Cenovus FCCL Ltd.
500 Centre Street SE
PO Box 766
Calgary, AB
T2P 0M5
403-766-2000

January 22, 2015

Mr. Andrew MacPherson, P.Eng.
Manager, In Situ Subsurface Authorizations
Authorizations Branch
Alberta Energy Regulator
Suite 1000, 250 – 5th Street SW
Calgary, AB T2P 0R4

Re: Christina Lake Thermal Project Phase H and Eastern Expansion Project Update and Supplemental Information Request 2 Responses
AER Application No. 1758947
EPEA Application No. 019-48522

Dear Mr. MacPherson,

Cenovus FCCL Ltd. (Cenovus), as operator for FCCL Partnership, submitted the Christina Lake Thermal Project Phase H and Eastern Expansion Project Application to the Energy Resources Conservation Board (now the Alberta Energy Regulator [AER]) and Alberta Environment and Sustainable Resource Development (ESRD) on March 22, 2013. Following this submission, the AER and ESRD issued the Round 1 Supplemental Information Request (SIR) on February 24, 2014, which Cenovus provided response to on June 23, 2014. Further to this, the AER and ESRD issued the Round 2 SIR on November 21, 2014. The enclosed document provides responses to the Round 2 SIR and also includes a Project Update to the subsurface drainage pattern for the S11 well pad.

Should you have any questions regarding the enclosed Phase H and Eastern Expansion Application Round 2 Project Update and SIR responses, please contact the undersigned at (403) 766-7521.

Yours truly,

B. Mitchell

Brent Mitchell
Specialist, Regulatory Applications
Cenovus FCCL Ltd.

Copy: Shay Dodds – AER
Rieanne Graham – AER
Doug Wong – AER
Corinne Kristensen – ESRD

Enclosure

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PROJECT UPDATE

INTRODUCTION

On March 22, 2013, Cenovus FCCL Ltd. (Cenovus) submitted regulatory applications and an environmental impact assessment (EIA; collectively referred to as the Application) to the Energy Resources Conservation Board (now Alberta Energy Regulator [AER]) and Alberta Environment and Sustainable Resource Development (ESRD) to construct, operate and reclaim the Christina Lake Thermal Project (CLTP) Phase H and Eastern Expansion (the Project). Following review of the Application, the AER and ESRD issued the Round 1 Supplemental Information Request (SIR) on February 24, 2014. Further to this, Cenovus provided responses to the Round 1 SIR on June 23, 2014. Upon review of the Round 1 SIR responses, the AER and ESRD issued the Round 2 SIR for the Application on November 21, 2014.

The purpose of this document is to provide responses to the Round 2 SIR package and provide updated information regarding the Project (Project Update). This document is organized into two parts as follows:

- Part 1 – Round 2 Project Update; and
- Part 2 – AER/ESRD Round 2 SIR Responses.

Since submittal of the Application and the Round 1 SIR responses, Cenovus has revised the subsurface reservoir drainage patterns for the Project S11 well pad. This revision is proposed to accommodate the amended subsurface drainage pattern for the CLTP Phases F and G approved B13 well pad. The amended B13 well pad is described in the B13 Pad Trajectory Amendment Application (Application No. 1817487) that was filed with the AER on December 4, 2014, approved by the AER on January 14th, 2015 (Scheme No. 8591 NN). No further changes to the Project central processing facility (CPF), well pad surface locations, or subsurface well pair drainage patterns are proposed. In addition, the proposed changes will not alter the Project development schedule, proposed production capacity, air and noise emissions, or CPF water usage. Given that the S11 well pad subsurface drainage pattern change does not result in footprint or emission source revisions, the Project Update will not alter the conclusions of the Application and EIA.

RESERVOIR AND RECOVERY PROCESS UPDATE

A minor Project Update is proposed to the Project S11 well pad drainage pattern to accommodate changes proposed to the CLTP Phases F and G approved B13 well pad well pairs. As described in the B13 Pad Trajectory Amendment Application (Application No. 1817487), Cenovus is proposing to extend the B13 well pairs to the south to better utilize the B13 well pad surface infrastructure and more efficiently access the resource in the area. Extending the length of the B13 well pairs in the proposed manner will prevent the

need to drill the two northern well pairs on the S11 pad at non-parallel angles. Cenovus does not have operational experience in producing well pairs at non-parallel angles and foresees a possible risk to resource conservation, particularly as the well spacing increases towards the toes of the wells. As such, Cenovus decided to remove the two northern wells on S11 pad and instead drill the B13 wells longer to access the resource.

Due to this proposed amendment, an update to the Project S11 well pad well drainage pattern is also required. The proposed change will not impact any of the other well pad drainage patterns given in the Project Application. Given the planned amendment for the B13 well pad, the following changes are proposed for the S11 well pad subsurface drainage pattern:

- the northern portion of the S11 drainage box has been revised to accommodate the extended length of the B13 well pad well pairs; and
- the two northern S11 well pairs have been removed and the total well pair count for the pad has been reduced to twelve well pairs.

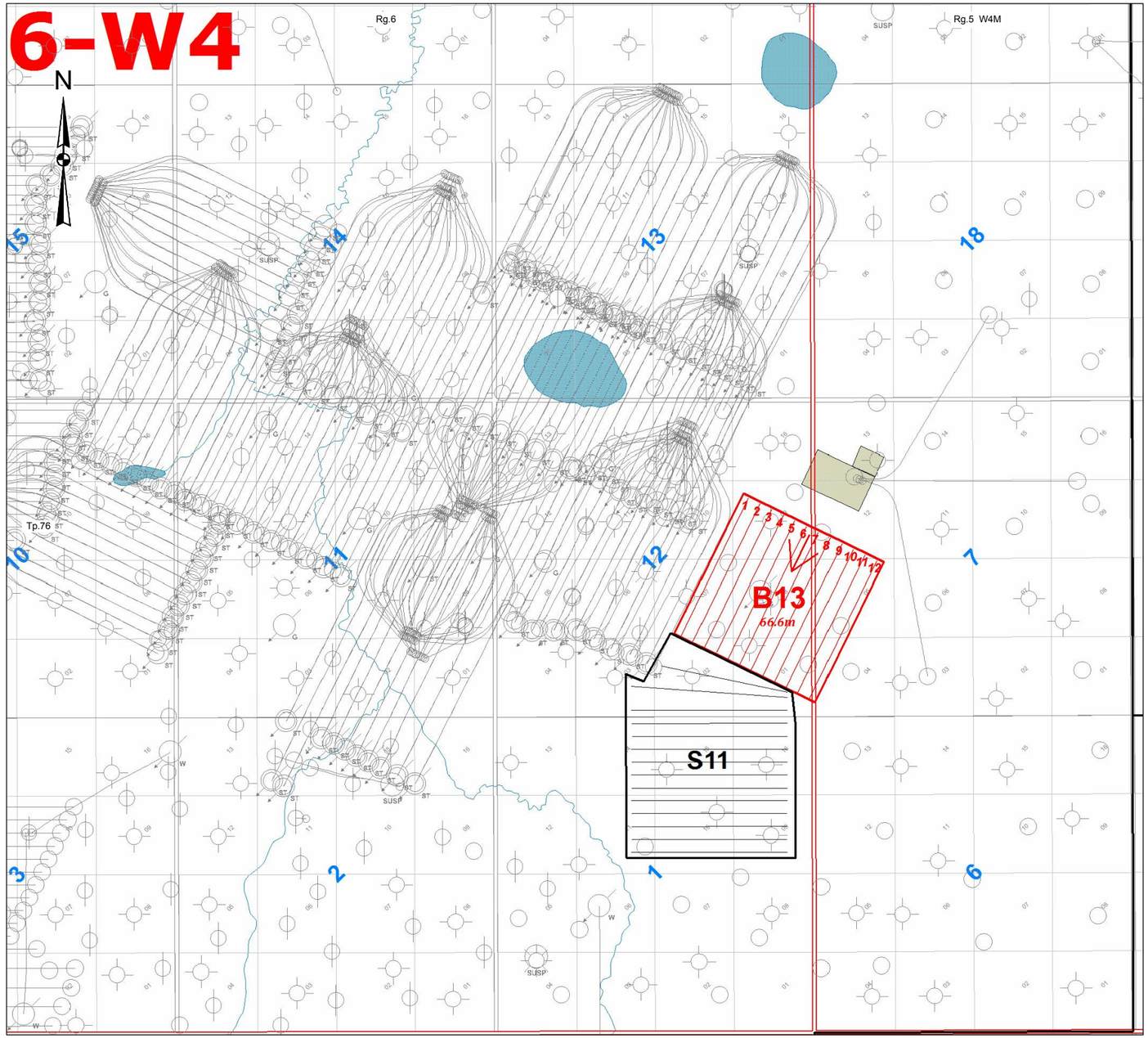
The updated well count and well lengths for the S11 well pairs are provided in Table 1. The inter well spacing for the twelve proposed well pairs remains unchanged at 64 m. Figure 1 shows the current applied for Project S11 and B13 well pair patterns, whereas Figure 2 gives the proposed updated well pair patterns for the B13 and S11 pads.

Table 1 Updated S11 Pad Well Count and Lengths

Well	Old Well Length [m]	New Proposed Well Length [m]	Length Extended [m]
S11-1	799.1	799.1	0
S11-2	797.9	797.9	0
S11-3	796.6	796.6	0
S11-4	796.6	796.6	0
S11-5	801.7	801.7	0
S11-6	799.2	799.2	0
S11-7	801.7	801.7	0
S11-8	797.9	797.9	0
S11-9	800.4	800.4	0
S11-10	797.9	797.9	0
S11-11	800.4	800.4	0
S11-12	802.0	802.0	0
S11-13	804.3	n/a	n/a
S11-14	659.2	n/a	n/a

n/a = Not applicable.

6-W4



0 500 1,000 1,500

SCALE (APPROX.) METRES

REFERENCE

IMAGE SIR 002 FIGURE 2-1.JPG OBTAINED FROM CENOVUS

PROJECT

cenovus ENERGY

CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION
SIR REPORT

TITLE

CURRENT PROPOSED B13 AND S11 PAD DRAINAGE AREA AND WELL PAIR

Golder Associates

PROJECT No.	14-1446-0011.5300		FILE No.	14134600115300A006
DESIGN	SS	2014-12-08	SCALE	AS SHOWN
CADD	BSW	2014-12-12		
CHECK	RL	2014-01-15		**FIGURE: 1**
REVIEW	SNS	2015-01-15		

L:\Cenovus\Christina Lake Thermal Project\99_PROJECTS\14-1346-0011\02_PRODUCTION\Rep\A_5300\DWG\14134600115300A006.dwg | Layout: 1 Proposed B13 and S11 | Modified: BWheeler 01/15/2015 11:12 AM | Plotted: BWheeler 01/15/2015

76-6-W4

N

Rg.6

Rg.5 W4M.

Tp.76

Tp.75

15

14

13

18

10

11

12

7

B13
66.6m

S11
64m

1

0 400 800 1,200

SCALE (APPROX.) METRES

REFERENCE

IMAGE SIR 002 FIGURE 2-1.JPG OBTAINED FROM CENOVUS

PROJECT

cenovus ENERGY

CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION
SIR REPORT

TITLE

UPDATED B13 AND S11 PAD DRAINAGE AREA AND WELL PAIR LAYOUT

Golder Associates

PROJECT No.	14-1446-0011.5300		FILE No.	14134600115300A007
DESIGN	RL	2014-01-09	SCALE	AS SHOWN
CADD	BSW	2014-01-12		
CHECK	RL	2015-01-15		
REVIEW	SNS	2015-01-15		

FIGURE: 2

L:\Cenovus\Christina Lake Thermal Project\99_PROJECTS\14-1346-0011\02_PRODUCTION\[RepA_5300]DWG\14134600115300A007.dwg | Layout: 2 Updated B13 and S11 | Modified: BWheeler 01/15/2015 11:12 AM | Plotted: BWheeler 01/15/2015

A summary of the current and updated B13 and S11 Oil in Place (OIP) drainage box volumes are provided in Table 2. As given in the table, there is minimal change in resource volumes contained within the updated drainage boxes, as compared to the original drainage boxes. Cenovus expects the small difference in resource volume to be recovered through passive heating and drainage over time, as the area will be surrounded by three steaming pads, including B13, S11, and the existing B06 pad. As such, there will be no impact to ultimate resource recovery due to the proposed changes to the B13 and S11 drainage boxes. Cenovus will continue to monitor the steam chamber development and conformance of these pads through 4D seismic to ensure resource recovery in the area.

Table 2 Current and Proposed Oil in Place Volumes for B13 and S11

Well	Oil In Place [m^3]	
	Current Drainage Box	**Proposed Drainage Box**
B13	4,746,393	5,867,144
S11	5,487,556	4,277,581
Total	**10,233,949**	**10,144,725**

No other changes to the well pad infrastructure, well pad measurement, reservoir monitoring or well completions are proposed as part of this Project Update.

ALBERTA ENERGY REGULATOR

GENERAL

1. Provide an update on the status of stakeholder (public and industry) notification and consultation respecting the subject application including:

a. a discussion on any outstanding statement of concerns (SOCs) respecting the subject application (including any SOCs sent to AESRD) and the efforts to resolve them,

b. an updated listing of all oil sands leaseholders in the off-setting quarter sections of the application area and P&NG leaseholders and the freehold mineral owners of any unleased lands in the application area that have received notification since Table 1-1 was presented in the SIR 1 responses.

c. an updated listing of all stakeholders (public and industry) that have received notification of the subject application.

Response:

a. Cenovus has continued to engage with Aboriginal communities and is working towards resolution of the issues and concerns raised.

Chipewyan Prairie Dene First Nation (CPDFN)

Cenovus's ongoing engagement with CPDFN has continued since the previous Supplemental Information Request (SIR) Round 1 update. Cenovus has exchanged ongoing telephone and e-mail correspondence with CPDFN over the past six months regarding Cenovus's schedule for responding to SIR Rounds 1 and 2, CPDFN's schedule for completing the Phase H & Eastern Expansion Traditional Land Use (TLU), and Cenovus's schedule for responding to CPDFN's technical review of the Project.

