARIBOU CALVING HABITAT

- LOW



0 250 500

1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT

BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT

PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE

ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT

Golder Associates

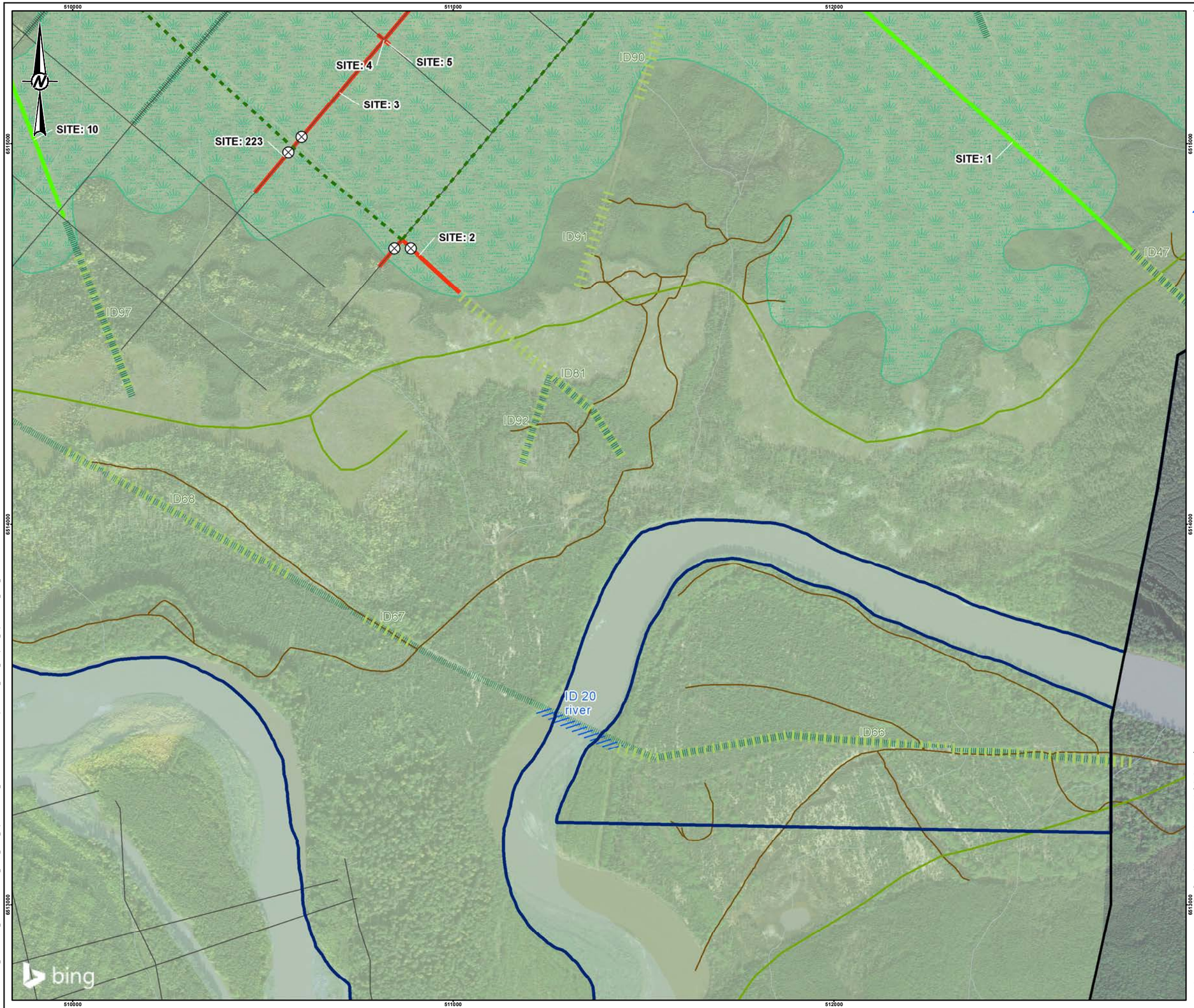
YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	**A - 1**

PATH: N:\Client\BC_OGRIS\BC09_PROJECTS\166829_Parker_Zone1_Implementation\02_PRODUCTION\7000MXD\Report\166829_Zone1_Completed_Implementation_Rev0_2017-04-28.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm



LEGEND

- CARIBOU HABITAT RESTORATION SIGN
- PARKER CARIBOU RANGE
- TACTICAL PLAN TREATMENT ZONE 1

TREATMENT TYPE

- TREE FELLING
- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING
- TREE FELLING / MOUNDING
- TREE FELLING / SCARIFICATION
- TREE FELLING / COARSE WOODY DEBRIS

OTHER

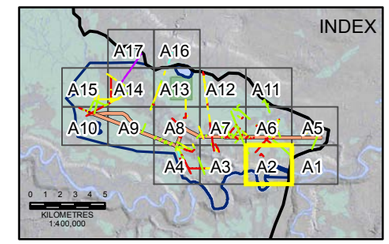
- LEAVE FOR NATURAL
- NATURAL REVEGETATION >3m : NO ACCESS
- WATER OBSTACLE
- SLED DOG TRAIL
- PARKER LAKE ECOLOGICAL RESERVE
- WATERBODY
- WETLAND
- WATERCOURSE

WINTER ACCESS

- ACTUAL RECREATIONAL TRAIL / PRIMARY WINTER ACCESS
- CANFOR PIPELINE BYPASS ROAD
- ORIGINALLY EXCLUDED LINEAR DISTURBANCES
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RESOURCE ROAD
- UNCLASSIFIED ROAD
- BC OGC PETROLEUM DEVELOPMENT ROAD
- BC OGC PETROLEUM ACCESS ROAD
- FORESTRY SERVICE ROAD / ROAD PERMIT
- RECREATIONAL TRAIL DESIGNATION

PREDICTED CARIBOU CALVING HABITAT

- LOW



0 250 500

1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011. COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT

BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT

PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE

ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

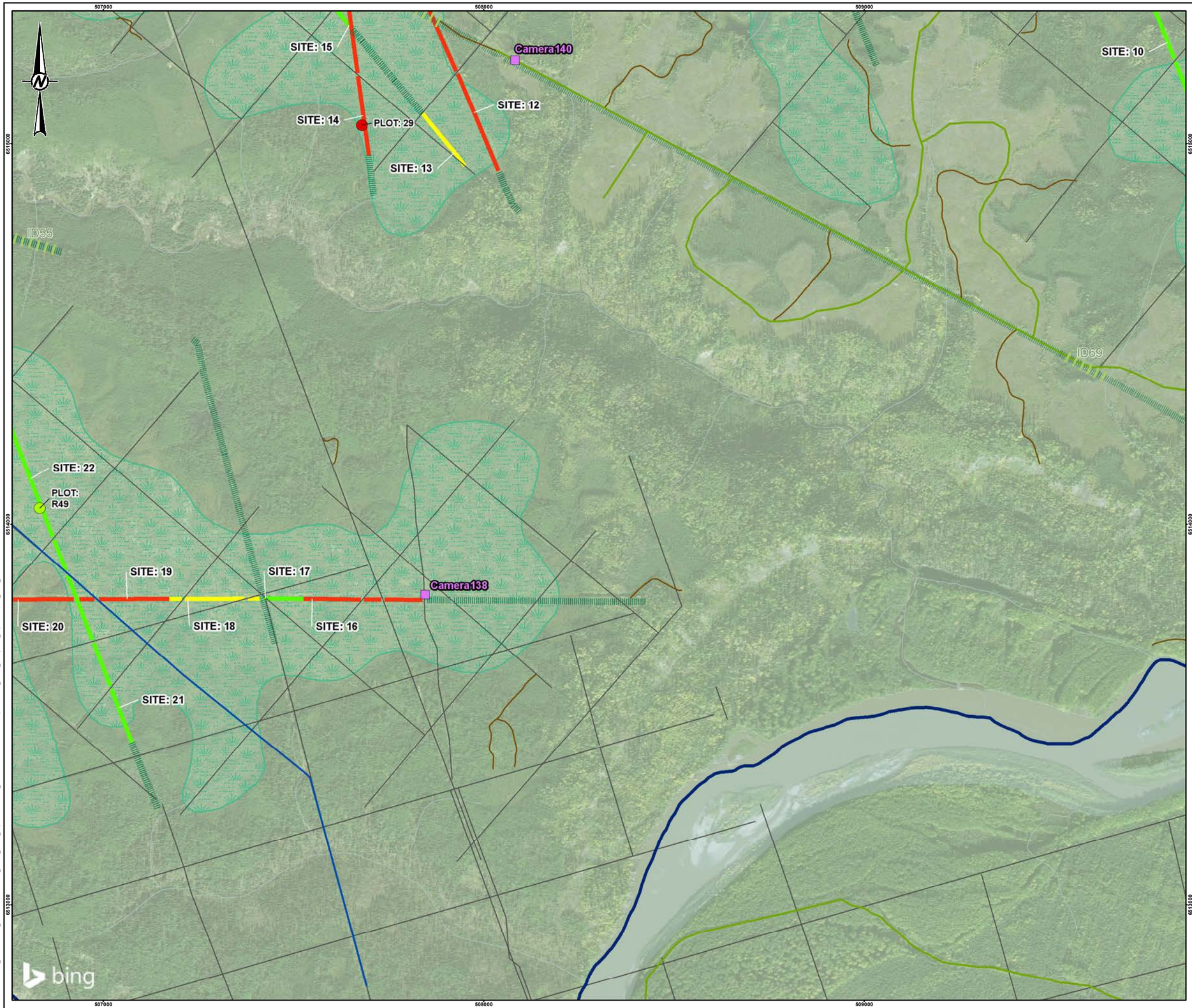
PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	A - 2

PATH: N:\Client\BC_OGRIS\BC019_PROJECTS\1668292_Parker_Zone1_Implementation\02_PRODUCTION\7000\MXD\Report\166829_Zone1_Completed_Implementation_Rev0_20170428.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0



LEGEND

- CAMERA LOCATION
- PARKER CARIBOU RANGE
- TACTICAL PLAN TREATMENT ZONE 1

MONITORING PLOT LOCATION AND SITE TREATMENT TYPE

- TREE FELLING
- MOUNDING / TREE FELLING / SEEDLING PLANTING

TREATMENT TYPE

- TREE FELLING
- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING
- TREE FELLING / MOUNDING
- TREE FELLING / SCARIFICATION
- TREE FELLING / COARSE WOODY DEBRIS