On July 8, 2014 Cenovus e-mailed CPDFN a link to the AER's website where the SIR Round 1 responses are stored for public access; this was in addition to the CD copies that Cenovus mailed to CPDFN in June 2014, to ensure that CPDFN received a copy of Cenovus's responses in a manner that CPDFN would be able to access.

On August 8, 2014 CPDFN e-mailed to Cenovus a copy of CPDFN's finalized TLU assessment for the Project, to provide Cenovus with additional background information in support of CPDFN's technical review. Cenovus also had e-mail discussions with CPDFN between August 14 and 20, 2014 to better understand some of the comments in CPDFN's technical review.

On October 1, 2014 Cenovus attended a community open house in Janvier to hear CPDFN's IRC and technical experts explain the results of the Moose Tissue Study (conducted by the IRC with funding from industry) regarding CPDFN's traditional land use in the Christina Lake Region.

Between September and October 2014 CPDFN and Cenovus exchanged e-mails in order to coordinate a meeting so that Cenovus could provide CPDFN with both a schedule update for SIR Round 2, (including when Cenovus believed it would receive the questions and its schedule for responding to the Regulator), and Cenovus's progress and updated schedule for responding to CPDFN regarding its technical review. On October 21, 2014 Cenovus and CPDFN were able to hold an update meeting via telephone. Cenovus explained at that time that it was anticipating receiving the SIR Round 2 questions either at the end of October or in early November and that Cenovus was working towards a date for approximately the end of November for responding to CPDFN's technical review.

Cenovus is currently in the ongoing process of reviewing CPDFN's issues and concerns, including its technical comments and recommendations, in more detail and continues to work with CPDFN to understand and address its concerns.

Chard Metis (Chard)

Throughout April and May 2014 Cenovus and Chard exchanged e-mails in order to set up an introductory meeting, to discuss the SOC in general and to discuss what Chard sees as the next steps for moving forward with its SOC.

On May 30, 2014 Cenovus and Chard had an introductory in person meeting, and discussed Chard's SOC and the next steps for both Cenovus and Chard to move forward together. Chard explained that it believes the first step is to have a leader to leader meeting so that Cenovus can fully understand where Chard is coming from at a high level. Chard also presented Cenovus with a potential funding proposal for Cenovus's consideration.

On June 23, 2014 Cenovus provided Chard with a copy of the SIR Round 1 responses. Between June and August 2014 Cenovus and Chard exchanged e-mails in order to facilitate the leader to leader meeting. On August 20, 2014 Cenovus and Chard met at Cenovus's Christina Lake facility for the leader to leader meeting. At the meeting Chard presented the idea of a consultation process that they would like to move forward on with Cenovus, and a community request for a van in order to transport children in the community to school. On August 26, 2014 Cenovus e-mailed Chard as follow up to the August 20, 2014 meeting and requested a more formalized process or idea of what Chard envisioned regarding the consultation process between Chard and Cenovus. Cenovus also advised that it had looked into the community request for a van to transport children to school and that Cenovus would be happy to help arrange, if desired, and to attend, a meeting with the Northlands School Division and leadership

from the community of Chard, both the Hamlet and Reserve (including CPDFN), to determine potential next steps for addressing the issue of adequate transportation to school for the children in the community.

On September 24, 2014 Chard e-mailed Cenovus a draft description of what it believed a consultation process could look like between Cenovus and Chard. Cenovus and Chard are still in discussions about potential details for a consultation process. Chard also requested a meeting with Cenovus to discuss potential funding, socio-economic and business opportunities for Chard. Cenovus responded that it would be happy to meet with Chard and that Cenovus would also like to present Project specific information and better understand Chard's potential site specific concerns and how the community may be directly and adversely affected by the Project.

On October 2, 2014 Chard and Cenovus met to discuss the Project and potential funding, socio-economic and business opportunities for Chard. Chard also explained to Cenovus that it had initial concerns regarding the level of engagement, clarity regarding effects, reclamation and accommodation. On October 15, 2014 Cenovus and Chard had a telephone conversation to discuss the next steps for addressing Chard's concerns, resolving Chard's SOC and to discuss potential business opportunities this winter for Chard and/or its joint venture partners.

Cenovus is currently in the ongoing process of reviewing Chard's issues and concerns in more detail and continues to work with Chard to understand and address its concerns.

Cold Lake First Nations (CLFN)

On June 23, 2014 Cenovus provided to the CLFN Access Committee, a copy of the SIR Round 1 responses. Cenovus met with the CLFN Access Committee on September 16, 2014 and introduced the Phase H and Eastern Expansion Project.

Cenovus is currently in the ongoing process of reviewing CLFNs concerns in greater detail and continues to work with CLFN to understand and address its concerns.

Fort McMurray Metis Local 1935 (ML1935)

On June 25, 2014 Cenovus responded to ML 1935's draft TLU assessment proposal and confirmed that it would provide funding along with other industry members to support ML1935's TLU assessment.

Cenovus e-mailed ML1935 on September 17, 2014 to arrange for a potential Cenovus and ML1935 leadership meeting. ML1935 e-mailed Cenovus on September 19, 2014 to confirm the October 16, 2014 Cenovus/ML1935 leadership meeting.

On October 16, 2014 Cenovus met with ML1935 leadership in Fort McMurray to discuss the Project. On October 24, 2014 ML1935 sent a letter to the AER and withdrew its notice of objection and Statement of Concern on the Project. Cenovus continues to

engage ML1935 as part of Cenovus's ongoing stakeholder engagement related to its long-term operations in the area.

Fort McMurray #468 First Nation (FMFN)

On April 3, 2014, FMFN withdrew its SOC. Cenovus understands that while FMFN continues to have concerns related to the regional cumulative effects of oil sands and other industrial development, Cenovus has adequately consulted with FMFN and addressed the potential effects of the Project on FMFN's rights, interests and traditional activities to FMFN's satisfaction.

Cenovus continues to engage FMFN as part of Cenovus's ongoing stakeholder engagement related to its long-term operations in the area.

Christina River Dene Nation Council (CRDNC)

On August 27, 2014 Cenovus received a telephone call from a consultant hired by CRDNC, inquiring as to whether Cenovus had made a decision regarding CRDNC's May 6, 2014, agreement request and funding proposal. Cenovus advised that no decision had been made and Cenovus would like to meet with CRDNC to discuss the Project in more detail. Cenovus and CRDNC corresponded throughout September and October of 2014 to arrange a follow-up meeting for November 6, 2014. To facilitate this meeting Cenovus agreed to cover CRDNC's consultant's time and travel costs for the meeting.

Cenovus e-mailed Project information and the Plain Language Document (PLD) to the CRDNC consultant on November 5, 2014. On November 6, 2014 Cenovus also met with CRDNC and its consultant to provide information regarding Cenovus and the Project, and to provide CRDNC with an opportunity to share any information it may have regarding site specific effects, based on the Project information that Cenovus presented that day. CRDNC's concerns raised in the November 6th meeting primarily related to potential socio-economic and funding opportunities. CRDNC also asked about Cenovus's plans for drilling under Winefred Lake. Cenovus advised CRDNC that its plans for well development begin with the pads closest to the central processing facility, and that Cenovus had no immediate plans to drill under Winefred Lake.

Cenovus is continuing to review the concerns outlined by CRDNC, including those in its SOC, in more detail and to work with CRDNC to understand and address its concerns.

Clearwater River Band #175 & Non-Status Fort McMurray Fort McKay Band

On August 12, 2014 the Clearwater River Band #175 and Non-Status Fort McMurray/Fort McKay Band filed Statements of Concern (SOC) with the AER. Cenovus was unable to determine from these SOCs what the specific effects of the Project may be to either community.

On October 16, 2014 Cenovus e-mailed Ms. Priscilla Kennedy of Davis LLP, legal counsel for the Clearwater River Band #175 and the Non-Status Fort McMurray/Fort McKay Band, regarding those two community's SOCs. Cenovus also included in this e-mail a copy of the Project's PLD for information.

On October 21, 2014 Cenovus followed up via telephone with Ms. Kennedy to discuss the possibility of an introductory meeting with Cenovus, Clearwater River Band #175 and the Non-Status Fort McMurray/Fort McKay Band. Cenovus explained to Ms. Kennedy that the purpose of the meeting was to seek a better understanding about the bands, provide updated Project information, and better understand what their site specific concerns were and how they may be directly and adversely affected. Ms. Kennedy acknowledged receiving Cenovus's previous correspondence, and advised she had not yet reviewed the information, including the PLD, with her clients but that she would within the upcoming week. Since October 21, 2014 Cenovus has been in contact over e-mail and telephone with Ms. Kennedy, a Mr. Malcolm, who was put forward by Ms. Kennedy as the representative for the Clearwater River Band #175, and a consultant based in Halifax who was put forward by Mr. Malcolm as someone who is helping him with regard to the Non-Status Fort McMurray/Fort McKay Band, attempting to schedule an introductory meeting for Cenovus to provide these groups with Project information.

Cenovus has attempted to offer solutions to meet with Clearwater River Band #175 and the Non-Status Fort McMurray / Fort McKay Band in-person at their communities, or via telephone or video conference, in order to have a preliminary meeting to better understand who these communities are, to introduce the Project to them, and to develop a preliminary understanding of how they may be directly and adversely affected by the Project. To date Cenovus has not succeeded in arranging a meeting with any representatives from either Clearwater River Band #175 or the Non-Status Fort McMurray / Fort McKay Band.

Cenovus is continuing to review the SOC concerns in more detail.

b. The oil sands leaseholders in the off-setting quarter sections of the application area, P&NG leaseholders and the freehold mineral owners of any unleased lands in the application area have been updated in Table 1-1. Notification of Round 1 SIRs responses were issued on the dates indicated in Table 1-1.

c. An updated List of Stakeholders, including those that received notification from Cenovus of the Application and SIRs Round 1 is provided in Table 1-1.

Table 1-1 List of Stakeholders

Grouping	Stakeholders	Date e-mailed PLD, PTOR and PTOR Public Notice	Date Mailed Notification and Application	Date Mailed Supplemental Information Request Round 1
Aboriginal Communities and Organizations	Chipewyan Prairie Dene First Nation	August 2012	April 24, 2013	June 23, 2014
	Beaver Lake Creek Nation	August 2012	April 24, 2013	June 23, 2014
	Heart Lake First Nation	August 2012	April 24, 2013	June 23, 2014
	Fort McMurray #468 First Nation	August 2012	April 24, 2013	June 23, 2014
	Cold Lake First Nation	March 4 2013	April 24, 2013	June 23, 2014
	Community of Conklin	August 2012	April 24, 2013	June 23, 2014
	Conklin Metis Local #193 and CRDAC	August 2012	April 24, 2013	June 23, 2014
	Yvonne McCallum (Trapper)[(b)]			
	Community of Chard [(a) (c)]			June 23, 2014
	Fort McMurray Métis 1935[(a) (c)]			June 23, 2014
	Christina River Dene Nation Council[(a) (c)]			June 23, 2014
	Clearwater River Band #175[(a) (c)]			
	Non-Status Fort McMurray/Fort McKay Band[(a) (c)]			
Government and Service Providers	Lac La Biche County		April 24, 2013	June 23, 2014
	Town of Bonnyville		April 24, 2013	June 24, 2014
	Regional Municipality of Wood Buffalo		April 24, 2013	June 24, 2014
	Alberta Energy Regulator		April 24, 2013	June 23, 2014
	Alberta Environment and Sustainable Resource Development		April 24, 2013	June 24, 2014
	Department of Fisheries and Oceans Canada		April 24, 2013	June 24, 2014
	Alberta Culture and Community Services		April 24, 2013	June 24, 2014
	Alberta Health and Wellness		April 24, 2013	June 24, 2014
	Alberta Transportation		April 24, 2013	June 24, 2014

Table 1-1 List of Stakeholders

Grouping	Stakeholders	Date e-mailed PLD, PTOR and PTOR Public Notice	Date Mailed Notification and Application	Date Mailed Supplemental Information Request Round 1
Industry	BP Canada Energy Resources Company		April 24,2013	June 23, 2014
	Paramount Energy Operating Corporation		April 24, 2013	June 24, 2014
	Devon Canada Corporation		April 24, 2013	June 23, 2014
	MEG Energy Corporation			June 23, 2014
	Korea National Oil Corporation (Harvest Operations Corporation)		April 24, 2013	July 15, 2014
	Husky Oil Operations Limited		April 24, 2013	July 16, 2014
	Enbridge Pipelines (Athabasca) Incorporated		April 24, 2013	June 23, 2014
	Nova Gas Transmission Limited		April 24, 2013	June 23, 2014
	AltaLink Management Limited		April 24, 2013	June 23, 2014
	Access Pipelines Incorporated		April 24, 2013	June 23, 2014
	Altagas Limited		April 24, 2013	June 23, 2014
	Canadian Natural Resources Limited		April 24, 2013	June 23, 2014
	Alberta-Pacific Forest Industries Incorporation		April 24, 2013	June 23, 2014
	TransCanada Pipeline Corporation		April 24, 2013	June 23, 2014
	Fortis Alberta Incorporated		April 24, 2013	June 24, 2014
	Signalta Resources Ltd.			
	Rocky Laymen Energy			

(a) Aboriginal groups that have filed SOCs, but who were not originally provided with advanced notice and copies of the Application of the Project.

(b) Cenovus is continuing efforts to contact Yvonne McCallum.

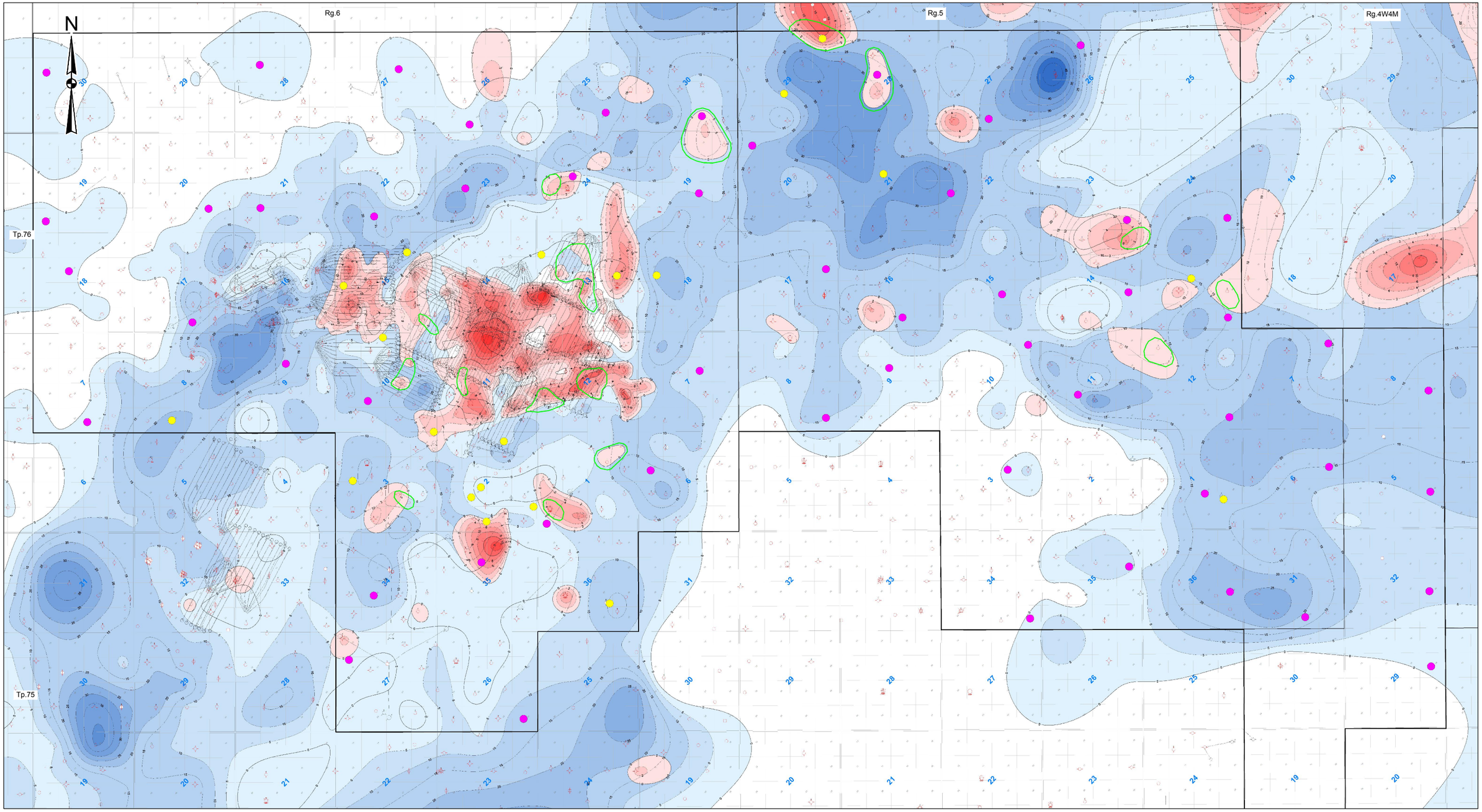
(c) These parties have received the PLD via e-mail.

HYDROGEOLOGY

2. SIR 1, Response 15: Figure 15-1, Page 36. This figure does not include a note in the legend for the existing and planned bottom water or top gas monitoring wells. A note in the legend for the green polygons was not included either. Update Figure 15-1 to include a complete legend.

Response:

The AER Round 1 SIR 15, Figure 15-1 with the legend included is provided as updated Figure 2-1.



LEGEND

- CURRENT BOTTOM WATER PIEZOMETER
- POTENTIAL FUTURE BOTTOM WATER PIEZOMETER
- BOTTOM WATER, STEAM CHAMBER, AND SAGD GAS ARE IN COMMUNICAITON

0 1,200 2,400 3,600

SCALE (APPROX.) METRES

REFERENCE

IMAGE SIR 002 FIGURE 2-1.JPG OBTAINED FROM CENOVUS

PROJECT

cenovus ENERGY

CHRISTINA LAKE THERMAL PROJECT
PHASE H AND THERMAL EXPANSON
SIR REPORT

TITLE

GAS CAP MANAGEMENT
SAGD GAS OVERLAYING BOTTOMWATER

Golder Associates

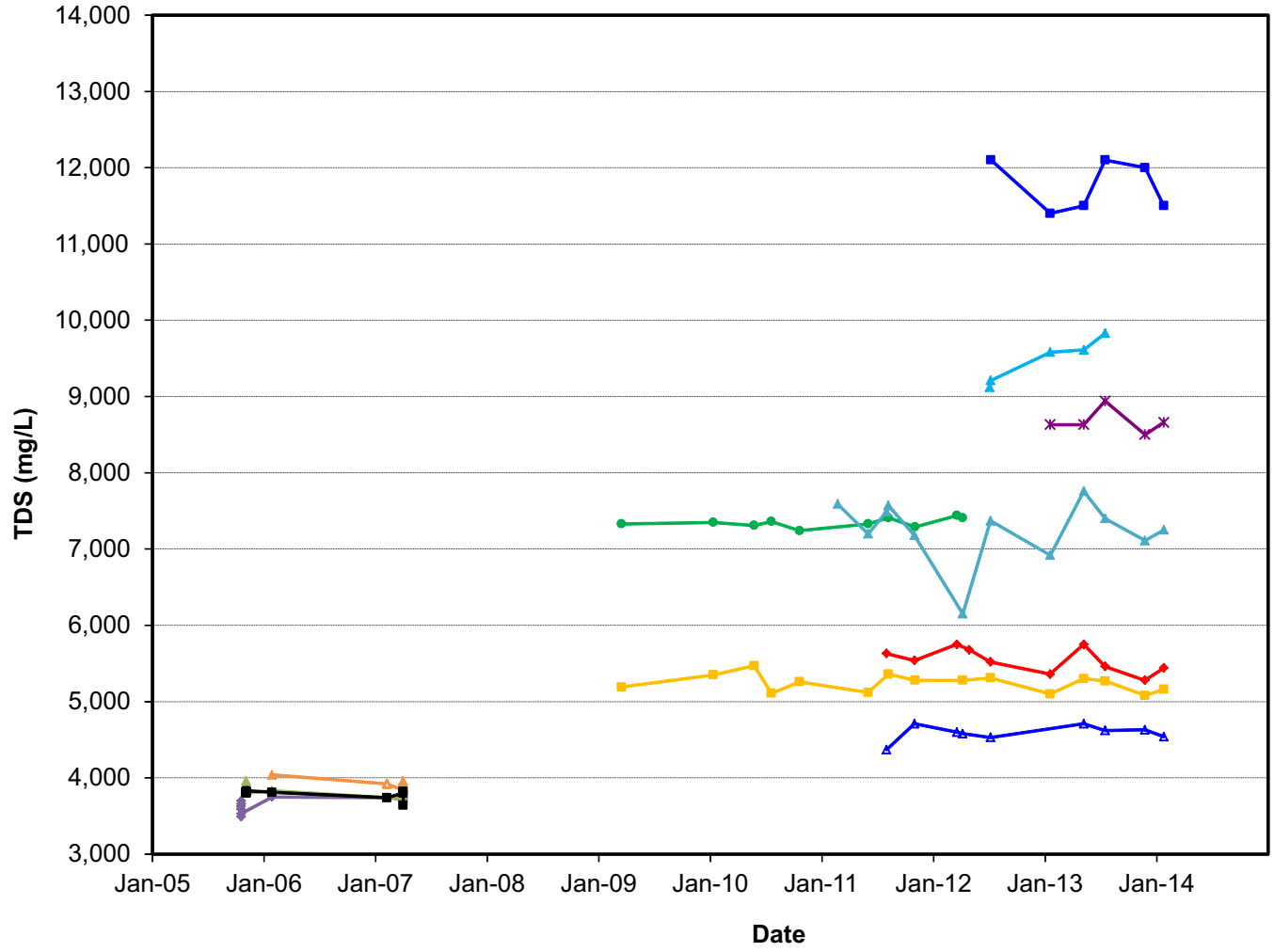
PROJECT No.	14-1446-0011.5300		FILE No.	14134600115300A008
DESIGN	RL	2015-01-13	SCALE	AS SHOWN
CADD	BSW	2015-01-13		
CHECK	RL	2015-01-15		FIGURE: 2-1
REVIEW	SNS	2015-01-15		

L:\Cenovus\Christina Lake Thermal Project\99_PROJECTS\14-1346-0011\02_PRODUCTION\[RepA_5300]\DWG\14134600115300A008.dwg | Layout: GasCap Management | Modified: BWheeler 01/16/2015 7:30 AM | Plotted: BWheeler 01/16/2015

3. SIR 1, Response 19: Table 19-1 and Figure 19-1, Pages 41 to 44. The subject table and figure did not include historical chemistries from Clearwater B water source wells F2/11-09-076-06W4M, F2/9-16-076-06W4M, or BW-A 100/3-17-076-06W4M, which were discussed in the response. Update Table 19-1 and Figure 19-1 to include the above three water source wells. If any additional Clearwater B source wells were missed, add them to the table and figure as well.

Response:

The AER Round 1 SIR 19, Figure 19-1 and Table 19-1 have been updated and are included as Figure 3-1 and Table 3-1. Well 1F2/9-16-076-06W4M was not the correct well name, rather it is 1F1/10-16-076-06. The data from this well is included in Figure 3-1 and Table 3-1.



- 1F1/16-03-076-06W4/00
- 1F1/02-03-076-06W4/00
- 100/04-35-075-06W4/00
- 100/02-27-075-06W4/00
- 100/13-27-075-06W4/00
- 1F1/13-35-075-06W4/00
- 1F1/15-27-075-06W4/00
- 1F1/13-34-075-06W4/00
- 100/03-17-076-06W4/00
- 1F2/13-16-076-06W4/00
- 1F1/10-16-076-06W4/00
- 1F2/11-09-076-06W4/00

PROJECT

cenovus ENERGY

CHRISTINA LAKE
THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

TITLE

CLEARWATER B SOURCE WELLS
TDS vs TIME

Matrix Solutions Inc.
ENVIRONMENT ENGINEERING

PROJECT		3280-514	FILE No.	3280-CH-SIR-14.CDR
DESIGN	AH	March 2014	SCALE	AS SHOWN REV. 0
CADD	ER	March 2014		
CHECK	SP	---		
REVIEW	WW	---		

FIGURE: 3-1

F:\3280\Drafting\2014\3280-CH-SIR-14.cdr

TABLE 3-1.

HISTORICAL WATER QUALITY RESULTS - CENOVUS MIDDLE CLEARWATER WELLS

Cenovus FCCL Ltd.