OTHER

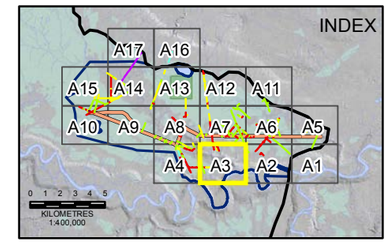
- LEAVE FOR NATURAL
- NATURAL REVEGETATION >3m : NO ACCESS
- SLED DOG TRAIL
- PARKER LAKE ECOLOGICAL RESERVE
- WATERBODY
- WETLAND
- WATERCOURSE

WINTER ACCESS

- ACTUAL RECREATIONAL TRAIL / PRIMARY WINTER ACCESS
- CANFOR PIPELINE BYPASS ROAD
- ORIGINALLY EXCLUDED LINEAR DISTURBANCES
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RESOURCE ROAD
- UNCLASSIFIED ROAD
- BC OGC PETROLEUM DEVELOPMENT ROAD
- BC OGC PETROLEUM ACCESS ROAD
- FORESTRY SERVICE ROAD / ROAD PERMIT
- RECREATIONAL TRAIL DESIGNATION

PREDICTED CARIBOU CALVING HABITAT

- LOW



0 250 500

1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT

BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT

PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE

ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT

Golder Associates

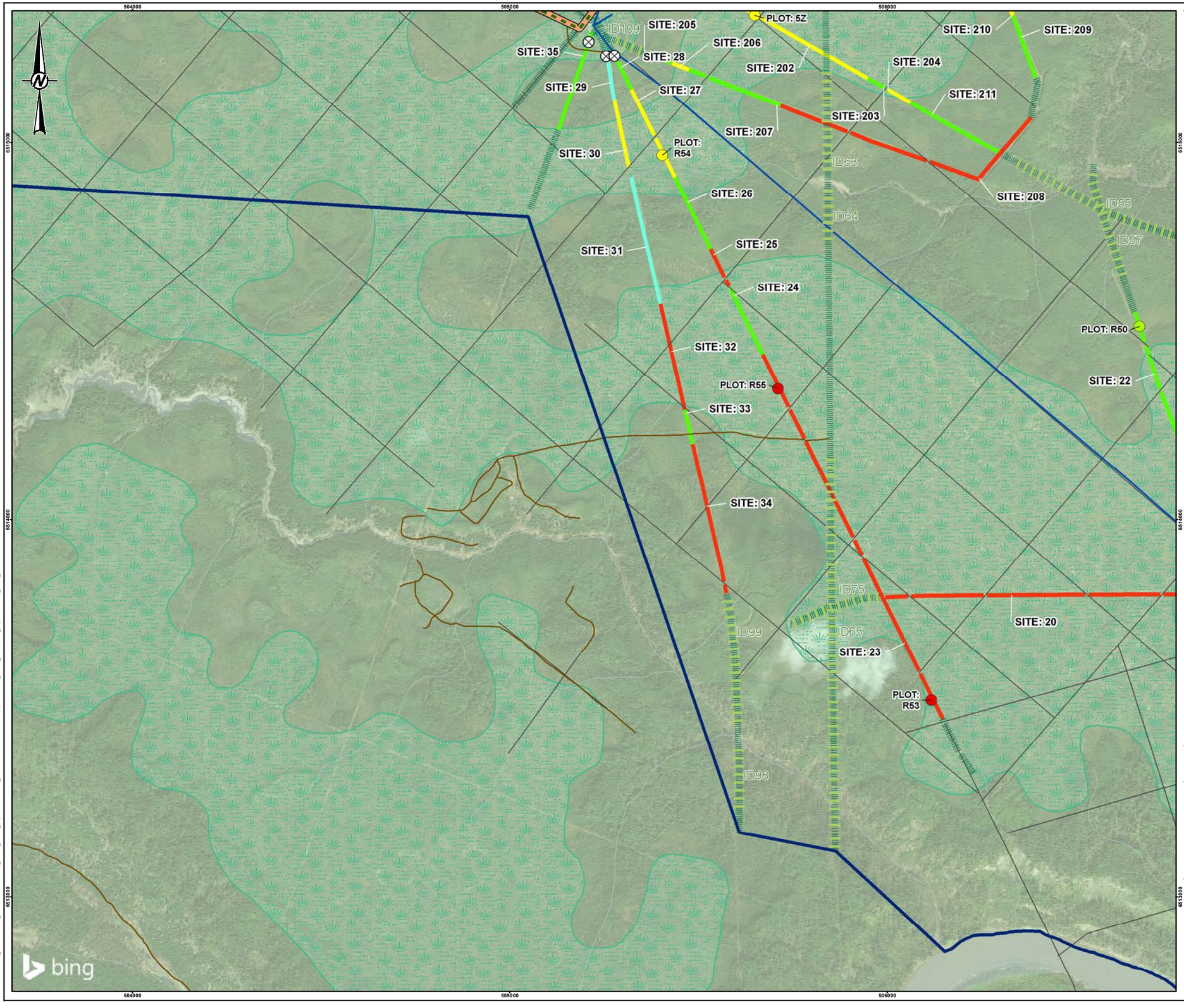
YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

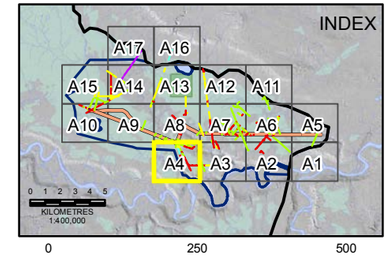
PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	**A - 3**

PATH: N:\Client\BC_OGRIS\BC\9_PROJECTS\1668292_Parker_Zone1_Implementation\02_PRODUCTION\7000MXD\Report\166829_Zone1_Completed_Implementation_Rev0_20170428.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm





0 250 500

1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT

BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT

PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE

ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	A - 4

PATH: N:\Clients\BC_OGRI\SBC\9_PROJECTS\166829_Parker_Zone1_Implementation\02_PRODUCTION\7500\MXD\Report\166829_Zone1_Completed_Implementation_Rev0_20170428.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0

513000 514000 515000 516000

6517000

6516000

97

ID119

ID 14
open body

ID34

SITE: 134

ID35

ID130

SITE: 212

ID134

ID132

ID133

ID131

SITE: 135

bing

LEGEND

- CARIBOU HABITAT RESTORATION SIGN
- PARKER CARIBOU RANGE
- TACTICAL PLAN TREATMENT ZONE 1

TREATMENT TYPE

- TREE FELLING
- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING
- TREE FELLING / MOUNDING
- TREE FELLING / SCARIFICATION
- TREE FELLING / COARSE WOODY DEBRIS

OTHER

- LEAVE FOR NATURAL
- NATURAL REVEGETATION >3m : NO ACCESS
- WATER OBSTACLE
- SLED DOG TRAIL
- PARKER LAKE ECOLOGICAL RESERVE
- WATERBODY
- WETLAND
- WATERCOURSE

WINTER ACCESS

- ACTUAL RECREATIONAL TRAIL / PRIMARY WINTER ACCESS
- CANFOR PIPELINE BYPASS ROAD
- ORIGINALLY EXCLUDED LINEAR DISTURBANCES
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RESOURCE ROAD
- UNCLASSIFIED ROAD
- BC OGC PETROLEUM DEVELOPMENT ROAD
- BC OGC PETROLEUM ACCESS ROAD
- FORESTRY SERVICE ROAD / ROAD PERMIT
- RECREATIONAL TRAIL DESIGNATION

PREDICTED CARIBOU CALVING HABITAT

- LOW
- LOW - MODERATE

INDEX

A17 A16
A15 A14 A13 A12 A11
A10 A9 A8 A7 A6 A5
A4 A3 A2 A1

0 1 2 3 4 5
KILOMETRES
1:400,000

0 250 500
1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT
PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE
ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

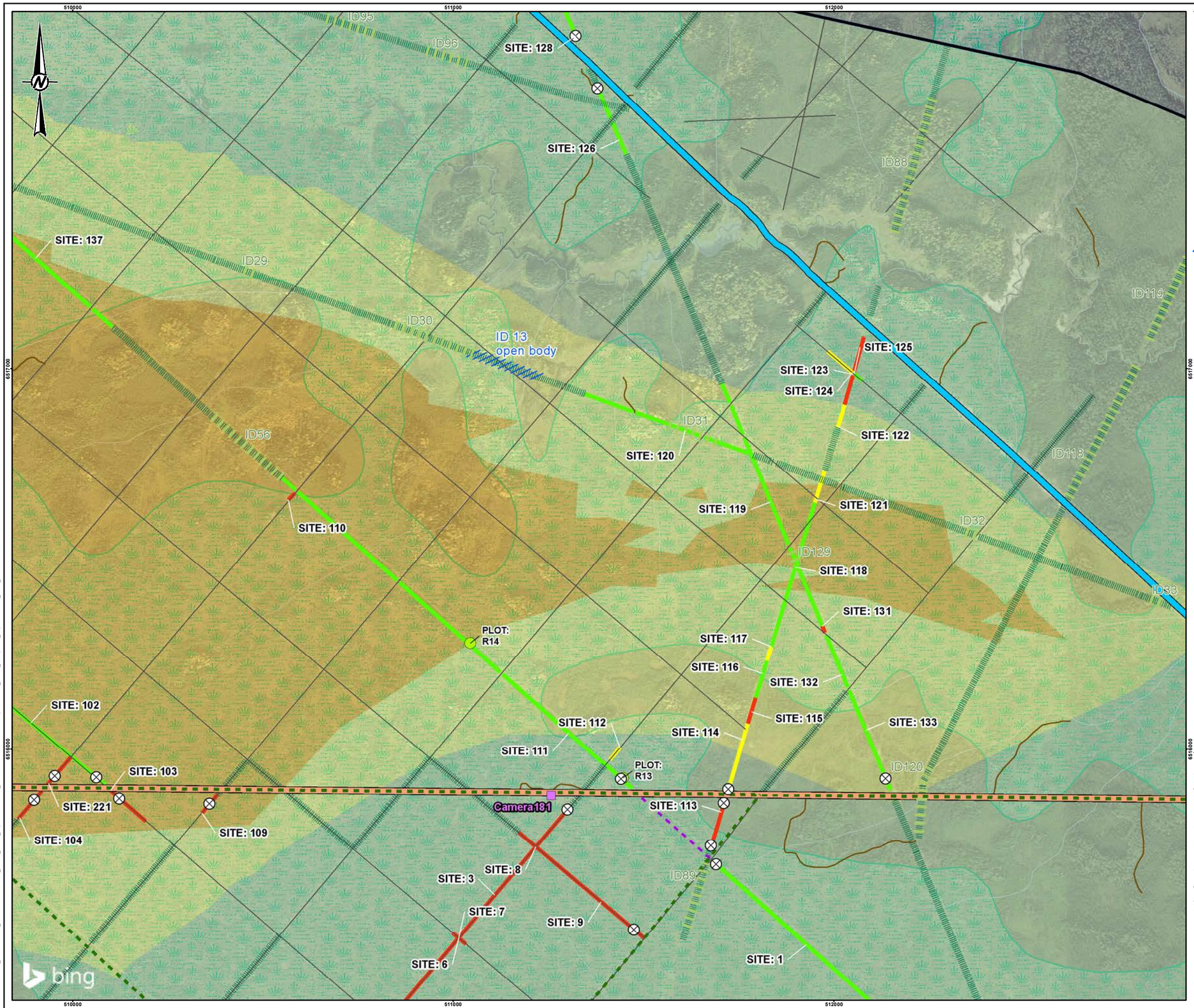
PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	**A - 5**