Christina Lake Thermal Project

Long Well Name	UWI	Sample Date	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO_4 mg/L	NO_2-N mg/L	NO_3-N mg/L	NO_2+NO_3-N mg/L	Total Alkalinity^ mg/L	HCO_3 mg/L	Hardness^ mg/L	TDS mg/L	TDS Calculated mg/L	TSS mg/L
CVE FCCL 16D KIRBY 16-3-76-6	1F1/16-03-076-06W4/00	02-Aug-11	8.40	7970	6.1	7.9	***1670***	6.7	***2200***	<4.0	<0.050	<0.10	<0.10	772	914	48	***4370***	***4360***	3
CVE FCCL 16D KIRBY 16-3-76-6	1F1/16-03-076-06W4/00	01-Nov-11	8.38	7890	9.8	9.9	***1890***	5.6	***2230***	<4.0	<0.050	<0.10	<0.10	767	912	65	***4710***	***4610***	<1
CVE FCCL 16D KIRBY 16-3-76-6	1F1/16-03-076-06W4/00	19-Mar-12	8.27	8220	10	10	***1960***	7.2	***2360***	<4.0	<0.050	<0.10	<0.10	750	914	67	***4600***	***4800***	<1
CVE FCCL 16D KIRBY 16-3-76-6	1F1/16-03-076-06W4/00	07-Apr-12	8.29	8020	9.5	9.5	***1890***	7.6	***2340***	<4.0	<0.050	<0.10	<0.10	755	920	63	***4580***	***4720***	4
CVE FCCL 16D KIRBY 16-3-76-6	1F1/16-03-076-06W4/00	07-Jul-12	8.26	7790	9.7	9.9	***1850***	6.1	***2330***	<4.0	<0.050	<0.10	<0.10	766	934	65	***4530***	***4670***	4
CVE FCCL 16D KIRBY 16-3-76-6	1F1/16-03-076-06W4/00	08-May-13	8.41	8080	9.6	9.6	***1890***	6	***2380***	<4.0	<0.050	<0.10	<0.10	794	937	64	***4710***	***4770***	2
CVE FCCL 16D KIRBY 16-3-76-6	1F1/16-03-076-06W4/00	17-Jul-13	8.38	8100	9.8	9.6	***1940***	5.5	***2300***	<4.0	<0.050	<0.10	<0.10	764	903	64	***4620***	***4730***	<1
CVE FCCL 16D KIRBY 16-3-76-6	1F1/16-03-076-06W4/00	24-Nov-13	8.38	7950	8.8	9.2	***1730***	5.1	***2410***	<4.0	<0.050	<0.10	<0.10	746	877	60	***4630***	***4610***	11
CVE FCCL 16D KIRBY 16-3-76-6	1F1/16-03-076-06W4/00	25-Jan-14	8.32	8310	9	9.4	***1770***	5.7	***2220***	<4.5	<0.050	<0.10	<0.10	731	892	61	***4540***	***4460***	12
CVE FCCL 15B KIRBY 2-3-76-6	1F1/02-03-076-06W4/00	02-Aug-11	8.34	9990	12	13	***2110***	8.7	***2910***	<4.0	<0.050	<0.10	<0.10	712	869	84	***5630***	***5480***	4
CVE FCCL 15B KIRBY 2-3-76-6	1F1/02-03-076-06W4/00	01-Nov-11	8.30	9690	14	14	***2170***	6.4	***2950***	<4.0	<0.050	<0.10	<0.10	724	882	92	***5540***	***5580***	6
CVE FCCL 15B KIRBY 2-3-76-6	1F1/02-03-076-06W4/00	19-Mar-12	8.27	10000	16	16	***2450***	9	***3050***	<9.0	<0.100	<0.20	<0.30	715	871	100	***5750***	***5960***	4
CVE FCCL 15B KIRBY 2-3-76-6	1F1/02-03-076-06W4/00	29-Apr-12	8.20	9690	15	14	***2280***	8.6	***3010***	<4.0	<0.050	<0.10	<0.10	714	870	96	***5680***	***5760***	2
CVE FCCL 15B KIRBY 2-3-76-6	1F1/02-03-076-06W4/00	07-Jul-12	8.16	9370	9.6	9.6	***2290***	6.4	***2860***	<4.0	<0.050	<0.10	<0.10	726	886	63	***5520***	***5610***	4
CVE FCCL 15B KIRBY 2-3-76-6	1F1/02-03-076-06W4/00	18-Jan-13	8.19	9550	14	13	***2080***	6.4	***2990***	<4.0	<0.050	<0.10	<0.10	708	863	89	***5360***	***5540***	4
CVE FCCL 15B KIRBY 2-3-76-6	1F1/02-03-076-06W4/00	08-May-13	8.38	9770	15	14	***2260***	7.1	***3050***	<4.0	<0.050	<0.10	<0.10	756	901	96	***5750***	***5800***	3
CVE FCCL 15B KIRBY 2-3-76-6	1F1/02-03-076-06W4/00	17-Jul-13	8.27	9750	16	14	***2400***	6.5	***3040***	<4.0	<0.050	<0.10	<0.10	721	879	99	***5460***	***5910***	3
CVE FCCL 15B KIRBY 2-3-76-6	1F1/02-03-076-06W4/00	24-Nov-13	8.34	9610	15	14	***2260***	6	***3080***	<9.0	<0.100	0.35	0.35	709	848	97	***5280***	***5800***	8
CVE FCCL 15B KIRBY 2-3-76-6	1F1/02-03-076-06W4/00	25-Jan-14	8.26	9930	14	13	***2110***	6.4	***2920***	<4.5	<0.050	<0.10	<0.10	685	835	90	***5440***	***5480***	2
CVE FCCL B KIRBY 4-35-75-6	100/04-35-075-06W4/00	05-Jul-12	7.85	14300	67	42	***3520***	17	***5460***	10	<0.100	<0.20	<0.30	576	702	340	***9120***	***9460***	101
CVE FCCL B KIRBY 4-35-75-6	100/04-35-075-06W4/00	07-Jul-12	7.97	15000	42	34	***3490***	14	***4880***	<9.0	<0.100	<0.20	<0.30	572	697	240	***9210***	***8810***	68
CVE FCCL B KIRBY 4-35-75-6	100/04-35-075-06W4/00	18-Jan-13	8.05	16000	52	48	***3470***	12	***5210***	<9.0	<0.100	<0.20	<0.30	545	664	330	***9580***	***9120***	32
CVE FCCL B KIRBY 4-35-75-6	100/04-35-075-06W4/00	08-May-13	8.25	16500	61	55	***3950***	15	***5940***	<9.0	<0.100	<0.20	<0.30	590	719	380	***9610***	***10400***	10
CVE FCCL B KIRBY 4-35-75-6	100/04-35-075-06W4/00	17-Jul-13	8.19	16400	55	51	***3820***	11	***5620***	<9.0	<0.100	<0.20	<0.30	555	677	350	***9830***	***9890***	6
CVE FCCL B KIRBY 2-27-75-6	100/02-27-075-06W4/00	18-Jan-13	8.14	14500	40	36	***3180***	10	***4940***	<9.0	<0.100	<0.20	<0.30	566	690	250	***8630***	***8550***	10
CVE FCCL B KIRBY 2-27-75-6	100/02-27-075-06W4/00	08-May-13	8.13	14900	46	40	***3620***	12	***5320***	<9.0	<0.100	<0.20	<0.30	562	686	280	***8630***	***9380***	33
CVE FCCL B KIRBY 2-27-75-6	100/02-27-075-06W4/00	17-Jul-13	8.23	14900	40	37	***3360***	10	***4980***	<9.0	<0.100	<0.20	<0.30	572	697	250	***8940***	***8780***	24
CVE FCCL B KIRBY 2-27-75-6	100/02-27-075-06W4/00	24-Nov-13	8.10	14700	42	38	***3240***	10	***5220***	<9.0	<0.100	<0.20	<0.20	548	668	260	***8500***	***8880***	12
CVE FCCL B KIRBY 2-27-75-6	100/02-27-075-06W4/00	25-Jan-14	8.03	15200	39	36	***3140***	10	***4780***	<9.0	<0.100	<0.20	<0.20	519	633	240	***8660***	***8310***	42
CVE FCCL 2C KIRBY 13-27-75-6	100/13-27-075-06W4/00	08-Jul-12	8.00	19600	85	74	***4660***	15	***7700***	20	<0.100	<0.20	<0.30	500	609	520	***12100***	***12900***	12
CVE FCCL 2C KIRBY 13-27-75-6	100/13-27-075-06W4/00	18-Jan-13	8.04	19100	76	70	***4110***	13	***6380***	<9.0	<0.100	<0.20	<0.30	504	615	480	***11400***	***10900***	7
CVE FCCL 2C KIRBY 13-27-75-6	100/13-27-075-06W4/00	08-May-13	8.18	19500	84	78	***4600***	15	***7110***	<9.0	<0.100	0.23	0.23	530	647	530	***11500***	***12200***	10
CVE FCCL 2C KIRBY 13-27-75-6	100/13-27-075-06W4/00	17-Jul-13	8.16	19400	77	74	***4460***	13	***6860***	<9.0	<0.100	<0.20	<0.30	510	621	500	***12100***	***11800***	11
CVE FCCL 2C KIRBY 13-27-75-6	100/13-27-075-06W4/00	24-Nov-13	8.13	19900	78	75	***4230***	10	***7230***	<20.0	<0.200	<0.50	<0.60	500	609	500	***12000***	***11900***	12
CVE FCCL 2C KIRBY 13-27-75-6	100/13-27-075-06W4/00	25-Jan-14	8.08	20100	74	70	***4070***	14	***6640***	<9.0	<0.100	<0.20	<0.20	492	600	470	***11500***	***11200***	68
CVE FCCL 13A KIRBY 13-35-75-6	1F1/13-35-075-06W4/00	09-Sep-08	***8.51***	13000	23	20	***3200***	7.1	***4100***	<0.50	<0.015	0.72	0.72	620	700	140	---	***7800***	---
CVE FCCL 13A KIRBY 13-35-75-6	1F1/13-35-075-06W4/00	18-Sep-08	8.24	12000	---	---	***2700***	---	***4400***	<0.50	<0.030	<0.030	<0.030	620	760	140	---	***7400***	---
CVE FCCL 13A KIRBY 13-35-75-6	1F1/13-35-075-06W4/00	17-Mar-09	---	---	---	---	---	---	---	---	---	---	---	---	---	---	***7330***	---	---
CVE FCCL 13A KIRBY 13-35-75-6	1F1/13-35-075-06W4/00	12-Jan-10	8.21	12800	29	26	***2890***	9	***4190***	<9.0	<0.100	<0.20	<0.30	625	762	180	***7350***	***7510***	9
CVE FCCL 13A KIRBY 13-35-75-6	1F1/13-35-075-06W4/00	21-Apr-10	8.23	12000	25	25	***2680***	8	***4170***	<9.0	<0.100	<0.20	<0.30	632	770	160	---	***7290***	<2
CVE FCCL 13A KIRBY 13-35-75-6	1F1/13-35-075-06W4/00	25-May-10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	***7310***	---	---
CVE FCCL 13A KIRBY 13-35-75-6	1F1/13-35-075-06W4/00	21-Jul-10	---	---	---	---	---	---	---	10	---	---	---	---	748	---	***7360***	---	10
CVE FCCL 13A KIRBY 13-35-75-6	1F1/13-35-075-06W4/00	13-Sep-10	8.15	12300	27	25	***2740***	8	***4010***	<9.0	<0.100	0.32	0.32	628	766	170	---	***7190***	---
CVE FCCL 13A KIRBY 13-35-75-6	1F1/13-35-075-06W4/00	21-Oct-10	8.17	12800	26	25	***2760***	9	***4100***	<9.0	<0.100	<0.20	<0.30	640	780	170	***7240***	***7310***	4
CVE FCCL 13A KIRBY 13-35-75-6	1F1/13-35-075-06W4/00	02-Jun-11	8.20	12600	31	29	***2730***	10	***4000***	<9.0	<0.100	<0.20	<0.30	663	808	200	***7330***	***7200***	4
CVE FCCL 13A KIRBY 13-35-75-6	1F1/13-35-075-06W4/00	08-Aug-11	8.30	12900	26	26	***2780***	8	***3950***	<9.0	<0.100	<0.20	<0.30	639	779	170	***7410***	***7170***	6
CVE FCCL 13A KIRBY 13-35-75-6	1F1/13-35-075-06W4/00	03-Nov-11	8.24	12600	29	27	***3120***	8.9	***4420***	<4.0	<0.020	<0.05	<0.07	646	788	180	***7290***	***8000***	<1
CVE FCCL 13A KIRBY 13-35-75-6	1F1/13-35-075-06W4/00	19-Mar-12	8.24	12900	30	29	***3110***	12	***4460***	<9.0	<0.100	<0.20	<0.30	637	777	190	***7440***	***8020***	2
CVE FCCL 13A KIRBY 13-35-75-6	1F1/13-35-075-06W4/00	07-Apr-12	8.18	12700	28	26	***2830***	17	***4300***	<9.0	<0.100	<0.20	<0.30	645	786	180	***7410***	***7590***	2
Canadian Drinking Water Guidelines*			**6.5-8.5$^{(AO)}$**	**NS**	**NS**	**NS**	**200$^{(AO)}$**	**NS**	**250$^{(AO)}$**	**500$^{(AO)}$**	**1$^{(MAC)}$**	**10$^{(MAC)}$**	**NS**	**NS**	**NS**	**NS**	**500$^{(AO)}$**	**500$^{(AO)}$**	**NS**

TABLE 3-1.

HISTORICAL WATER QUALITY RESULTS - CENOVUS MIDDLE CLEARWATER WELLS

Cenovus FCCL Ltd.