PATH: N:\Client\BC_OGRIS\BC19_PROJECTS\1668292_Parker_Zone 1_Implementation\02_PRODUCTION\7000\MXD\Report\166829_Zone1_Completed_Implementation_Rev0_20170428.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0



LEGEND

- CARIBOU HABITAT RESTORATION SIGN
- CAMERA LOCATION
- PARKER CARIBOU RANGE
- TACTICAL PLAN TREATMENT ZONE 1

MONITORING PLOT LOCATION AND SITE TREATMENT TYPE

- TREE FELLING

TREATMENT TYPE

- TREE FELLING
- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING
- TREE FELLING / MOUNDING
- TREE FELLING / SCARIFICATION
- TREE FELLING / COARSE WOODY DEBRIS

OTHER

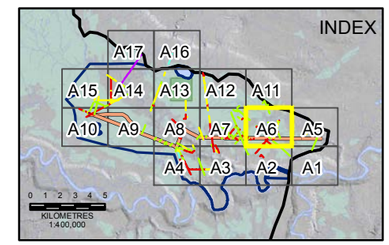
- LEAVE FOR NATURAL
- NATURAL REVEGETATION >3m : NO ACCESS
- WATER OBSTACLE
- SLED DOG TRAIL
- PARKER LAKE ECOLOGICAL RESERVE
- WATERBODY
- WETLAND
- WATERCOURSE

WINTER ACCESS

- ACTUAL RECREATIONAL TRAIL / PRIMARY WINTER ACCESS
- CANFOR PIPELINE BYPASS ROAD
- ORIGINALLY EXCLUDED LINEAR DISTURBANCES
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RESOURCE ROAD
- UNCLASSIFIED ROAD
- BC OGC PETROLEUM DEVELOPMENT ROAD
- BC OGC PETROLEUM ACCESS ROAD
- FORESTRY SERVICE ROAD / ROAD PERMIT
- RECREATIONAL TRAIL DESIGNATION

PREDICTED CARIBOU CALVING HABITAT

- LOW
- LOW - MODERATE
- MODERATE



0 250 500

1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT
PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE
ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	**A - 6**

PATH: N:\Client\BC_OGRIS\BC09_PROJECTS\166829_Parker_Zone1_Implementation\02_PRODUCTION\7000\MXD\Report\166829_Zone1_Completed_Implementation_Rev0_20170428.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

25mm

0

507000 508000 509000

6517000 6516000

SITE: 139 ID 12 wetland ID42 SITE: 138 SITE: 136 SITE: 137 PLOT: 37TB SITE: 65 SITE: 91 SITE: 92 SITE: 93 ID80 Camera179 SITE: 77 SITE: 90 SITE: 64 SITE: 82 Camera193 SITE: 74 SITE: 94 SITE: 80 SITE: 81 SITE: 95 SITE: 78 SITE: 219 SITE: 63 SITE: 76 ID82 SITE: 75 SITE: 89 SITE: 97 SITE: 96 SITE: 86 SITE: 87 SITE: 98 SITE: 79 ID116 SITE: 58 SITE: 73 SITE: 88 SITE: 102 SITE: 85 SITE: 59 SITE: 70 SITE: 108 SITE: 100 SITE: 61 SITE: 66 SITE: 69 SITE: 71 SITE: 214 SITE: 101 SITE: 218 SITE: 106 SITE: 105 SITE: 68 SITE: 83 ID79 SITE: 107 SITE: 84 SITE: 67 SITE: 72 ID60 SITE: 60 SITE: 213 SITE: 10 SITE: 14 ID61 SITE: 11 SITE: 15 ID78 ID70 SITE: 12 bing

LEGEND

- CARIBOU HABITAT RESTORATION SIGN
- CAMERA LOCATION
- PARKER CARIBOU RANGE
- TACTICAL PLAN TREATMENT ZONE 1

MONITORING PLOT LOCATION AND SITE TREATMENT TYPE

- MOUNDING / SEEDLING PLANTING

TREATMENT TYPE

- TREE FELLING
- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING
- TREE FELLING / MOUNDING
- TREE FELLING / SCARIFICATION
- TREE FELLING / COARSE WOODY DEBRIS

OTHER

- LEAVE FOR NATURAL
- NATURAL REVEGETATION >3m : NO ACCESS
- WATER OBSTACLE
- SLED DOG TRAIL
- PARKER LAKE ECOLOGICAL RESERVE
- WATERBODY
- WETLAND
- WATERCOURSE

WINTER ACCESS

- ACTUAL RECREATIONAL TRAIL / PRIMARY WINTER ACCESS
- CANFOR PIPELINE BYPASS ROAD
- ORIGINALLY EXCLUDED LINEAR DISTURBANCES
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RESOURCE ROAD
- UNCLASSIFIED ROAD
- BC OGC PETROLEUM DEVELOPMENT ROAD
- BC OGC PETROLEUM ACCESS ROAD
- FORESTRY SERVICE ROAD / ROAD PERMIT
- RECREATIONAL TRAIL DESIGNATION

PREDICTED CARIBOU CALVING HABITAT

- LOW
- LOW - MODERATE
- MODERATE

INDEX

A17 A16 A15 A14 A13 A12 A11 A10 A9 A8 A7 A6 A5 A4 A3 A2 A1

0 1 2 3 4 5 KILOMETRES 1:400,000

0 250 500

1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT

BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT

PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE

ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT

Golder Associates

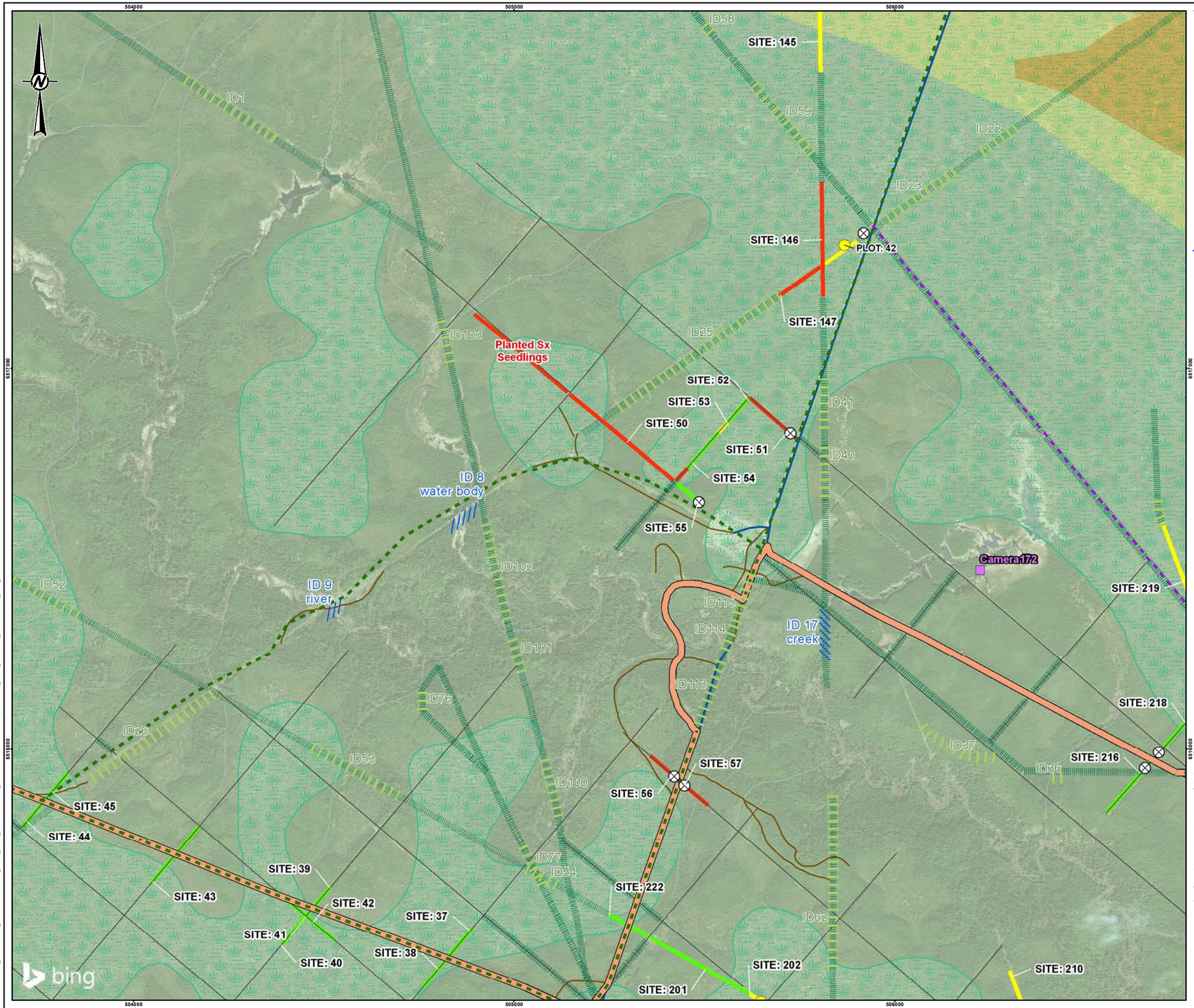
YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	A - 7

PATH: N:\Clients\BC_OGRIS\8CP\9_PROJECTS\1668292_Parker_Zone1_Implementation\02_PRODUCTION\7000MXD\Report\1668229_Zone1_Completed_Implementation_Rev0_20170428.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