Christina Lake Thermal Project

Long Well Name	UWI	Sample Date	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO_4 mg/L	NO_2-N mg/L	NO_3-N mg/L	NO_2+NO_3-N mg/L	Total Alkalinity^ mg/L	HCO_3 mg/L	Hardness^ mg/L	TDS mg/L	TDS Calculated mg/L	TSS mg/L
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	18-Sep-08	8.31	9700	---	---	***2000***	---	***3100***	<0.50	0.037	<0.030	0.037	700	840	68	---	***5500***	---
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	17-Mar-09	---	---	---	---	---	---	---	---	---	---	---	---	---	---	***5190***	---	---
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	20-Aug-09	8.28	9050	15	13	***2110***	7	***2930***	20	<0.100	<0.20	<0.30	705	859	92	---	***5520***	2
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	20-Oct-09	8.26	9780	14	13	***2200***	7	***3020***	61	<0.100	<0.20	<0.30	686	836	90	---	***5730***	---
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	12-Jan-10	8.29	9500	14	13	***2170***	7.1	***2890***	<4.0	<0.050	<0.10	<0.10	704	859	89	***5350***	***5510***	7
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	21-Apr-10	8.33	9010	12	12	***1990***	6	***2970***	<4.0	<0.050	<0.10	<0.10	708	851	81	---	***5410***	<2
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	25-May-10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	***5470***	---	---
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	21-Jul-10	---	---	---	---	---	---	---	<4.0	---	---	---	---	822	---	***5110***	---	260
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	13-Sep-10	8.27	9020	13	12	***2030***	6.1	***2690***	<4.0	<0.050	0.11	0.11	706	860	83	---	***5170***	---
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	21-Oct-10	8.30	9370	13	12	***2020***	7	***2830***	<9.0	<0.100	<0.20	<0.30	714	870	81	***5260***	***5320***	2
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	02-Jun-11	8.24	9010	15	13	***2100***	8.4	***2660***	5	<0.050	<0.10	<0.10	714	871	91	***5120***	***5220***	80
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	08-Aug-11	8.36	9300	12	12	***2000***	6.2	***2660***	<4.0	<0.050	<0.10	<0.10	722	866	78	***5360***	***5120***	7
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	03-Nov-11	8.28	7460	14	13	***2170***	6.5	***2760***	<4.0	<0.050	<0.10	<0.10	578	705	89	***5280***	***5310***	<1
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	07-Apr-12	8.25	9430	15	13	***2220***	11	***2890***	<4.0	<0.050	<0.10	<0.10	712	868	93	***5280***	***5580***	3
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	07-Jul-12	8.22	8640	15	13	***2190***	7.4	***2750***	<4.0	<0.050	<0.10	<0.10	733	894	92	***5310***	***5420***	3
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	18-Jan-13	8.35	8960	13	12	***1950***	6	***2780***	<4.0	<0.050	<0.10	<0.10	715	854	81	***5100***	***5190***	3
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	08-May-13	8.39	9060	14	13	***2200***	6.7	***2850***	<4.0	<0.050	<0.10	<0.10	770	911	87	***5300***	***5550***	6
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	17-Jul-13	8.33	9120	13	12	***2130***	6	***2750***	<4.0	<0.050	<0.10	<0.10	736	885	82	***5270***	***5360***	2
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	24-Nov-13	8.35	8970	13	12	***2050***	6	***2730***	<4.0	<0.050	<0.10	<0.10	719	861	82	***5080***	***5240***	9
CVE FCCL 15B KIRBY 15-27-75-6	1F1/15-27-075-06W4/00	25-Jan-14	8.32	9330	12	11	***1930***	6.1	***2750***	<4.5	<0.050	<0.10	<0.10	705	859	78	***5160***	***5130***	37
CVE FCCL 13C KIRBY 13-34-75-6	1F1/13-34-075-06W4/00	23-Feb-11	---	---	---	---	---	---	---	---	---	---	---	---	---	---	***7590***	---	4
CVE FCCL 13C KIRBY 13-34-75-6	1F1/13-34-075-06W4/00	02-Jun-11	8.18	12400	29	27	***2920***	10	***3880***	<9.0	<0.100	<0.20	<0.30	637	777	180	***7200***	***7250***	4
CVE FCCL 13C KIRBY 13-34-75-6	1F1/13-34-075-06W4/00	02-Aug-11	8.22	13200	24	26	***2860***	11	***4080***	<9.0	<0.100	<0.20	<0.30	615	750	170	***7490***	***7380***	2
CVE FCCL 13C KIRBY 13-34-75-6	1F1/13-34-075-06W4/00	08-Aug-11	8.28	12700	25	25	***2750***	8	***3940***	<9.0	<0.100	<0.20	<0.30	618	753	160	***7570***	***7120***	6
CVE FCCL 13C KIRBY 13-34-75-6	1F1/13-34-075-06W4/00	01-Nov-11	8.22	12400	28	25	***2800***	9	***4220***	<9.0	<0.100	<0.20	<0.30	631	769	170	***7180***	***7460***	4
CVE FCCL 13C KIRBY 13-34-75-6	1F1/13-34-075-06W4/00	07-Apr-12	7.89	13300	33	30	***2980***	13	***4630***	<9.0	<0.100	<0.20	<0.30	599	730	200	***6150***	***8050***	8
CVE FCCL 13C KIRBY 13-34-75-6	1F1/13-34-075-06W4/00	07-Jul-12	8.12	11800	31	28	***2970***	10	***3990***	<9.0	<0.100	<0.20	<0.30	638	777	190	***7370***	***7420***	3
CVE FCCL 13C KIRBY 13-34-75-6	1F1/13-34-075-06W4/00	18-Jan-13	8.18	12200	26	24	***2760***	8.5	***4050***	<4.0	<0.050	<0.10	<0.10	621	757	160	***6920***	***7240***	3
CVE FCCL 13C KIRBY 13-34-75-6	1F1/13-34-075-06W4/00	08-May-13	8.32	13200	33	30	***3030***	10	***4470***	<9.0	<0.100	<0.20	<0.30	644	786	200	***7760***	***7960***	3
CVE FCCL 13C KIRBY 13-34-75-6	1F1/13-34-075-06W4/00	17-Jul-13	8.24	12500	29	27	***3010***	8	***3990***	<9.0	<0.100	<0.20	<0.30	634	772	180	***7400***	***7440***	3
CVE FCCL 13C KIRBY 13-34-75-6	1F1/13-34-075-06W4/00	24-Nov-13	8.22	12200	28	25	***2770***	8	***4150***	<9.0	<0.100	<0.20	<0.20	624	761	170	***7110***	***7360***	6
CVE FCCL 13C KIRBY 13-34-75-6	1F1/13-34-075-06W4/00	25-Jan-14	8.22	13000	27	25	***2650***	8	***4120***	<9.0	<0.100	<0.20	<0.20	605	737	170	***7250***	***7190***	5
CVE FCCL 8-17 LEISMER 3-17-76-6	100/03-17-076-06W4/00	29-Jan-06	8.50	7150	6.38	7.99	***1710***	4.6	***2110***	<1	<0.06	<0.2	<0.2	654	754	49	***4040***	***4230***	---
CVE FCCL 8-17 LEISMER 3-17-76-6	100/03-17-076-06W4/00	08-Feb-07	8.42	6920	6	7	***1600***	4	***1970***	<9.0	<0.050	<0.10	<0.10	643	756	40	---	***3980***	---
CVE FCCL 8-17 LEISMER 3-17-76-6	100/03-17-076-06W4/00	03-Apr-07	---	6970	---	---	---	---	***2100***	<0.5	---	---	---	603	---	---	***3920***	***3851***	---
CVE FCCL 8-17 LEISMER 3-17-76-6	100/03-17-076-06W4/00	03-Apr-07	---	6860	---	---	---	---	***2100***	<0.5	---	---	---	597	---	---	***3840***	***3841***	---
CVE FCCL 8-17 LEISMER 3-17-76-6	100/03-17-076-06W4/00	03-Apr-07	---	6850	---	---	---	---	***2100***	<0.5	---	---	---	599	---	---	***3920***	***3842***	---
CVE FCCL 8-17 LEISMER 3-17-76-6	100/03-17-076-06W4/00	03-Apr-07	---	6790	---	---	---	---	***2100***	<0.5	---	---	---	596	---	---	***3940***	***3847***	---
CVE FCCL 8-17 LEISMER 3-17-76-6	100/03-17-076-06W4/00	03-Apr-07	---	6790	---	---	---	---	***2100***	<0.5	---	---	---	600	---	---	***3960***	***3841***	---
CVE FCCL 8-17 LEISMER 13-16-76-6	1F2/13-16-076-06W4/00	19-Oct-05	8.30	6280	5.0	5.8	***1450***	4.7	***1680***	2.0	<0.05	0.9	---	---	803	36	***3630***	***3550***	---
CVE FCCL 8-17 LEISMER 13-16-76-6	1F2/13-16-076-06W4/00	19-Oct-05	8.30	6360	3.1	4.8	***1460***	4.0	***1640***	2.5	<0.05	1.01	---	---	847	28	***3630***	***3540***	---
CVE FCCL 8-17 LEISMER 13-16-76-6	1F2/13-16-076-06W4/00	19-Oct-05	8.30	6300	3.9	5.7	***1410***	4.0	***1800***	1.5	<0.05	1.01	---	---	750	33	***3590***	***3640***	---
CVE FCCL 8-17 LEISMER 13-16-76-6	1F2/13-16-076-06W4/00	20-Oct-05	8.40	6280	4.2	6.0	***1430***	4.2	***1810***	3.1	<0.05	0.86	---	---	766	35	***3700***	***3680***	---
CVE FCCL 8-17 LEISMER 13-16-76-6	1F2/13-16-076-06W4/00	20-Oct-05	8.40	6280	4.3	6.1	***1410***	4.3	***1930***	2.3	<0.05	0.85	---	---	730	36	***3660***	***3760***	---
CVE FCCL 8-17 LEISMER 13-16-76-6	1F2/13-16-076-06W4/00	20-Oct-05	8.40	6380	4.2	5.9	***1380***	4.1	***1700***	1.8	<0.05	0.87	---	---	713	35	***3490***	***3500***	---
CVE FCCL 8-17 LEISMER 13-16-76-6	1F2/13-16-076-06W4/00	20-Oct-05	8.40	6460	5.1	5.6	***1360***	3.6	***1800***	2.1	<0.05	0.99	---	---	778	36	***3530***	***3600***	---
CVE FCCL 8-17 LEISMER 13-16-76-7	1F2/13-16-076-06W4/01	29-Jan-06	8.50	6720	4.97	7.48	***1610***	4.3	***1960***	<1	<0.06	<0.2	<0.2	651	749	43	***3750***	***3970***	---
CVE FCCL 8-17 LEISMER 13-16-76-6	1F2/13-16-076-06W4/00	08-Feb-07	8.43	6670	6.0	7.0	***1540***	4.0	***1890***	<9.0	<0.050	<0.10	<0.10	642	750	40	---	***3830***	---
CVE FCCL 8-17 LEISMER 13-16-76-6	1F2/13-16-076-06W4/00	03-Apr-07	---	6520	---	---	---	---	***1900***	<0.5	---	---	---	599	---	---	***3740***	***3655***	---
CVE FCCL 8-17 LEISMER 13-16-76-6	1F2/13-16-076-06W4/00	03-Apr-07	---	6520	---	---	---	---	***1900***	<0.5	---	---	---	599	---	---	***3720***	***3656***	---
CVE FCCL 8-17 LEISMER 13-16-76-6	1F2/13-16-076-06W4/00	03-Apr-07	---	6520	---	---	---	---	***2000***	<0.5	---	---	---	600	---	---	***3700***	***3756***	---
CVE FCCL 8-17 LEISMER 13-16-76-6	1F2/13-16-076-06W4/00	03-Apr-07	---	6570	---	---	---	---	***2000***	<0.5	---	---	---	605	---	---	***3740***	***3766***	---
CVE FCCL 8-17 LEISMER 13-16-76-6	1F2/13-16-076-06W4/00	03-Apr-07	---	6580	---	---	---	---	***2000***	<0.5	---	---	---	601	---	---	***3820***	***3769***	---
Canadian Drinking Water Guidelines*			**6.5-8.5$^{(AO)}$**	**NS**	**NS**	**NS**	**200$^{(AO)}$**	**NS**	**250$^{(AO)}$**	**500$^{(AO)}$**	**1$^{(MAC)}$**	**10$^{(MAC)}$**	**NS**	**NS**	**NS**	**NS**	**500$^{(AO)}$**	**500$^{(AO)}$**	**NS**

TABLE 3-1.

HISTORICAL WATER QUALITY RESULTS - CENOVUS MIDDLE CLEARWATER WELLS

Cenovus FCCL Ltd.

Christina Lake Thermal Project

Long Well Name	UWI	Sample Date	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO_4 mg/L	NO_2-N mg/L	NO_3-N mg/L	NO_2+NO_3-N mg/L	Total Alkalinity^ mg/L	HCO_3 mg/L	Hardness^ mg/L	TDS mg/L	TDS Calculated mg/L	TSS mg/L
CVE FCCL 3-16-1 LEISMER 10-16-76-6	1F1/10-16-076-06W4/00	05-Nov-05	8.50	6880	9.3	8.7	*1550*	5.1	*1930*	54.2	<0.05	<0.1	---	---	891	59	*3960*	*4020*	---
CVE FCCL 3-16-1 LEISMER 10-16-76-6	1F1/10-16-076-06W4/00	06-Nov-05	8.50	6900	6.7	7.9	*1490*	4.9	*1980*	26.3	<0.05	<0.1	---	---	814	49	*3880*	*3940*	---
CVE FCCL 3-16-1 LEISMER 10-16-76-6	1F1/10-16-076-06W4/00	06-Nov-05	8.50	6920	6.4	2.9	*1690*	5.1	*2010*	14.8	<0.05	<0.1	---	---	799	28	*3850*	*4150*	---
CVE FCCL 3-16-1 LEISMER 10-16-76-6	1F1/10-16-076-06W4/00	06-Nov-05	8.50	6950	6.4	2.8	*1530*	5	*2020*	12.3	<0.05	<0.1	---	---	789	28	*3840*	*3990*	---
CVE FCCL 3-16-1 LEISMER 10-16-76-6	1F1/10-16-076-06W4/00	07-Nov-05	8.50	6770	7	2.8	*1490*	5.6	*2020*	7.9	<0.05	<0.1	---	---	799	29	*3800*	*3950*	---
CVE FCCL 3-16-1 LEISMER 10-16-76-7	1F1/10-16-076-06W4/01	29-Jan-06	8.50	6770	4.66	7.40	*1640*	4.3	*1960*	<1	<0.06	<0.2	<0.2	780	899	42	*3830*	*4080*	---
CVE FCCL 3-16-1 LEISMER 10-16-76-6	1F1/10-16-076-06W4/00	08-Feb-07	8.47	6710	5	7	*1580*	4	*1940*	<9.0	<0.050	<0.10	<0.10	671	778	40	---	*3930*	---
CVE FCCL 3-16-1 LEISMER 10-16-76-6	1F1/10-16-076-06W4/00	03-Apr-07	---	6610	---	---	---	---	*2000*	<0.5	---	---	---	623	---	---	*3740*	*3784*	---
CVE FCCL 3-16-1 LEISMER 10-16-76-6	1F1/10-16-076-06W4/00	03-Apr-07	---	6580	---	---	---	---	*2000*	<0.5	---	---	---	630	---	---	*3740*	*3774*	---
CVE FCCL 3-16-1 LEISMER 10-16-76-6	1F1/10-16-076-06W4/00	03-Apr-07	---	6580	---	---	---	---	*2000*	<0.5	---	---	---	626	---	---	*3860*	*3784*	---
CVE FCCL 3-16-1 LEISMER 10-16-76-6	1F1/10-16-076-06W4/00	03-Apr-07	---	6580	---	---	---	---	*2000*	<0.5	---	---	---	626	---	---	*3700*	*3778*	---
CVE FCCL 3-16-1 LEISMER 10-16-76-6	1F1/10-16-076-06W4/00	03-Apr-07	---	6610	---	---	---	---	*2000*	<0.5	---	---	---	622	---	---	*3800*	*3763*	---
CVE FCCL 3-6-1 LEISMER 11-9-76-6	1F2/11-09-076-06W4/00	05-Nov-05	8.40	6870	6.4	7.1	*1540*	4.2	*2010*	0.8	<0.05	<0.1	---	---	810	45	*3800*	*3990*	---
CVE FCCL 3-6-1 LEISMER 11-9-76-6	1F2/11-09-076-06W4/00	05-Nov-05	8.50	6910	6.5	2.5	*1510*	5	*1990*	4.9	<0.05	<0.1	---	---	805	27	*3810*	*3940*	---
CVE FCCL 3-6-1 LEISMER 11-9-76-6	1F2/11-09-076-06W4/00	06-Nov-05	8.40	6900	6.6	2.8	*1600*	4.6	*2030*	4.7	<0.05	<0.1	---	---	802	28	*3800*	*4070*	---
CVE FCCL 3-6-1 LEISMER 11-9-76-6	1F2/11-09-076-06W4/00	06-Nov-05	8.50	6880	6.2	2.5	*1470*	4.9	*2020*	4.4	<0.05	<0.1	---	---	799	26	*3820*	*3930*	---
CVE FCCL 3-6-1 LEISMER 11-9-76-6	1F2/11-09-076-06W4/00	06-Nov-05	8.40	6880	6.2	2.4	*1490*	3.8	*2000*	4.3	<0.05	<0.1	---	---	813	25	*3830*	*3930*	---
CVE FCCL 3-6-1 LEISMER 11-9-76-7	1F2/11-09-076-06W4/01	29-Jan-06	8.50	6750	4.77	7.16	*1600*	4.5	*1920*	<1	<0.06	<0.2	<0.2	799	916	41	*3810*	*4010*	---
CVE FCCL 3-6-1 LEISMER 11-9-76-6	1F2/11-09-076-06W4/00	08-Feb-07	8.48	6630	5	6	*1530*	4	*1840*	<9.0	<0.050	<0.10	<0.10	688	793	40	---	*3800*	---
CVE FCCL 3-6-1 LEISMER 11-9-76-6	1F2/11-09-076-06W4/00	03-Apr-07	---	6510	---	---	---	---	*2000*	<0.5	---	---	---	642	---	---	*3740*	*3884*	---
CVE FCCL 3-6-1 LEISMER 11-9-76-6	1F2/11-09-076-06W4/00	03-Apr-07	---	6520	---	---	---	---	*2000*	<0.5	---	---	---	648	---	---	*3800*	*3909*	---
CVE FCCL 3-6-1 LEISMER 11-9-76-6	1F2/11-09-076-06W4/00	03-Apr-07	---	6530	---	---	---	---	*2000*	<0.5	---	---	---	647	---	---	*3820*	*3934*	---
CVE FCCL 3-6-1 LEISMER 11-9-76-6	1F2/11-09-076-06W4/00	03-Apr-07	---	6580	---	---	---	---	*2100*	<0.5	---	---	---	648	---	---	*3800*	*3996*	---
CVE FCCL 3-6-1 LEISMER 11-9-76-6	1F2/11-09-076-06W4/00	03-Apr-07	---	6580	---	---	---	---	*2000*	<0.5	---	---	---	654	---	---	*3640*	*3904*	---
Canadian Drinking Water Guidelines*			**6.5-8.5$^{(AO)}$**	**NS**	**NS**	**NS**	**200$^{(AO)}$**	**NS**	**250$^{(AO)}$**	**500$^{(AO)}$**	**1$^{(MAC)}$**	**10$^{(MAC)}$**	**NS**	**NS**	**NS**	**NS**	**500$^{(AO)}$**	**500$^{(AO)}$**	**NS**