0 25mm



LEGEND

- CARIBOU HABITAT RESTORATION SIGN
- CAMERA LOCATION
- PARKER CARIBOU RANGE
- TACTICAL PLAN TREATMENT ZONE 1

MONITORING PLOT LOCATION AND SITE TREATMENT TYPE

- MOUNDING / SEEDLING PLANTING

TREATMENT TYPE

- TREE FELLING
- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING
- TREE FELLING / MOUNDING
- TREE FELLING / SCARIFICATION
- TREE FELLING / COARSE WOODY DEBRIS

OTHER

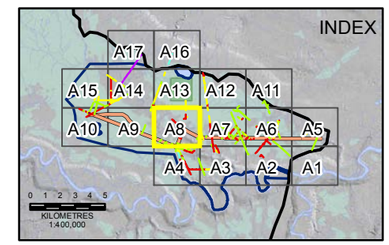
- LEAVE FOR NATURAL
- NATURAL REVEGETATION >3m : NO ACCESS
- WATER OBSTACLE
- SLED DOG TRAIL
- PARKER LAKE ECOLOGICAL RESERVE
- WATERBODY
- WETLAND
- WATERCOURSE

WINTER ACCESS

- ACTUAL RECREATIONAL TRAIL / PRIMARY WINTER ACCESS
- CANFOR PIPELINE BYPASS ROAD
- ORIGINALLY EXCLUDED LINEAR DISTURBANCES
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RESOURCE ROAD
- UNCLASSIFIED ROAD
- BC OGC PETROLEUM DEVELOPMENT ROAD
- BC OGC PETROLEUM ACCESS ROAD
- FORESTRY SERVICE ROAD / ROAD PERMIT
- RECREATIONAL TRAIL DESIGNATION

PREDICTED CARIBOU CALVING HABITAT

- LOW
- LOW - MODERATE
- MODERATE



0 250 500

1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT

BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT

PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE

ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT

Golder Associates

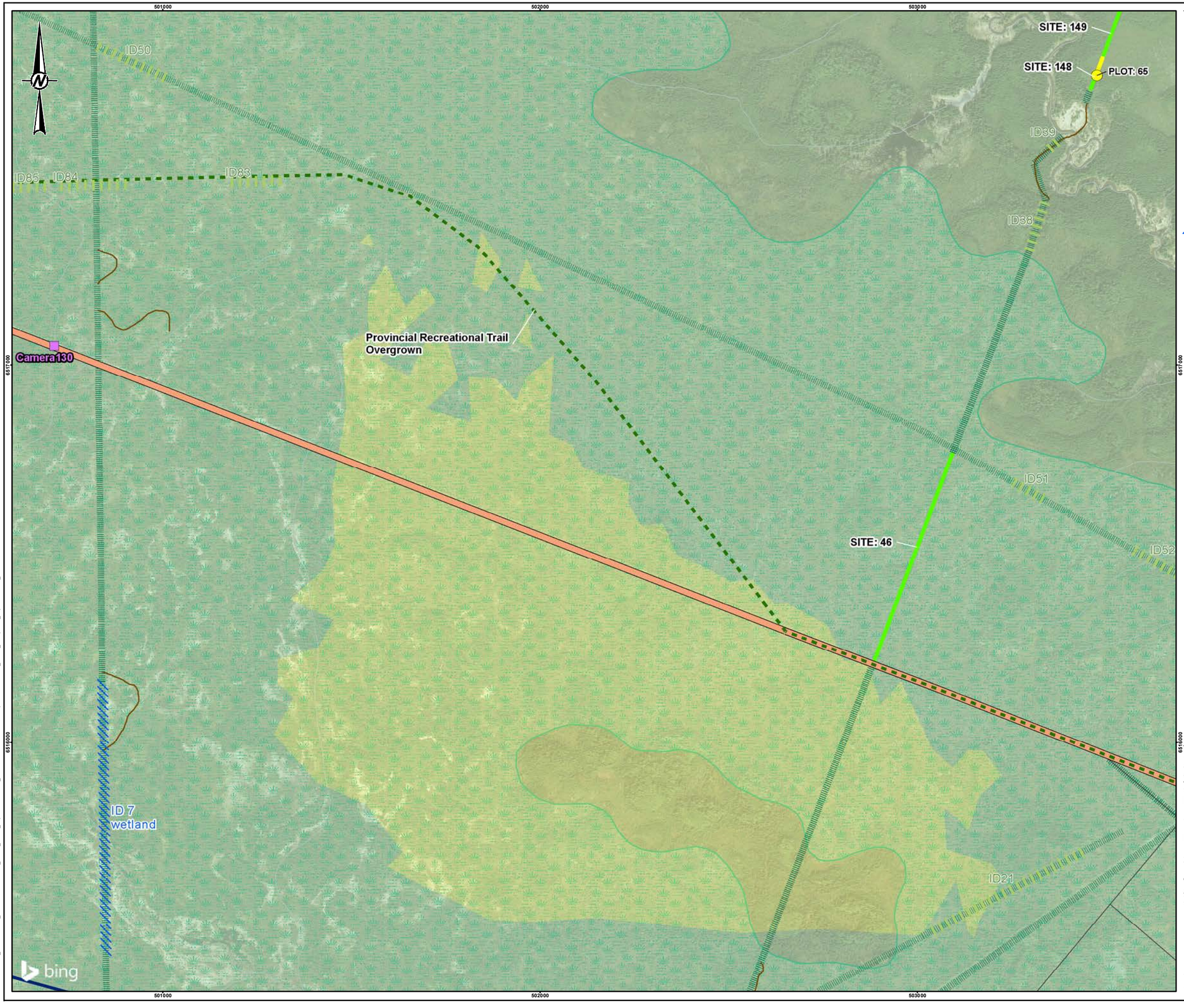
YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	A - 8

PATH: N:\Clients\BC_OGRIS\BC09_PROJECTS\1668292_Parker_Zone1_Implementation\02_PRODUCTION\7000\MXD\Report\166829_Zone1_Completed_Implementation_Rev0_20170428.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

25mm
0



LEGEND

- CAMERA LOCATION
- PARKER CARIBOU RANGE
- TACTICAL PLAN TREATMENT ZONE 1

MONITORING PLOT LOCATION AND SITE TREATMENT TYPE

- MOUNDING / SEEDLING PLANTING

TREATMENT TYPE

- TREE FELLING
- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING
- TREE FELLING / MOUNDING
- TREE FELLING / SCARIFICATION
- TREE FELLING / COARSE WOODY DEBRIS

OTHER

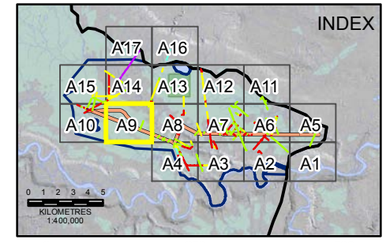
- LEAVE FOR NATURAL
- NATURAL REVEGETATION >3m : NO ACCESS
- WATER OBSTACLE
- SLED DOG TRAIL
- PARKER LAKE ECOLOGICAL RESERVE
- WATERBODY
- WETLAND
- WATERCOURSE

WINTER ACCESS

- ACTUAL RECREATIONAL TRAIL / PRIMARY WINTER ACCESS
- CANFOR PIPELINE BYPASS ROAD
- ORIGINALLY EXCLUDED LINEAR DISTURBANCES
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RESOURCE ROAD
- UNCLASSIFIED ROAD
- BC OGC PETROLEUM DEVELOPMENT ROAD
- BC OGC PETROLEUM ACCESS ROAD
- FORESTRY SERVICE ROAD / ROAD PERMIT
- RECREATIONAL TRAIL DESIGNATION

PREDICTED CARIBOU CALVING HABITAT

- LOW
- LOW - MODERATE



0 250 500

1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT

BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT

PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE

ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT

Golder Associates

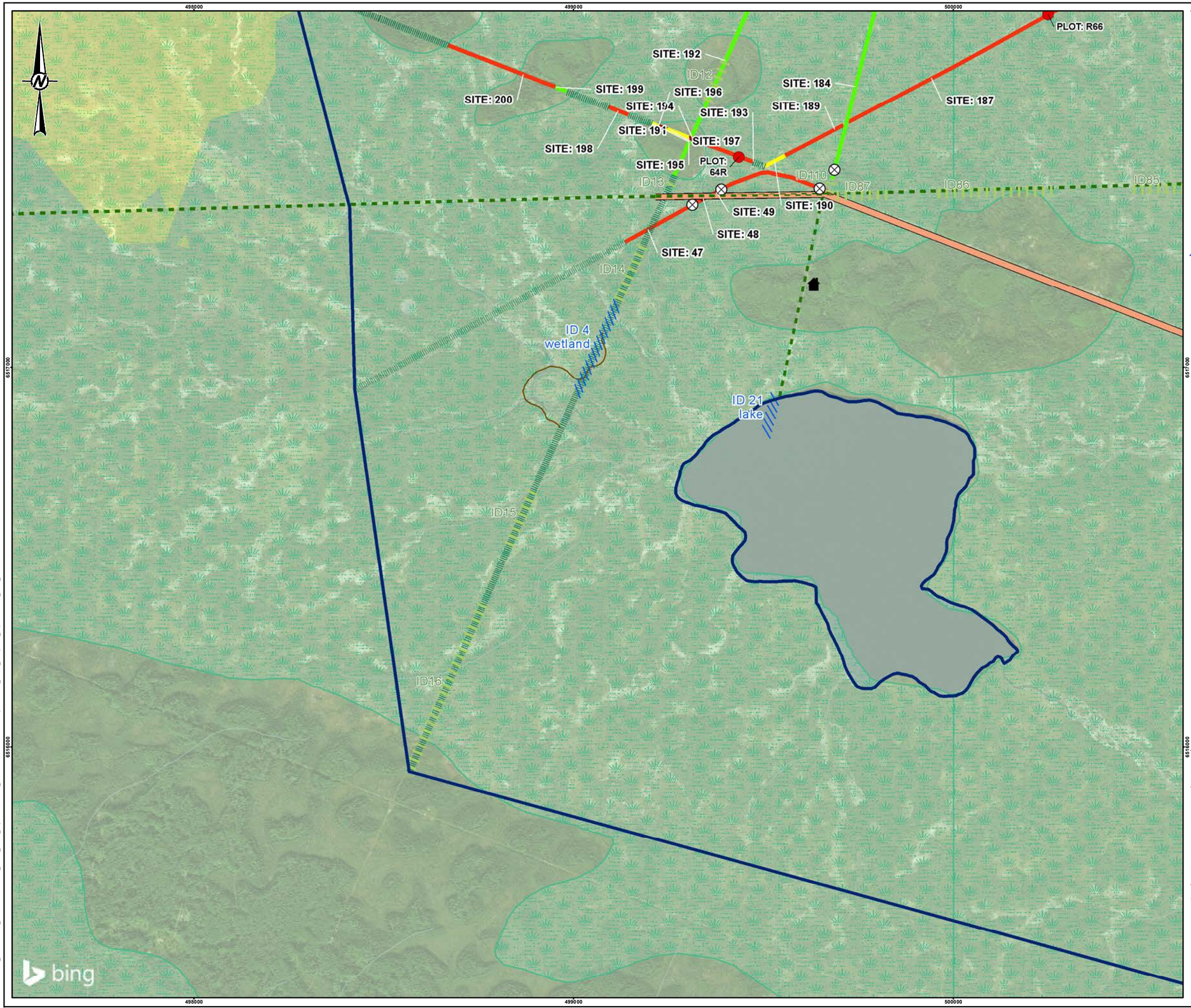
YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	A - 9

PATH: N:\Client\BC_OGRIS\BC\9_PROJECTS\1668292_ Parker_Zone1_Implementation\02_PRODUCTION\7000MXD\Report\Final\166829_Zone1_ Completed_Implementation_Rev0.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm



LEGEND

- CARIBOU HABITAT RESTORATION SIGN
- WARMING HUT
- PARKER CARIBOU RANGE
- TACTICAL PLAN TREATMENT ZONE 1

MONITORING PLOT LOCATION AND SITE TREATMENT TYPE

- MOUNDING / TREE FELLING / SEEDLING PLANTING

TREATMENT TYPE

- TREE FELLING
- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING
- TREE FELLING / MOUNDING
- TREE FELLING / SCARIFICATION
- TREE FELLING / COARSE WOODY DEBRIS

OTHER

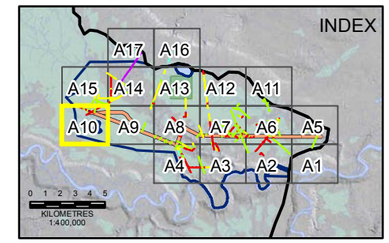
- LEAVE FOR NATURAL
- NATURAL REVEGETATION >3m : NO ACCESS
- WATER OBSTACLE
- SLED DOG TRAIL
- PARKER LAKE ECOLOGICAL RESERVE
- WATERBODY
- WETLAND
- WATERCOURSE

WINTER ACCESS

- ACTUAL RECREATIONAL TRAIL / PRIMARY WINTER ACCESS
- CANFOR PIPELINE BYPASS ROAD
- ORIGINALLY EXCLUDED LINEAR DISTURBANCES
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RESOURCE ROAD
- UNCLASSIFIED ROAD
- BC OGC PETROLEUM DEVELOPMENT ROAD
- BC OGC PETROLEUM ACCESS ROAD
- FORESTRY SERVICE ROAD / ROAD PERMIT
- RECREATIONAL TRAIL DESIGNATION

PREDICTED CARIBOU CALVING HABITAT

- LOW
- LOW - MODERATE



0 250 500

1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011. COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT

BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT

PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE

ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

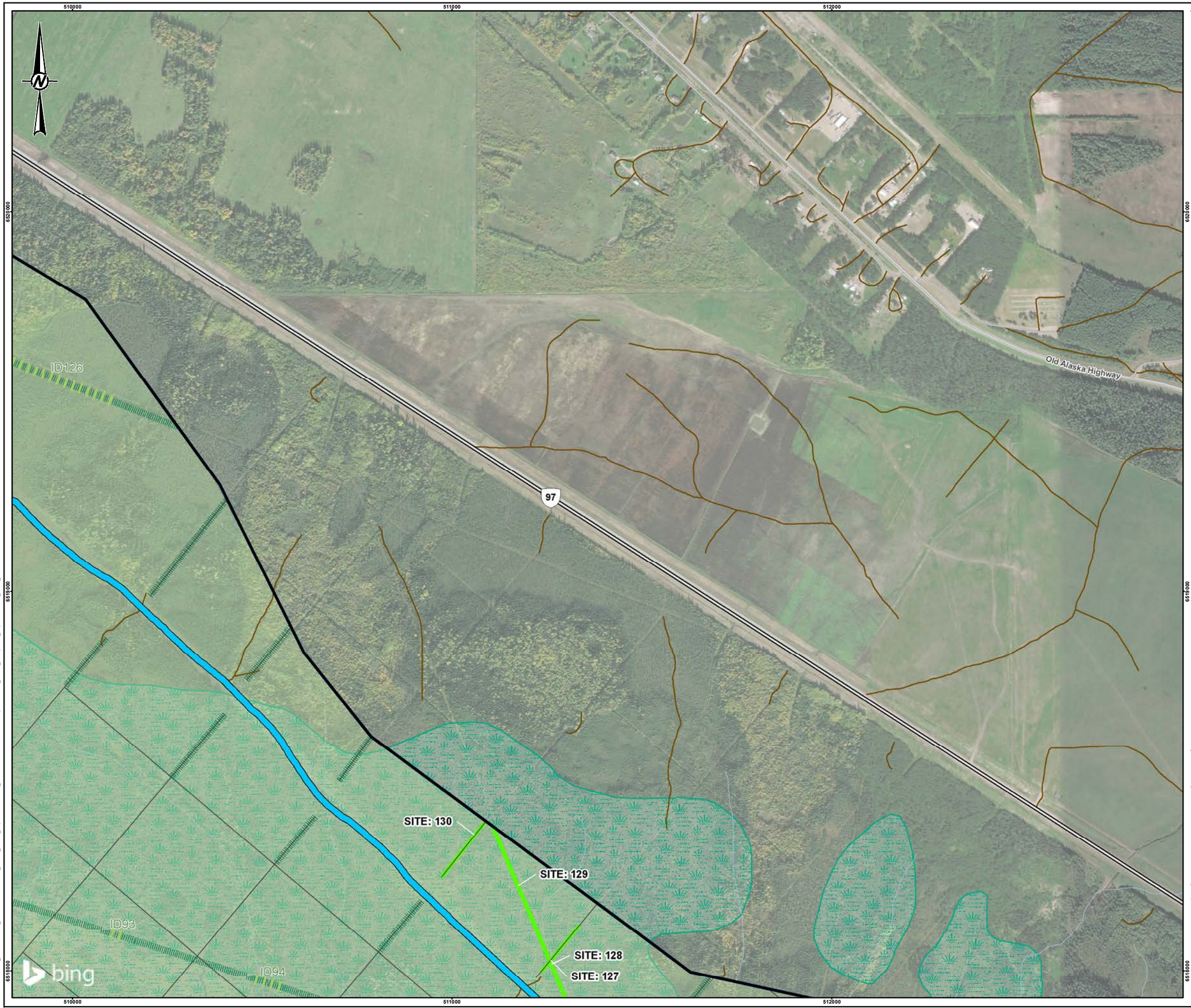
PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	**A - 10**

PATH: N:\Client\BC_OGRIS\BC09_PROJECTS\166829_Parker_Zone1_Implementation\02_PRODUCTION\7000MXD\Report\166829_Zone1_Completed_Implementation_Rev0_20170428.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0



LEGEND

PARKER CARIBOU RANGE
TACTICAL PLAN TREATMENT ZONE 1

TREATMENT TYPE

- TREE FELLING
- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING
- TREE FELLING / MOUNDING
- TREE FELLING / SCARIFICATION
- TREE FELLING / COARSE WOODY DEBRIS

OTHER

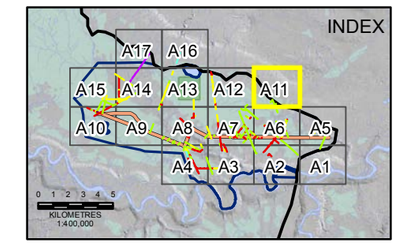
- LEAVE FOR NATURAL
- NATURAL REVEGETATION >3m : NO ACCESS
- SLED DOG TRAIL
- PARKER LAKE ECOLOGICAL RESERVE
- WATERBODY
- WETLAND
- WATERCOURSE

WINTER ACCESS

- ACTUAL RECREATIONAL TRAIL / PRIMARY WINTER ACCESS
- CANFOR PIPELINE BYPASS ROAD
- ORIGINALLY EXCLUDED LINEAR DISTURBANCES
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RESOURCE ROAD
- UNCLASSIFIED ROAD
- BC OGC PETROLEUM DEVELOPMENT ROAD
- BC OGC PETROLEUM ACCESS ROAD
- FORESTRY SERVICE ROAD / ROAD PERMIT
- RECREATIONAL TRAIL DESIGNATION

PREDICTED CARIBOU CALVING HABITAT

- LOW



0 250 500

1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT
PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE
ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