Notes:

--- - not analyzed

NS - not specified

^ - expressed as $CaCO_3$

AO - aesthetic objective from Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)

MAC - maximum acceptable concentration based on health effects from Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)

* - Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)

Italics - indicates values do not meet applicable guidelines

4. SIR 1, Response 24: Regional Management of Bottom Water Pressures, Pages 55 to 57. The response indicates Cenovus is committing to a significant amount of bottom water monitoring (1 piezometer per section) and that Cenovus may need to collaborate with neighbouring producers to manage bottom water pressures regionally. CLRWMA is evidence that Cenovus has already started collaborating with neighbouring projects.

In the response to SIR 24c, Cenovus discusses the possibility of implementing a Basal McMurray "pressure management" scheme.

The response to SIR 24d also indicates there is potential for additional McMurray water sourcing near the south boundary to reduce potential negative effects to bitumen recovery. Recently, Devon (Devon, 2013) proposed to source water from the Basal McMurray aquifer to reduce bottom water pressure near the Cenovus – Christina Lake / Devon – Jackfish boundary, but Cenovus would not have had this information in time to incorporate it into numerical predictions submitted under this EIA.

a. Provide an update on CLRWMA discussions that relate to regionally managing bottom water pressures.

b. Provide more details on the possible "pressure management" scheme Cenovus described in SIR 24c. Describe the monitoring systems and decision-making processes that Cenovus will use to trigger the implementation of this type of pressure management scheme. Describe how Cenovus will ensure their pressure management scheme does not impact resource recovery at neighbouring projects.

c. Discuss whether or not additional surface disturbance or expanded footprint would be required to implement the "pressure management" scheme. If additional surface disturbance is anticipated, describe how Cenovus will minimize environmental impacts.

d. Confirm that Cenovus is aware of Devon's commitment to source Basal McMurray water at Jackfish.

e. Based on the newly predicted pressure regime associated with Devon's proposed Basal McMurray water sourcing near the boundary, does Cenovus still anticipate further mitigation to avoid impacts to resource recovery?

f. If further mitigation to avoid impacts to resource recovery is still predicted, are the anticipated measures Cenovus will employ still the same as those listed in the response to SIR 24c? List and describe any new mitigation measures along with their associated benefits.

Response:

a. Cenovus continues to engage with Christina Lake Regional Water Management Agreement (CLRWMA) members Devon and MEG Energy on an ongoing basis. Cenovus is aware of Devon's proposal for sourcing from the Basal McMurray Aquifer, and Cenovus and Devon regularly share data of mutual interest.

b. In the Phase H application, Cenovus identified several potential Basal McMurray source/pumping well locations, which are distributed across the CLTP. These locations may or may not be drilled/developed, depending on observed pressure changes and conditions. Pumping from the developed locations would be optimized, based on detailed pressure monitoring, to steward towards maintaining neutral pressure conditions or to offset pressure increases from disposal elsewhere should they continue to occur. Cenovus will continue ongoing consultation through the CLRWMA to ensure activities do not affect resource recovery at neighbouring projects.

c. The maximum surface footprint associated with the potential pressure management scheme (including the potential well pads noted in the response to SIR 4b) was included and assessed as part of the Phase H application. No additional footprint is anticipated due to the potential pressure management scheme.

d. Cenovus is aware that Devon has planned to source Basal McMurray water at Jackfish, and that they are currently doing so with two wells in operation.

e. Devon's proposed sourcing provides a degree of mitigation to increasing bottom water pressures. Cenovus anticipates that mitigation may still be necessary in some instances, depending on how actual activities occur as compared to what is predicted or planned, and on how the aquifer responds to the long-term operations of the CLRWMA members.

f. Cenovus anticipates that it will still employ the same mitigation measures as listed in AER Round 1 SIR 24c.

5. SIR 1, Response 27, Pages 71 to 73. Longer thermal plume predictions are considered more conservative from a risk assessment perspective, but as more data is collected there is potential for making more accurate predictions that may be shorter. It is noted that Cenovus' predicted length of thermal plumes at the Christina Lake Thermal Project (CLTP) are smaller than the lengths predicted in the 2009 EIA (EnCana, 2009) and smaller than the lengths predicted by an independent neighbouring project (Harvest, 2011 and 2012). However, project specific field experience still appears limited for providing less conservative assessments.

	EnCana – CLTP Phases 1E, 1F & 1G (2009)	Harvest – BlackGold Expansion (2011 and 2012)	Cenovus – CLTP Phase H & Eastern Expansion (this EIA and SIR response)
Aquifer/Aquitard	**Predicted Thermal Plume Length [m]**		
Marie Creek Fm/ Undiff. Quaternary Aquitard	60	-	40
Ethel Lake Fm/ Undiff. Quaternary Aquifer	250	550	60
Empress Fm Aquifer	700	820	75

a. Compare the models and input parameters used to predict thermal plume lengths noted above.

b. Provide a detailed explanation for predicting shorter thermal plumes in these aquifer and aquitard units at the CLTP in 2013 compared to the neighbouring project and the CLTP in 2009. Confirm that Cenovus still considers these 2013 predictions to be conservative.

Response:

a. Thermal plume migration at the CLTP in 2009 and 2013 was computed using a one-dimensional (1D) numerical solution. At the neighboring BlackGold Expansion Project (Korea National Oil Corporation [KNOC] 2010), it was computed using a two-dimensional (2D) numerical model. For the latter, a three-dimensional (3D) numerical code was used but the conceptual model was restricted to a 2D transport and groundwater flow model (although few details are provided).

Within a 1D conduction-convection heat transport model, processes such as heat losses due to horizontal and vertical transverse conduction in the aquifer are not accounted for. These processes may be accounted for, however, in a 2D model. Additionally, within a 1D or a 2D conduction-convection heat transport model, processes such as vertical conduction into the overlying and underlying sediments and heat losses to surface are not accounted for (as compared to a 3D model).

For the three assessments it was conservatively assumed that the temperature in the aquifers immediately adjacent to the thermal well is the same temperature as the steam for the operational life of the steam assisted gravity drainage (SAGD) well (15 years). The change in temperature to define the extent of the thermal plume in the KNOC (2010) assessment was not listed, however.

Thermal properties were similar in the three assessments. Thermal properties have low variability compared to hydraulic parameters. Hydraulic conductivity, for instance, can vary over more than eight orders of magnitude, whereas thermal parameters, such as the thermal conductivity and volumetric heat capacity of sediments, vary usually no more than one order or magnitude.

Differences between the assessments with respect to Darcy flux estimates are shown in the Table 5-1.

Table 5-1 Darcy Flux Estimates Used in Thermal Plume Length Calculations

Aquifer/Aquitard	EnCana – CLTP Phases 1E, 1F & 1G (2009)[a]		Harvest – BlackGold Expansion (KNOC 2010)[b]		Cenovus – CLTP Phase H & Eastern Expansion (this EIA and SIR response)	
	Darcy Flux [m/s]	Thermal Plume Length [m]	Darcy Flux [m/s]	Thermal Plume Length [m]	Darcy Flux [m/s]	Thermal Plume Length [m]
Marie Creek Fm/ Undiff. Quaternary Aquitard	2×10^{-8}	60	-	-	4×10^{-9}	40
Ethel Lake Fm/ Undiff. Quaternary Aquifer	3×10^{-7}	250	5×10^{-7}	550	2×10^{-8}	60
Empress Fm Aquifer	1×10^{-6}	700	8×10^{-7}	820	4×10^{-8}	75

[a] Source: EnCana (2009).

[b] Source: KNOC (2010).

- = Not available.

b. The differences in the predicted thermal plume migration for each assessment are primarily due to the different Darcy fluxes used in the models. As a result, there is a difference in the forced convection term as presented in Equation 3 in Volume 4, Appendix 4-I.

Representative Darcy velocities for the CLTP in 2009 were calculated based on observed gradients and hydraulic conductivities described in EnCana (2009), Appendix 4-II. For the CLTP in 2013, lower Darcy velocities were estimated based on direct measurements at the Central Processing Facility and adjacent well pads.

Higher calculated groundwater velocities at the CLTP in 2009 and the neighboring BlackGold Expansion Project resulted in greater transport distances than those computed at the CLTP in 2013. The Darcy velocities selected for the CLTP in 2013 are considered representative of the aforementioned units. These predictions have been

updated by direct measurements of local groundwater flow conditions and are still considered conservative because the method of estimating thermal plume migration did not consider heat losses due to transverse conduction in the aquifer, vertical conduction into the overlying and underlying sediments, and heat loss to surface.

References:

EnCana (EnCana FCCL Ltd.). 2009. *Application for Approval of the EnCana Christina Lake Thermal Expansion Project, Phases 1E, 1F and 1G, Integrated Application and Environmental Impact Assessment*. Application No. 1626781. Submitted to the Energy Resources Conservation Board and Alberta Environment, October 2009. AER Approval No. 8591Q issued April 26, 2011. Calgary, AB.

KNOC (Korea National Oil Corporation). 2010. *Application for Approval of the BlackGold Expansion Project. Volume 4 – EIA Addendum*. Section 6, Hydrogeology. March 2010. Calgary, AB. Available at: ftp://ftp.gov.ab.ca/env/fs/eia/2009-12-HarvestOperationsCorpBlackGoldExpansionProject/Working%20PDF/Volume_4/Volume_4_Section_6_Vol_2_Append.pdf

---

6. SIR 1, Response 28, Pages 73 to 74. Without accurate information on disposal and withdrawal rates, additional uncertainty is added to the initial conditions and the overall model calibration. Enhanced monitoring is needed in some areas influenced by the CLTP expansion proposed in this EIA. Enhanced monitoring is useful for calibration targets for improving the model calibration over time. Cenovus is currently not proposing any additional groundwater monitoring in aquifers overlying the McMurray disposal zone near RD2 and RD3. These two disposal pads overlie the buried Christina Channel in an area where the Colorado Group shale is very thin and water less than 4000 mg/L TDS is observed deep into the Clearwater Formation. Discuss how does Cenovus propose to monitor groundwater in aquifers overlying the McMurray at RD2 and RD3?

Response:

Cenovus plans to install a shallow aquifer observation well at RD2 when it drills three additional disposal wells on the RD2 pad (expected late 2015 to early 2016). The cased well will be perforated into the Clearwater B formation (CWB) to allow for the periodic collection of water quality samples. A hanging piezometer will be installed to monitor pressure and temperature in the CWB, and additional piezometers will be cemented to the exterior of the casing for monitoring the Clearwater A formation (CWA) and Lower Grand Rapids aquifers. When RD3 is undergoing initial development, a similar shallow observation well will be installed when the initial disposal wells are drilled at the pad.

FACILITIES

7. SIR 1, Response 7: Figure 7-1, Page 20. Given the close proximity of the proposed drainage areas and the interlocking design, discuss any opportunities where Cenovus could drill several drainage areas from a single surface pad location, which could ultimately decrease surface disturbance.

Response:

As discussed in the response to AER Round 2 SIR 11, Cenovus uses a constraints mapping approach in the development of its well pad footprint. Environmental and engineering constraints considered in the planning of the well pad footprint include, at a minimum, the following:

- the suitability of existing topographical (slopes, valley breaks), biophysical (soil, vegetation, wildlife) and hydrological conditions;
- maintain Project component sites a minimum distance of 100 m (recommended) from watercourses and waterbodies;
- consider traditional land use and historical resources and avoid culturally significant sites;
- locate sites that maximize sub-surface oil sands resource target access;
- locate pipelines, roads and power lines on existing disturbance, where practical;
- consider pipeline operability and safety in the footprint layout;
- avoid or minimize effects to caribou ranges, wetlands and old growth forest, where possible; and
- locate sites to minimize watercourse crossings.

Prior to the construction of the Project well pads, Cenovus will review the proposed well pad surface footprint and subsurface well pair layout to minimize surface disturbance and optimize reservoir recovery. Where possible, Cenovus will consider surface footprint reductions, including drilling multiple drainage patterns from a single surface pad location. Examples of this may include combining well pads L01/L02, M11/M13, N11/N13, and A31/A33. Final surface footprints for these pads would be dependent on the constraints referenced above as well as site specific considerations including drilling collisions, well spacing, and detailed earthworks and pipeline designs.