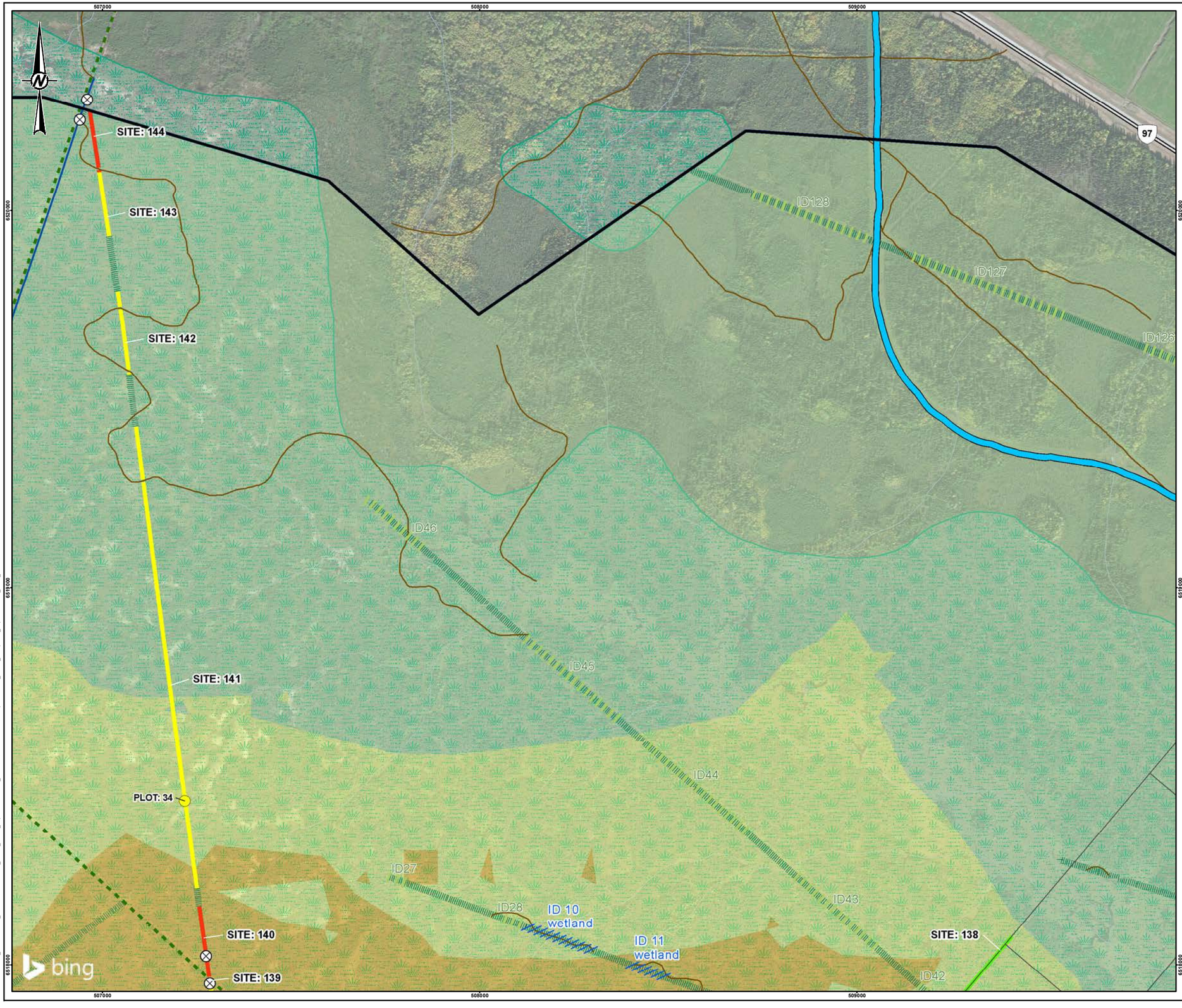
PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	**A - 11**

PATH: N:\Clients\BC_OGRIS\BC09_PROJECTS\166829_Parker_Zone1_Implementation\02_PRODUCTION\7000MXD\Report\166829_Zone1_Completed_Implementation_Rev0_20170428.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0



LEGEND

- CARIBOU HABITAT RESTORATION SIGN
- PARKER CARIBOU RANGE
- TACTICAL PLAN TREATMENT ZONE 1

MONITORING PLOT LOCATION AND SITE TREATMENT TYPE

- MOUNDING / SEEDLING PLANTING

TREATMENT TYPE

- TREE FELLING
- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING
- TREE FELLING / MOUNDING
- TREE FELLING / SCARIFICATION
- TREE FELLING / COARSE WOODY DEBRIS

OTHER

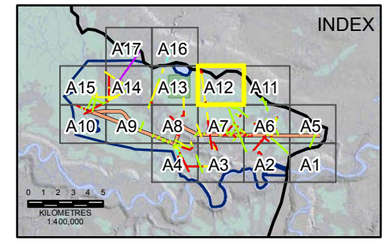
- LEAVE FOR NATURAL
- NATURAL REVEGETATION >3m : NO ACCESS
- WATER OBSTACLE
- SLED DOG TRAIL
- PARKER LAKE ECOLOGICAL RESERVE
- WATERBODY
- WETLAND
- WATERCOURSE

WINTER ACCESS

- ACTUAL RECREATIONAL TRAIL / PRIMARY WINTER ACCESS
- CANFOR PIPELINE BYPASS ROAD
- ORIGINALLY EXCLUDED LINEAR DISTURBANCES
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RESOURCE ROAD
- UNCLASSIFIED ROAD
- BC OGC PETROLEUM DEVELOPMENT ROAD
- BC OGC PETROLEUM ACCESS ROAD
- FORESTRY SERVICE ROAD / ROAD PERMIT
- RECREATIONAL TRAIL DESIGNATION

PREDICTED CARIBOU CALVING HABITAT

- LOW
- LOW - MODERATE
- MODERATE



0 250 500

1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT

BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT

PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE

ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT

Golder Associates

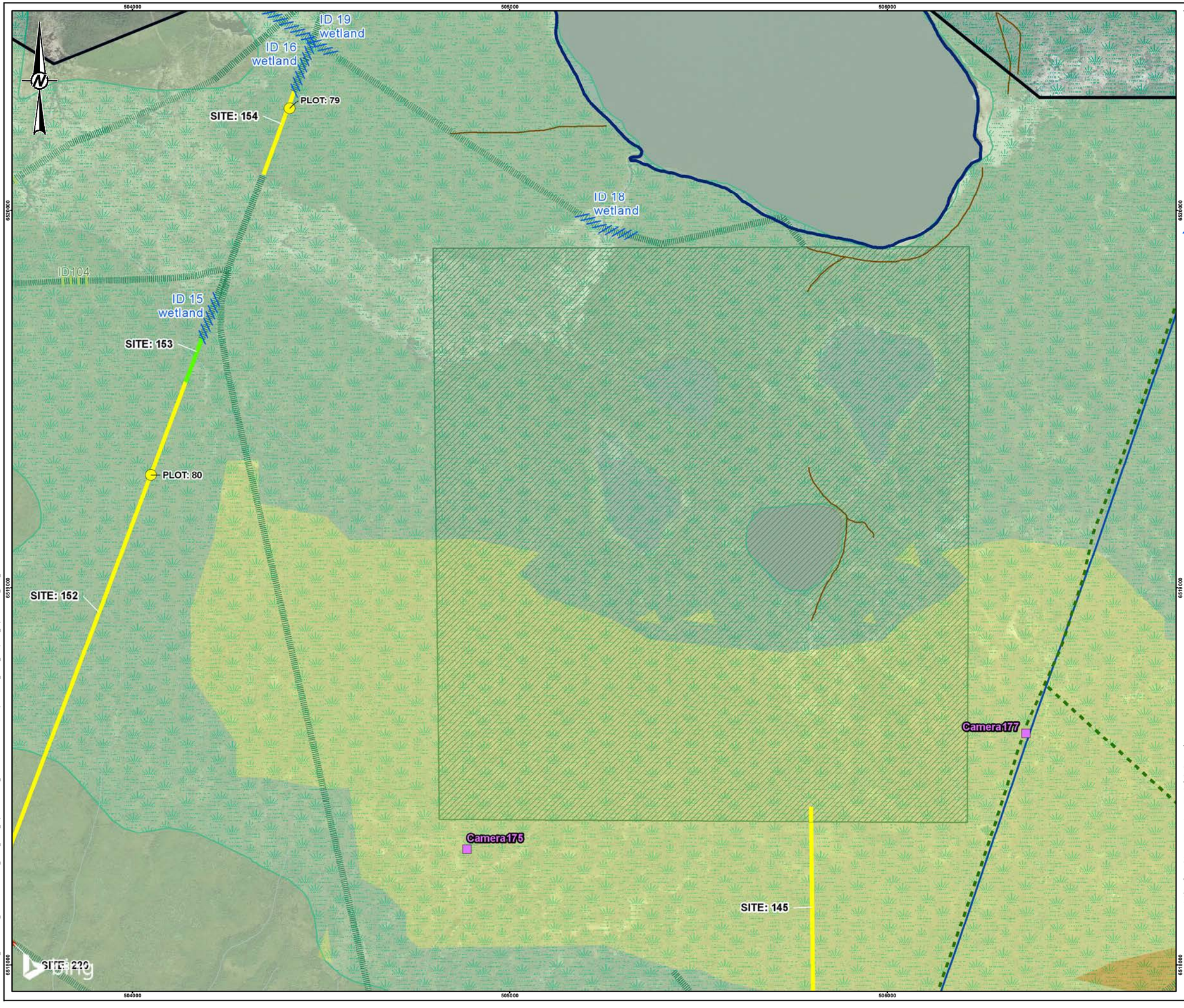
YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	A - 12

PATH: N:\Client\BC_OGRS\BCOG9_PROJECTS\1668292_Parker_Zone 1_Implementation\02_PRODUCTION\7000\MXD\Report\166829_Zone1_Completed_Implementation_Rev0_20170428.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm



LEGEND

- CAMERA LOCATION
- PARKER CARIBOU RANGE
- TACTICAL PLAN TREATMENT ZONE 1

MONITORING PLOT LOCATION AND SITE TREATMENT TYPE

- MOUNDING / SEEDLING PLANTING

TREATMENT TYPE

- TREE FELLING
- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING
- TREE FELLING / MOUNDING
- TREE FELLING / SCARIFICATION
- TREE FELLING / COARSE WOODY DEBRIS

OTHER

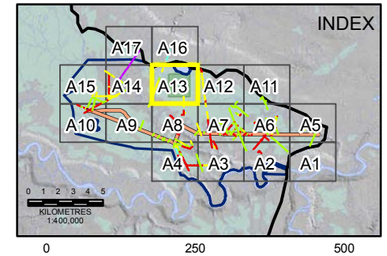
- LEAVE FOR NATURAL
- NATURAL REVEGETATION >3m : NO ACCESS
- WATER OBSTACLE
- SLED DOG TRAIL
- PARKER LAKE ECOLOGICAL RESERVE
- WATERBODY
- WETLAND
- WATERCOURSE

WINTER ACCESS

- ACTUAL RECREATIONAL TRAIL / PRIMARY WINTER ACCESS
- CANFOR PIPELINE BYPASS ROAD
- ORIGINALLY EXCLUDED LINEAR DISTURBANCES
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RESOURCE ROAD
- UNCLASSIFIED ROAD
- BC OGC PETROLEUM DEVELOPMENT ROAD
- BC OGC PETROLEUM ACCESS ROAD
- FORESTRY SERVICE ROAD / ROAD PERMIT
- RECREATIONAL TRAIL DESIGNATION