8. SIR 1, Response 52, Page 131. Cenovus states that a common flare system for phases F/G/H will be utilized, but did not clarify if a low pressure flare system will be installed. Discuss whether or not the subject flare system will be designed to handle low pressure vapors from the VRU and if a low pressure flare is necessary.

Response:

The Project will utilize a common Phase F/G/H flare system that is designed to handle low pressure and high pressure flaring events during process upsets. Given this, Cenovus does not intend to install a designated low pressure flare system for Phase H. The common flare system design has been previously implemented in the CLTP Phase A to E facilities with no significant operational concerns.

The Phase F/G/H vapour recovery unit (VRU) uses a combined compressor and ejector system to handle tank and vessel related vapours. These vapours are combined and then used to feed the OTSGs as mixed fuel gas. If for any reason the OTSGs do not require the mixed fuel gas, then the unused fuel gas is sent to the common Phase F/G/H flare system. The VRU and flare systems are illustrated in the following process flow diagrams (Volume 1C, Appendix 1-IX):

- CL1H-42-PFD-07-140-01;
- CL1H-42-PFD-07-140-02; and
- CL1H-42-PFD-07-146-01.

9. SIR 1, Response 56: Figure 56-1, Page 136. Discuss the reasoning for the ratio of treated BFW to first stage blowdown water sent to the second stage boilers increasing as PWSR increases. The discussion should include any relevant details regarding boiler limitations (TDS, silica, hardness, etc.), the use of softened brackish makeup at higher PWSRs (i.e., 1.10), and minimum water requirements throughout the plant.

Response:

As the PWSR increases, the Christina Lake Phase A-H Plant has larger amounts of produced water to use and must make choices on which water to feed the 2nd Stage OTSGs, and which water to send to disposal. The total amount of water feeding the 2nd Stage OTSGs remains fixed and does not vary with PWSR. To prevent exceeding the OTSG feed water demand, either:

- deoiled produced water may be sent to disposal; or
- blowdown may be sent to disposal.

The treated produced water is of better quality than the blowdown and will result in a lower cycle up of non-volatile components in the boiler feed water. In the balances summarized in AER Round 1 SIR 56, Figures 56-1 through 56-7 it was assumed that treated produced water would be used preferentially as second stage boiler feed water. As the available produced water rate increases with PWSR, the treated produced water rate eventually exceeds demand and excess treated produced water is available for the 2nd Stage OTSG feed, displacing the amount of first stage blowdown that can be utilized.

The selection of disposing produced water or blowdown does not significantly affect the overall disposal or the AER disposal equation limits. When deciding whether to use produced water or blowdown to feed the 2nd Stage OTSGs, selection criteria such as the consideration of which combination of waters allows the longest performance interval between steam generator outages for pigging as well as treating performance and operational flexibility will be used. Preferential use of produced water results in a lower cycle-up of non-volatile components but there may be merit to higher ratios of blowdown due to potential for higher solubilities and reduced fouling at elevated pH.

Christina Lake will optimize the Phase H 2nd stage feed ratios and steam qualities based on experience with the CLTP CDE Optimization blowdown boilers, which is scheduled for start-up in September 2015, and Foster Creek 2nd stage OTSG operating experience. Foster Creek Phase F has operated with second stage boiler feed water consisting of approximately 25% primary boiler feed water and 75% first stage blowdown since May 2014 with no significant operational concerns noted to date. Foster Creek also has operational experience using 100% first stage blowdown as part of its 2nd stage OTSG trials.

Table 9-1 indicates how the available primary boiler feed water begins to exceed demand above a PWSR of 1.05, for the PWSR sensitivity cases presented in AER Round 1 SIR 56, Table 56-1. When the available primary boiler feedwater exceeds demand it was assumed that it would be used preferentially and displace primary blowdown to maintain the total 2nd stage boiler feed water design rate of 16,183 tonne/d. Note that initially there is a requirement of 1,904 tonne/d of primary boiler feed water to the 2nd stage boilers based on the difference between the available blowdown from first stage boilers (14,279 tonne/d) and the design feed rate of the 2nd stage boilers (16,183 tonne/d).

Christina Lake Phases F/G/H do not rely on brackish water for dilution water, seal flush or cooling and do not have a minimum brackish water demand. These phases use cooled treated water as the source for dilution and seal flush.

Christina Lake Phase A-E was modelled with a base load of about 2,800 tonne/d of softened brackish water for sample coolers, pump seal coolers, chemical dilution water and seal flush. This number increases slightly with PWSR based on slightly higher chemical dilution water requirements under higher produced water flowrates. There is no source of cold treated water in Phases A-E.

Table 9-1 2nd Stage OTSG Primary Feed Use Relative to PWSR

PWSR	Untreated Produced Water [tonne/d]	1st Stage Steam Gen BFW [tonne/d]	Blowdown Boiler			
			Primary BFW [tonne/d]	Primary Blowdown [tonne/d]	Total 2nd Stage BFW [tonne/d]	Primary Feed Ratio [%]
0.90	79,123	96,496	1,904	14,279	16,183	11.8
0.95	83,793	96,496	1,904	14,279	16,183	11.8
1.00	88,493	96,496	1,904	14,279	16,183	11.8
1.05	93,224	96,496	2,700	13,483	16,183	16.7
1.10	97,954	96,496	5,029	11,154	16,183	31.1
1.15	102,420	96,496	8,007	8,176	16,183	49.5
1.20	106,887	96,496	12,482	3,701	16,183	77.1

References:

AER Round 1 SIR 56, Table 56-1 and Figures 56-1 to 56-7.

TERRESTRIAL

10. Volume 1, Section 1.2, Page 14-19; Volume 1, Tables 1.3-3, 3.3-1 and 14.4-1, Pages 23, 67 and 387; SIR 1, Response 13: Tables 13-1 to 13-3, Pages 25-30; SIR 1, ESRD Response 69: Figures 69-1 to 69-13, Pages 162-174. Section 1.2 provides a history of applications for the CLTP. Tables 13-1 and 13-2 identify the status of approved and existing well pads and Table 13-1 identifies the applied for Phase H pads. Figures 69-1 to 69-4 visually illustrate the progression of Phase H by year.

This information is useful, however it should be consolidated in tabular form to improve readability. To provide consistency the table should include the entire Christina Lake project. This information would allow the Phase H expansion to be understood in the context of the entire Christina Lake project footprint and provide a baseline conceptual well pad development schedule.

Table 1.3-3 provides a summary of approved and proposed pads for the CLTP. The totals provided differ slightly from those indicated in Table 13-4 of the SIR responses (203 versus 206 total well pads). In the application 20 pads are referred to as currently approved and planned versus 22 identified in the SIR responses. In addition, the surface disturbance estimate of 1723 ha from Table 3.3-1 differs from the 1893 ha vegetation disturbance from Table 14.4-1.

a. Provide a visual chronology for the Christina Lake project by expanding each phase (A – H) into its own figure. Illustrate the applied-for and approved project footprint for each Phase.

b. Understanding that well pad development schedules are conceptual and subject to change, in order to illustrate the development and status of the full project footprint and the conceptual build-out footprint, augment the above illustration of the project area expansion by filling in the quantification tables provided in Appendix A. This information should also address inconsistencies in the number of pads estimated and the surface disturbance associated with the project. For consistency, indicate the facility types included in each disturbance footprint expansion application's quantification (e.g., CPF, well pads, camps, seismic, disposal wells, ROWs, access roads, exploration wells, etc.).

Response:

Cenovus is currently verifying the CLTP existing and approved footprint in relation to the footprints described in previously approved *Oil Sands Conservation Act* scheme amendment applications. Once this verification process is complete, Cenovus will provide the requested footprints for each project phase as required in part a), and complete the quantification tables as required in part b). This information will be provided to the AER as a supplemental submission to this Round 2 Project Update and SIR Response document at the time of completion.

---

11. Volume 1, Section 5.8.1, Page 164; Volume 1, Section 8.5.1.1, Page 249; Volume 1, Section 13.3.7.5, Page 369; Volume 5, Appendix 5-III, Section 6.3, Page 859. On Page 164, Cenovus states, "The SAGD pad layout proposed in this application could be constructed with minimal interference to other developments to access the resources discussed in Section 4.5.2. The proposed SAGD pad layout has considered the factors in the EIA sections of the Application."

On Page 249, it is indicated the Cenovus will maintain a 300 m setback from the high water marks of Christina and Winefred Lakes (400 m from Winefred Lake is noted in SIR1, Response 57) and a 100 m setback where possible from water bodies and watercourses.

On Page 369, the EIA identified lichen jack pine ecosite phases as a KIR due to its importance for caribou habitat and due to its limited spatial distribution. Cenovus stated, "During the project planning, design and layout disturbance to a1 ecosite phases will be avoided."

Aside from the above, there does not appear to be any other specific discussion of environmental constraints considered in the proposed footprint development.

a. Clarify the setback Cenovus intends to maintain from Winefred Lake.

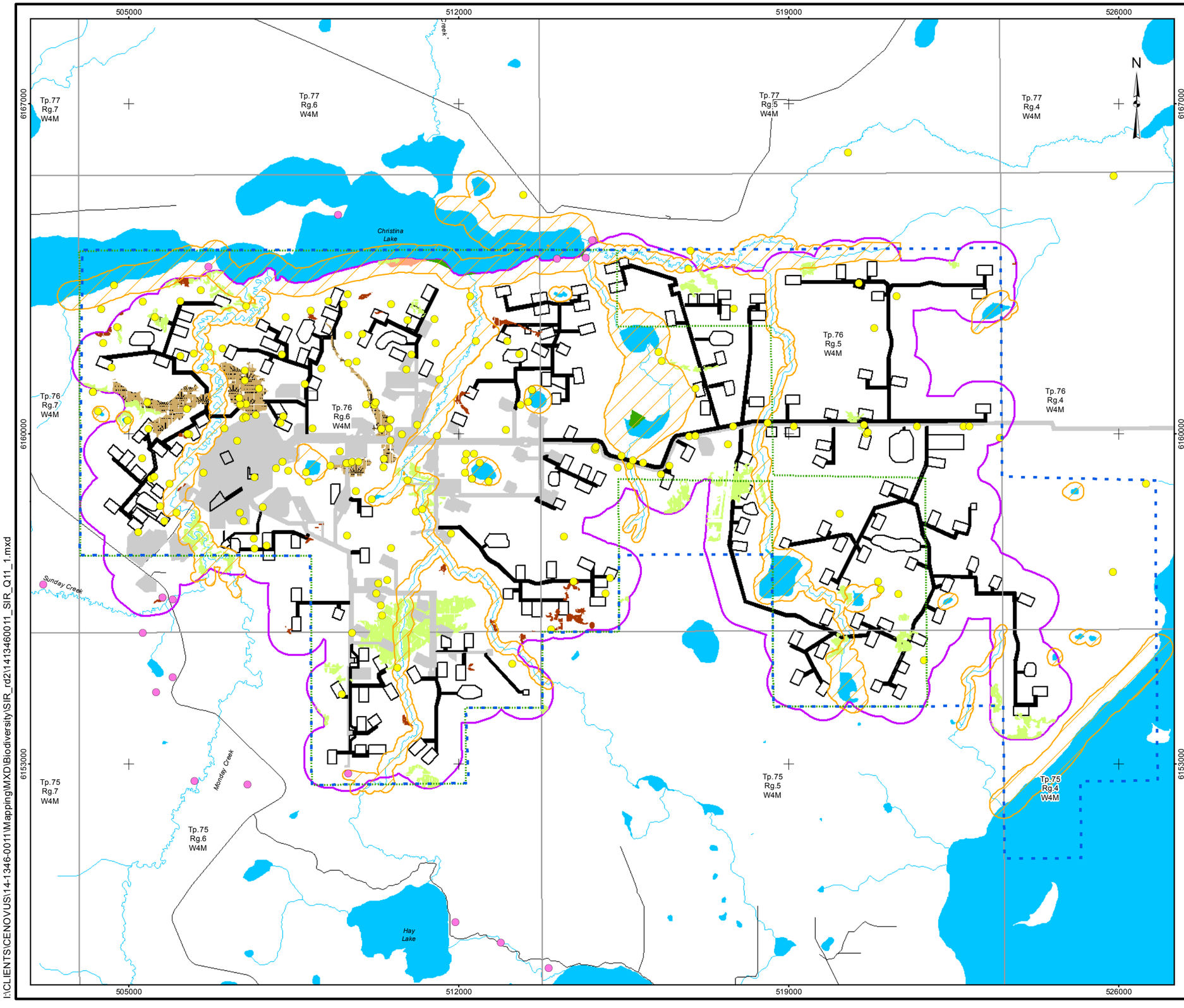
b. Provide a surface constraints map identifying all environmental constraints considered as part of the disturbance footprint selection process. The figure should illustrate sensitive areas located in the area of the proposed project (e.g., anthropogenic features, patterned fen, rare plants, old growth forest, a1 ecosite phases, non-burned areas, etc.), the setbacks utilized from water bodies, the proposed project and development area boundaries, and the full project footprint. On Page 859 of Volume 5, it is stated that a potential movement corridor for woodland caribou was identified in the CLTP area. Include identification of this potential corridor on the constraints map.

c. Reference the above-identified features and discuss how footprint locations were selected in support of minimizing environmental impacts. The discussion must include specific references to features such as patterned fen, undisturbed caribou habitat and the potential caribou movement corridor. Provide site-specific examples for the development area that include identification of the trade-offs made.

Response:

a. The setback Cenovus intends to maintain from the high water mark of Winefred Lake is 400 m.

b. See Figure 11-1 for the requested environmental constraints map. The potential north-south movement corridor for woodland caribou discussed in Volume 5, Appendix 5-III, Section 6.3 is not shown in Figure 11-1 because it does not have defined boundaries. As stated in the EIA, the potential north-south corridor appears to exist between caribou wintering areas within peatland complexes north of Christina Lake and spring calving/summer habitats south of Christina Lake (Kansas 2005, pers. comm.). Caribou appear to move south to calving areas by either crossing Christina Lake or moving between Christina Lake and Winefred Lake (Kansas 2005, pers. comm.). However, it is difficult to confirm woodland caribou movement patterns and it is possible that the caribou in the CLTP area move south in winter, instead of north (Golder 2012).