PREDICTED CARIBOU CALVING HABITAT

- LOW
- LOW - MODERATE
- MODERATE



0 250 500

1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT

BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT

PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE

ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

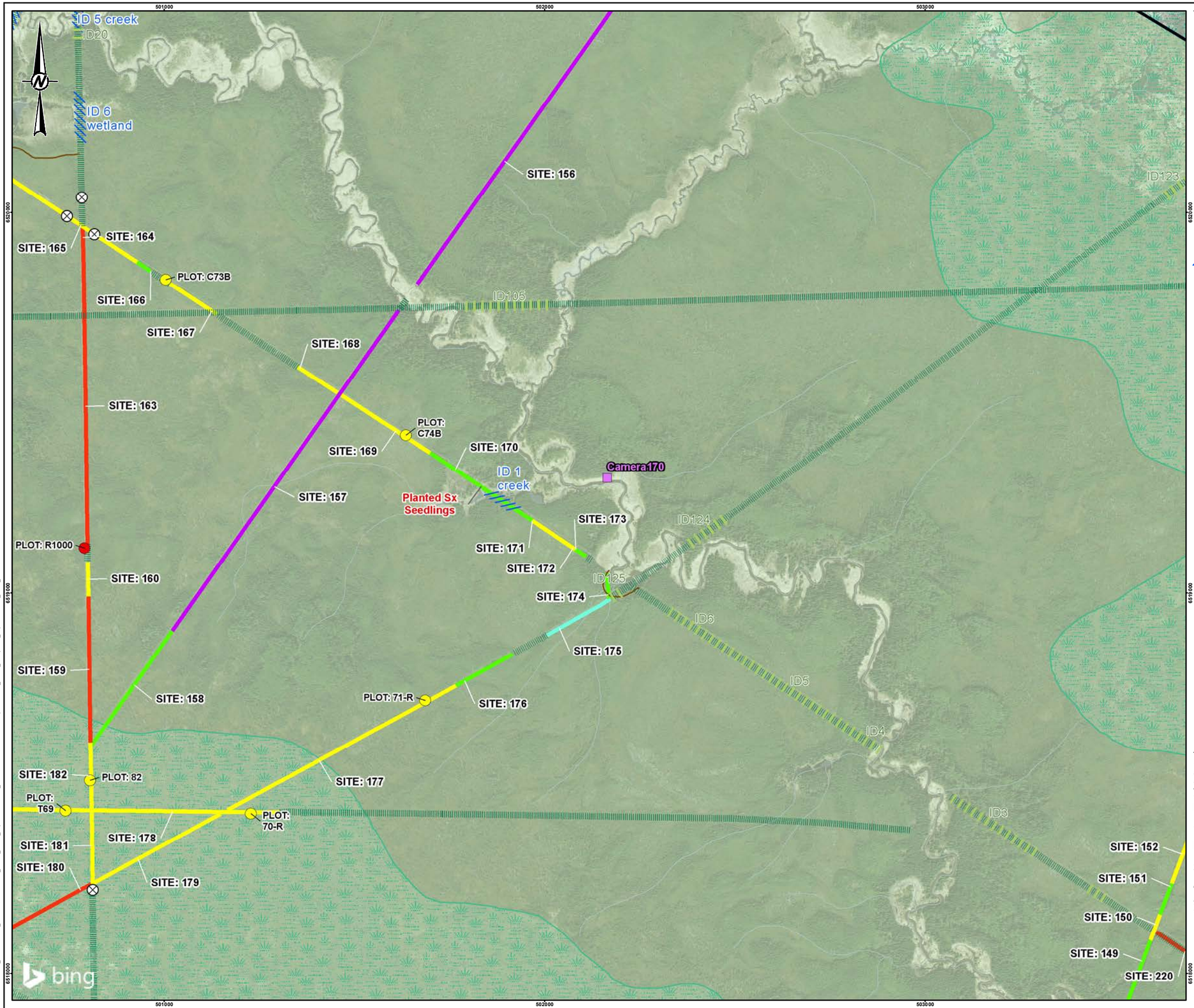
PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	A - 13

PATH: N:\Clients\BC_OGRIS\BC09_PROJECTS\166829_Parker_Zone1_Implementation\02_PRODUCTION\7000\MXD\Report\166829_Zone1_Completed_Implementation_Rev0_20170428.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

25mm

0



LEGEND

- CARIBOU HABITAT RESTORATION SIGN
- CAMERA LOCATION
- PARKER CARIBOU RANGE
- TACTICAL PLAN TREATMENT ZONE 1

MONITORING PLOT LOCATION AND SITE TREATMENT TYPE

- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING

TREATMENT TYPE

- TREE FELLING
- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING
- TREE FELLING / MOUNDING
- TREE FELLING / SCARIFICATION
- TREE FELLING / COARSE WOODY DEBRIS

OTHER

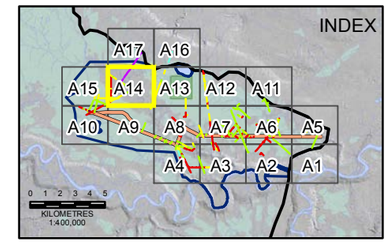
- LEAVE FOR NATURAL
- NATURAL REVEGETATION >3m : NO ACCESS
- WATER OBSTACLE
- SLED DOG TRAIL
- PARKER LAKE ECOLOGICAL RESERVE
- WATERBODY
- WETLAND
- WATERCOURSE

WINTER ACCESS

- ACTUAL RECREATIONAL TRAIL / PRIMARY WINTER ACCESS
- CANFOR PIPELINE BYPASS ROAD
- ORIGINALLY EXCLUDED LINEAR DISTURBANCES
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RESOURCE ROAD
- UNCLASSIFIED ROAD
- BC OGC PETROLEUM DEVELOPMENT ROAD
- BC OGC PETROLEUM ACCESS ROAD
- FORESTRY SERVICE ROAD / ROAD PERMIT
- RECREATIONAL TRAIL DESIGNATION

PREDICTED CARIBOU CALVING HABITAT

- LOW



0 250 500

1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT

BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT

PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE

ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

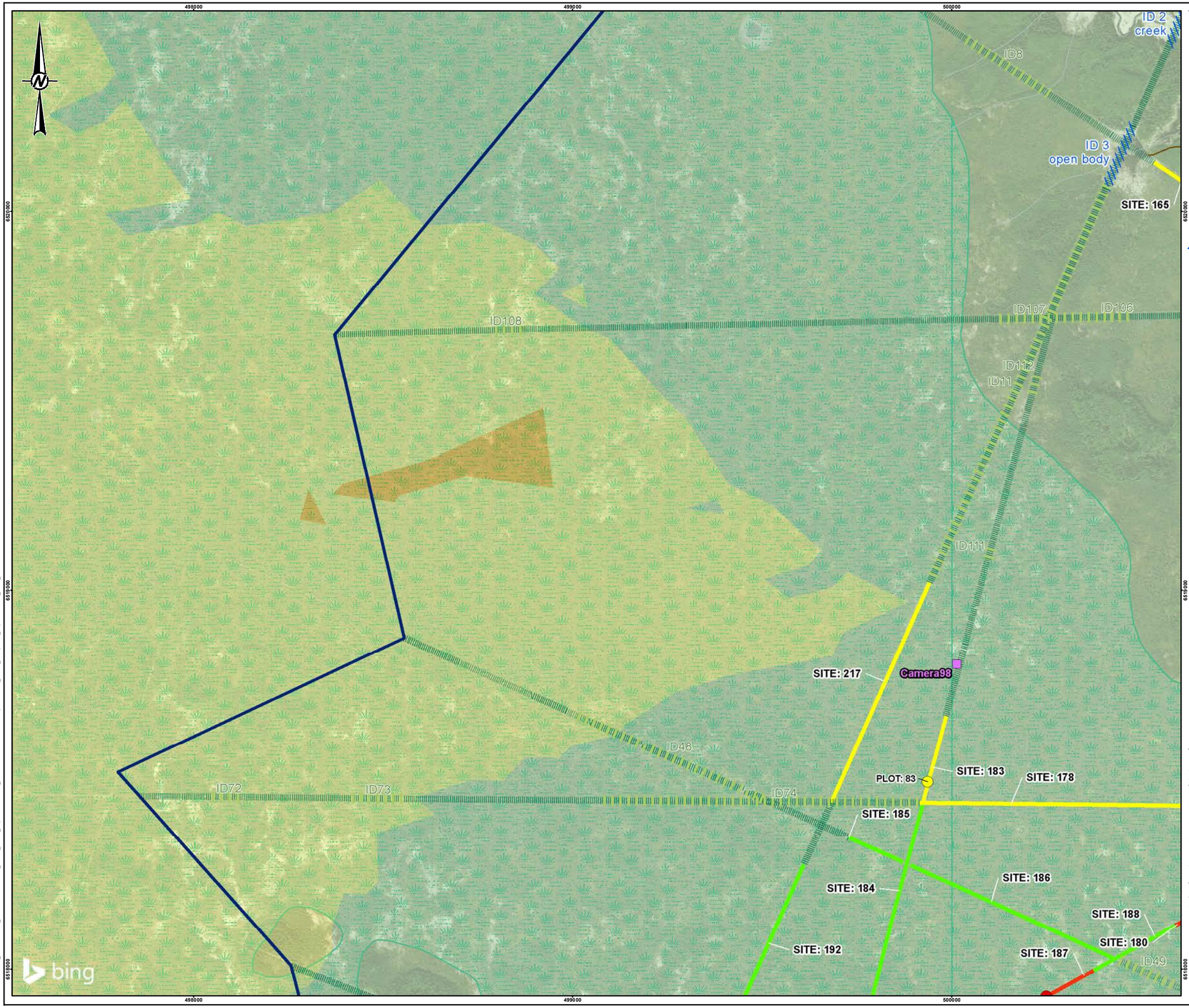
PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	A - 14

PATH: N:\Client\BC_OGRIS\BC09_PROJECTS\166829_Parker_Zone 1_Implementation\02_PRODUCTION\7000\MXD\Report\166829_Zone1_Completed_Implementation_Rev0_20170428.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0



LEGEND

- CAMERA LOCATION
- PARKER CARIBOU RANGE
- TACTICAL PLAN TREATMENT ZONE 1

MONITORING PLOT LOCATION AND SITE TREATMENT TYPE

- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING

TREATMENT TYPE

- TREE FELLING
- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING
- TREE FELLING / MOUNDING
- TREE FELLING / SCARIFICATION
- TREE FELLING / COARSE WOODY DEBRIS

OTHER

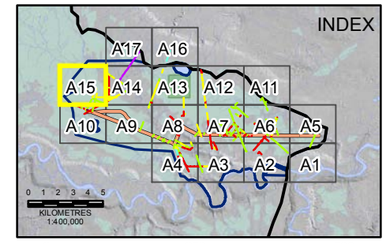
- LEAVE FOR NATURAL
- NATURAL REVEGETATION >3m : NO ACCESS
- WATER OBSTACLE
- SLED DOG TRAIL
- PARKER LAKE ECOLOGICAL RESERVE
- WATERBODY
- WETLAND
- WATERCOURSE

WINTER ACCESS

- ACTUAL RECREATIONAL TRAIL / PRIMARY WINTER ACCESS
- CANFOR PIPELINE BYPASS ROAD
- ORIGINALLY EXCLUDED LINEAR DISTURBANCES
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RESOURCE ROAD
- UNCLASSIFIED ROAD
- BC OGC PETROLEUM DEVELOPMENT ROAD
- BC OGC PETROLEUM ACCESS ROAD
- FORESTRY SERVICE ROAD / ROAD PERMIT
- RECREATIONAL TRAIL DESIGNATION

PREDICTED CARIBOU CALVING HABITAT

- LOW
- LOW - MODERATE
- MODERATE



0 250 500

1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT

BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT

PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE

ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	A - 15

PATH: N:\Client\BC_OGRIS\BC09_PROJECTS\168292_Parker_Zone 1_Implementation\02_PRODUCTION\7000\MXD\Report\166829_Zone1_Completed_Implementation_Rev0_20170428.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

504000 505000 506000

6523000 6522000 6521000

97

Old Alaska Highway

SITE: 155

ID 19
wetland

bing

LEGEND

- CARIBOU HABITAT RESTORATION SIGN
- PARKER CARIBOU RANGE
- TACTICAL PLAN TREATMENT ZONE 1

TREATMENT TYPE

- TREE FELLING
- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING
- TREE FELLING / MOUNDING
- TREE FELLING / SCARIFICATION
- TREE FELLING / COARSE WOODY DEBRIS

OTHER

- LEAVE FOR NATURAL
- WATER OBSTACLE
- SLED DOG TRAIL
- PARKER LAKE ECOLOGICAL RESERVE
- WATERBODY
- WETLAND
- WATERCOURSE

WINTER ACCESS

- ACTUAL RECREATIONAL TRAIL / PRIMARY WINTER ACCESS
- CANFOR PIPELINE BYPASS ROAD
- ORIGINALLY EXCLUDED LINEAR DISTURBANCES
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RESOURCE ROAD
- UNCLASSIFIED ROAD
- BC OGC PETROLEUM DEVELOPMENT ROAD
- BC OGC PETROLEUM ACCESS ROAD
- FORESTRY SERVICE ROAD / ROAD PERMIT
- RECREATIONAL TRAIL DESIGNATION

PREDICTED CARIBOU CALVING HABITAT

- LOW

0 250 500

1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT
PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE
ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT
Golder Associates

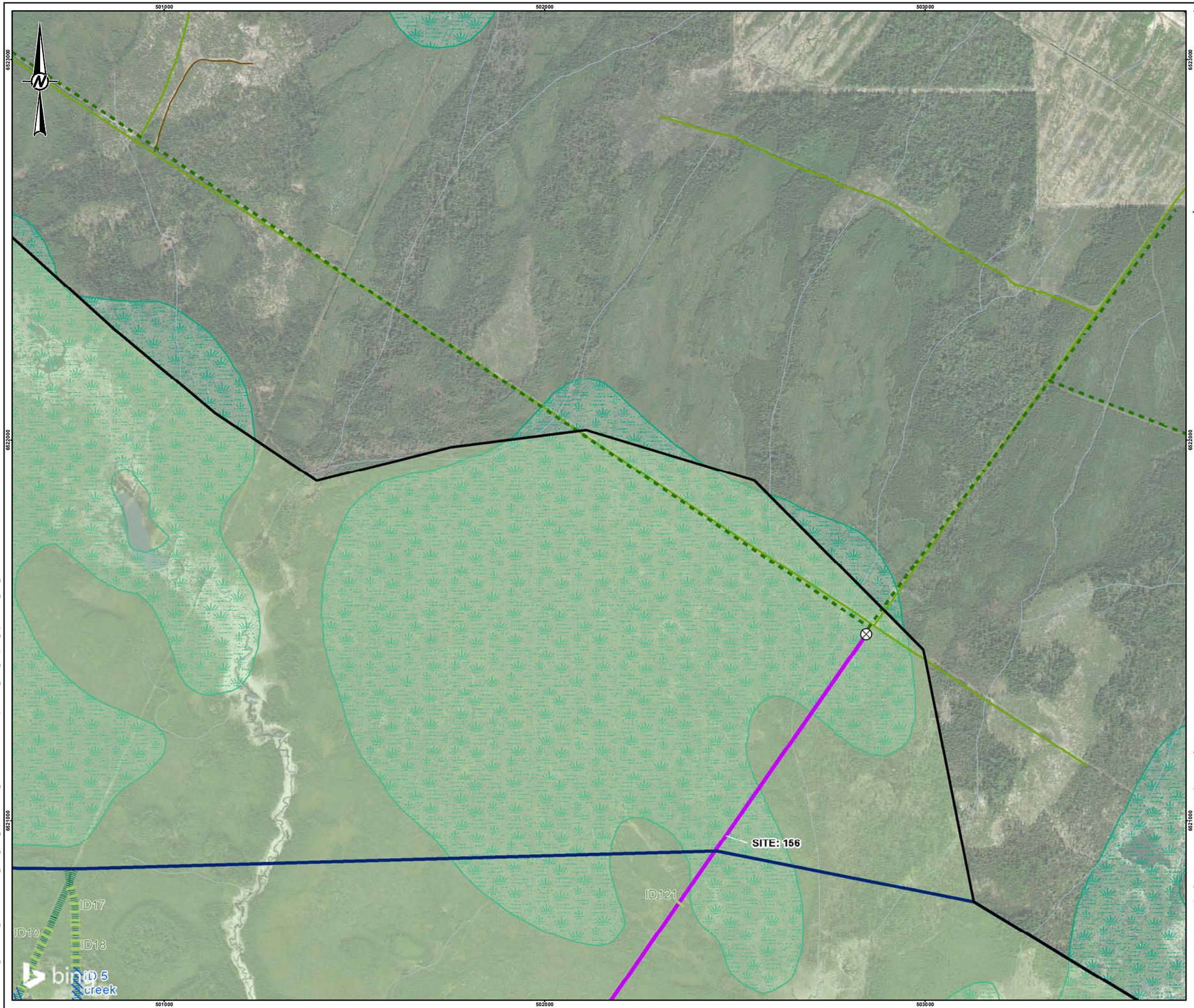
YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	A - 16

PATH: N:\Client\BC_OGRIS\PROJECTS\166829_Parker_Zone 1_Implementation\02_PRODUCT\ON7000\MXD\Report\166829_Zone1_Completed_Implementation_Rev0_20170428.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm



LEGEND

- CARIBOU HABITAT RESTORATION SIGN
- PARKER CARIBOU RANGE
- TACTICAL PLAN TREATMENT ZONE 1

TREATMENT TYPE

- TREE FELLING
- MOUNDING / SEEDLING PLANTING
- MOUNDING / TREE FELLING / SEEDLING PLANTING
- TREE FELLING / MOUNDING
- TREE FELLING / SCARIFICATION
- TREE FELLING / COARSE WOODY DEBRIS

OTHER

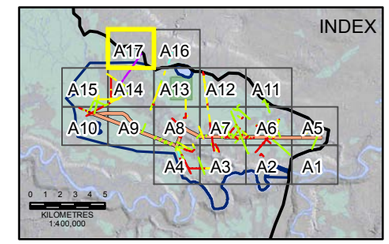
- LEAVE FOR NATURAL
- NATURAL REVEGETATION >3m : NO ACCESS
- WATER OBSTACLE
- SLED DOG TRAIL
- PARKER LAKE ECOLOGICAL RESERVE
- WATERBODY
- WETLAND
- WATERCOURSE

WINTER ACCESS

- ACTUAL RECREATIONAL TRAIL / PRIMARY WINTER ACCESS
- CANFOR PIPELINE BYPASS ROAD
- ORIGINALLY EXCLUDED LINEAR DISTURBANCES
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RESOURCE ROAD
- UNCLASSIFIED ROAD
- BC OGC PETROLEUM DEVELOPMENT ROAD
- BC OGC PETROLEUM ACCESS ROAD
- FORESTRY SERVICE ROAD / ROAD PERMIT
- RECREATIONAL TRAIL DESIGNATION

PREDICTED CARIBOU CALVING HABITAT

- LOW



0 250 500

1:10,000 METRES

REFERENCES

1. IMAGERY OBTAINED FROM BING MAPS FOR ARCGIS PUBLISHED BY MICROSOFT CORPORATION, REDMOND, WA, MAY 2009. DATE: MAY 2011.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT

BC OIL AND GAS RESEARCH AND INNOVATION SOCIETY

PROJECT

PARKER CARIBOU RANGE HABITAT RESTORATION

TITLE

ZONE 1 FIELD IMPLEMENTATION
AS - BUILT DRAWINGS

CONSULTANT

Golder Associates

YYYY-MM-DD	2017-04-28
DESIGNED	CP
PREPARED	HR
REVIEWED	BC
APPROVED	PB

PROJECT NO.	CONTROL	REV.	FIGURE
166829	5000	0	A - 17

PATH: N:\Client\BC_OGRIS\BC19_PROJECTS\1668292_Parker_Zone 1_Implementation\02_PRODUCTION\7000\MXD\Report\166829_Zone1_Completed_Implementation_Rev0_20170428.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm
0

APPENDIX B

Habitat Restoration Photo Log

Photo 1: Typical Example of Tree-felling

Photo 2: Tree-Felling Treatment on a Variable Density Treed Wetland

Photo 3: Mounding Using a Berm and Trench Style

Photo 4: Traditional Silviculture Style Mounding in Lowland Site

Photo 5: Typical Tree-felling, Mounding, and Seedling Planting Site

Photo 6: Planting Frozen Seedlings on a Berm Style Mounding Treatment in Lowland Site

Photo 7: Winter Planted Black Spruce Seedling

Photo 8: Tree-felling and Coarse Woody Debris

Photo 9: Tree-felling and Scarification by Ripping

Photo 10: Typical Overgrown Seismic Line in Zone 1

Photo 11: Tree Felling and Habitat Enhancement Site Sign

Photo 12: Monitoring Plot Establishment on Treated and Control Area

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

For more information, visit golder.com

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 44 1628 851851
North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

solutions@golder.com
www.golder.com

Golder Associates Ltd.
102, 2535 - 3rd Avenue S.E.
Calgary, Alberta, T2A 7W5
Canada
T: +1 (403) 299 5600

Golder Associates