LEGEND

- HISTORIC RESOURCE SITE
- RARE PLANT LOCATION
- ROAD
- WATERCOURSE
- CENOVUS PHASE H FOOTPRINT
- EXISTING AND APPROVED FOOTPRINT
- TERRESTRIAL LOCAL STUDY AREA
- CLTP PROPOSED DEVELOPMENT AREA
- CLTP PROPOSED PROJECT AREA (PPA)
- LICHEN JACKPINE (a1)
- OLD GROWTH FOREST
- PATTERNED FEN (FOPN, FTPN)
- UNDISTURBED CARIBOU HABITAT OUTSIDE CARIBOU RANGE
- UNDISTURBED CARIBOU HABITAT WITHIN CARIBOU RANGE
- WATERBODY AND WATERCOURSE BUFFER
- WATERBODY

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

3 0 3
SCALE 1:80,000 KILOMETRES

PROJECT
cenovus ENERGY
CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

TITLE
ENVIRONMENTAL CONSTRAINTS MAP

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	JG	05 Dec. 2014	SCALE AS SHOWN	REV. 0
GIS	GU	15 Jan. 2015		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 11-1

I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\Biodiversity\SIR_rd2\14134600 11_SIR_Q11_1.mxd

c. Environmental constraints mapping was undertaken early in the design stage of the Project to aid in delineation of the development footprint, such that disturbance to sensitive environmental features could be avoided or minimized. Since initial footprint delineation, further adjustments are proposed to the well pad locations to maintain a minimum 100 m setback from waterbodies and watercourses, including valley walls, for new Project disturbances (refer to SIR 24 for additional information). Historic resource sites identified in the area will also not be disturbed by the Project footprint.

Due to the trade-off of maximizing recovery of the resource, it was not possible to avoid disturbance to all other sensitive environmental features, such as, rare plants, old growth forest, patterned fens and lichen jackpine (Figure 11-1). To reduce surface disturbance, the development footprint was minimized to the extent possible. For example, the number of production wells per well pad was increased, the use of existing rights-of-way and disturbed areas for access was maximized, and wildlife crossing opportunities along Project infrastructure were incorporated to minimize barriers to woodland caribou movement through the area. As a result, less than 10% of rare plant occurrences and old growth forest and 1% or less of patterned fens, caribou habitat and lichen jackpine present in the LSA in the Baseline Case will be affected by the Project footprint.

References:

Golder (Golder Associates Ltd.). 2012. *Christina Lake Thermal Project Wildlife Monitoring Program.* Submitted to Cenovus FCCL Ltd., Calgary. 41 pp. + app.

Kansas, J. (Ursus Environmental). 2005. Personal Communication with Paula Bentham (Golder Associates Ltd.). Initially Contacted in January 2005.

---

12. SIR 1, Response 3, Pages 12-15; SIR 1, ESRD Response 57, Pages 115-120.

In response to SIR1, response 3, Cenovus identified 15 locations (including 5 crossings), that may be within 100 m of water bodies. These locations are illustrated in SIR1 Figure 57-3. Cenovus stated that final locations would depend on field investigations.

It is understood that footprint locations in the larger project area will be subject to modifications in future amendment applications. Focusing on the development area, from Figure 57-3, it does not appear that any of the pads proposed in the initial development area encroach upon lakes or watercourses. However, the 100 m water body setback in *Directive 056* also applies to wetlands.

The AER understands that wetlands occupy the largest portion of the local area and cannot be avoided entirely. However, to fully understand the potential impact of the development area footprint, further information is required.

a. Excluding watercourse crossings, confirm that none of the development area footprint encroaches upon any lakes or watercourses.

b. For the development area, where footprint locations encroach upon water bodies including wetlands, provide a table that includes well pad identification, water body identification (e.g., wetland ecosite, or small intermittent stream), amount of wetland disturbed, rationale for the footprint location (i.e. constraints), and proposed mitigation for those locations.

Response:

a. Cenovus confirms that footprint components within the proposed Project Development Area will be situated outside of the 100 m setback of a lake or watercourse, as defined by the AER Directive 056.

b. As discussed in part a), Cenovus plans to maintain a minimum 100 m setback from waterbodies and watercourses with a defined bed and bank. The Project well pads that are proposed to be located within 100 m of a wetland, the type(s) of wetlands disturbed and the amount of wetlands disturbed are shown in Table 12-1. The general constraints considered to aid in delineation of the development footprint are discussed in SIR 11. The rationale for well pad locations is provided in the EIA, Volume 1, Sections 11.7 and 11.8. The proposed mitigations to reduce the effects of the Project on Terrestrial Resources, including wetlands, are discussed in the EIA, Volume 5, Section 3 and include the following measures:

- Well pad and source and disposal well access will follow seismic line clearings wherever possible and applicable.
- Areas for facilities, well sites, multi-well pads, ROWs and exploration well pads will be sized as small as reasonably possible.
- New clearing for well pads will involve the salvage of merchantable timber. If a site is located on a slope that requires levelling, the procedure will include:
  - the soil Litter, Fermented, Humus (LFH) and “A” horizons will be salvaged, if present, and will be stockpiled on the edge of the well site;
  - up to 30 cm of the “B” horizon will be salvaged and stockpiled on the edge of the well site; and
  - the site will be levelled to allow access to the drilling rig.
- Reclaim well pad or pipeline construction and development areas not needed during operations. Reclamation will be ongoing throughout the life of the Project.

- Conduct or participate in reclamation trials for well pads constructed on deep peat (more than 40 cm) with the goal of establishing wetlands vegetation, including a mix of herbaceous and woody plant species.
- Reclaim well pads located in wetlands according to plans provided in the Project's Conservation and Reclamation Plan (C&R Plan; EIA, Volume 1, Section 14.9.1). For the two wetland reclamation alternatives, the plant species existing in the pre-disturbance scenario will be allowed to regenerate through natural processes. The plan is to allow an equivalent wetlands type to re-establish in the long term and to be verified and adapted through research and monitoring. Should peatland well pad reclamation research and experience over the years result in a specific method becoming the accepted industry standard, Cenovus will, where practical, incorporate this method into future C&R Plans.

Table 12-1 Well Pads that Encroach Within 100 Metres of Wetlands

Well Pad ID	Within Development Area	Amount of Wetland Types[(a)] Directly Disturbed [ha]													Amount of Wetlands Indirectly Disturbed[(b)] [ha]	Total
		BTNN	BUw	FONG	FONS	FOPN	FTNI	FTNN	FTPN	MONG	Sh (wetland)	SONS	STNN	WONN		
A03	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	0.17	0.17
A04	Yes	0.26	-	-	-	-	-	3.47	-	-	0.07	-	-	-	0.87	4.66
A05	Yes	1.82	-	-	-	-	-	1.55	-	-	0.10	-	-	-	1.85	5.32
A07	Yes	-	-	-	-	-	-	4.47	-	-	0.12	-	-	-	1.65	6.24
A09	Partially	-	-	-	-	-	-	4.56	-	-	0.07	-	-	-	0.10	4.73
A11	Yes	2.46	-	-	-	-	-	2.20	-	-	0.15	-	-	-	0.30	5.12
A13	Yes	-	-	-	4.56	-	-	-	-	-	0.14	-	-	-	0.93	5.63
A15	Yes	-	-	-	2.20	-	-	-	-	-	0.06	-	-	-	2.72	4.97
A19	Yes	1.31	-	-	0.07	-	-	2.75	-	-	0.12	-	-	-	1.61	5.85
A21	Yes	0.40	-	-	-	-	3.40	0.20	0.85	-	0.82	-	-	-	0.39	6.04
A23	Yes	-	-	-	-	-	2.82	1.33	-	-	0.12	-	-	-	0.02	4.29
A25	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	1.00	1.00
A27	Yes	2.39	-	-	-	-	-	0.09	-	-	0.10	-	-	-	1.91	4.49
A29	Yes	-	-	-	-	-	-	0.04	-	-	-	-	-	-	2.68	2.72
A31	Yes	1.00	-	-	-	-	-	1.69	-	-	0.09	-	-	-	2.38	5.16
A33	Yes	1.01	-	-	-	-	-	-	-	-	0.03	-	-	-	3.71	4.74
A35	Yes	1.35	-	-	-	-	-	2.99	-	-	0.15	-	-	-	1.36	5.85
A37	Yes	0.49	-	-	-	-	-	-	-	-	0.01	-	-	-	3.49	3.99
A39	Yes	5.58	-	-	-	-	-	-	-	-	0.16	-	-	-	0.30	6.05
B15	Yes	-	-	-	0.73	-	-	4.80	-	-	0.17	-	-	-	0.18	5.88
B17	Yes	-	0.03	-	-	-	-	2.93	-	-	0.10	-	-	-	2.11	5.18
B19	Yes	-	4.91	-	-	-	-	0.21	-	-	0.17	-	-	-	0.61	5.90
B21	Yes	-	-	-	-	-	-	5.12	-	-	0.16	-	-	-	-	5.28
B23	Yes	0.55	-	-	-	-	-	5.43	-	-	0.18	-	-	-	0.08	6.24
B25	Yes	-	-	-	-	-	-	4.94	-	-	0.16	-	-	-	0.17	5.26
B27	Yes	0.67	-	2.54	-	-	-	0.27	-	-	0.12	-	-	-	0.30	3.90
C01	Partially	-	-	-	1.82	-	-	2.30	-	-	0.16	-	-	-	-	4.29
C03	No	-	-	-	-	-	-	3.25	-	-	0.11	-	-	0.55	1.93	5.85
C05	No	-	-	-	0.00	-	-	5.20	-	-	0.17	-	-	-	0.48	5.85
C07	No	-	-	-	0.03	-	-	2.11	-	-	0.06	-	-	-	2.86	5.07
C09	No	-	-	-	-	-	-	-	-	0.43	-	-	-	-	2.74	3.17
C11	No	-	-	-	-	-	-	2.93	-	-	-	-	-	-	4.09	7.02
C13	Yes	-	-	-	-	-	4.29	0.67	-	-	-	-	-	-	1.27	6.24
C15	Yes	-	-	-	-	-	3.29	-	-	-	0.10	-	-	-	2.45	5.85
C17	Yes	-	-	-	-	-	4.61	0.85	-	-	0.18	-	-	-	0.40	6.05
C19	Yes	0.72	-	-	-	-	-	3.35	-	-	0.11	-	-	-	2.06	6.24
C21	Yes	-	-	-	-	-	1.75	1.57	-	-	0.11	-	-	-	2.55	5.97
C23	Yes	1.09	-	-	-	-	-	-	-	-	0.04	-	-	-	4.66	5.79
C25	Yes	-	-	-	-	-	-	0.91	-	-	0.02	-	-	-	2.78	3.71
C27	Yes	3.14	-	-	0.00	-	-	0.11	-	-	0.09	-	-	-	1.90	5.24
C29	Yes	0.57	-	-	0.25	-	-	0.99	-	-	0.06	-	-	-	4.03	5.91
F03	Yes	0.33	-	-	-	-	-	4.25	-	-	0.13	-	-	-	0.32	5.04
F05	Yes	2.50	2.10	-	0.35	-	-	-	-	-	0.18	-	-	-	0.73	5.85
F07	Yes	0.82	1.94	-	-	-	-	-	-	-	0.18	-	-	-	3.61	6.55
F09	Yes	-	2.98	-	-	-	-	-	-	-	0.10	-	-	-	3.16	6.24
F11	Yes	1.92	1.00	-	-	-	-	1.34	-	-	0.09	-	-	-	0.14	4.49
F13	Yes	0.16	-	-	0.01	-	-	1.52	-	-	0.12	-	-	-	2.87	4.68

Table 12-1 Well Pads that Encroach Within 100 Metres of Wetlands

Well Pad ID	Within Development Area	Amount of Wetland Types[(a)] Directly Disturbed [ha]													Amount of Wetlands Indirectly Disturbed[(b)] [ha]	Total
		BTNN	BUw	FONG	FONS	FOPN	FTNI	FTNN	FTPN	MONG	Sh (wetland)	SONS	STNN	WONN		
F15	Yes	2.61	-	-	-	-	-	2.56	-	-	0.19	-	-	-	0.88	6.24
F17	Yes	1.83	-	-	1.36	-	-	-	-	-	0.12	-	-	-	2.93	6.24
F19	Yes	-	-	-	0.79	-	-	1.50	-	-	0.12	-	-	-	3.81	6.23
F21	Yes	0.04	-	-	-	-	-	3.90	-	-	0.13	-	-	-	0.70	4.77
F23	Yes	2.35	-	-	-	-	-	-	-	-	0.07	-	-	-	3.16	5.58
F25	Yes	4.67	-	-	-	-	-	0.29	-	-	0.14	-	-	-	1.14	6.24
F27	Yes	5.81	-	-	-	-	-	0.05	-	-	0.13	-	-	-	0.25	6.24
F29	Yes	1.46	-	-	-	-	-	2.13	-	-	0.08	-	-	-	2.58	6.24
F31	Yes	-	-	-	-	-	-	5.74	-	-	0.18	-	-	-	0.12	6.04
H02	Yes	2.73	-	-	-	-	-	2.09	-	-	0.31	-	-	-	1.32	6.45
H04	Yes	-	-	-	-	-	-	0.12	-	-	0.01	-	-	-	2.47	2.60
H05	Yes	0.20	-	-	-	-	-	2.35	-	-	0.08	-	-	-	3.42	6.05
H11	Yes	0.37	-	-	-	-	-	-	-	-	0.01	-	-	-	3.90	4.29
H13	No	0.16	-	-	-	-	-	-	-	-	-	-	-	-	4.28	4.44
H15	No	3.13	-	-	0.91	-	-	-	-	-	-	-	-	-	1.81	5.85
H19	Yes	0.94	-	-	-	-	-	0.00	-	-	0.02	-	-	-	3.60	4.56
H21	Yes	1.29	-	-	-	-	-	2.59	-	-	0.09	-	-	-	2.27	6.24
H23	Yes	-	-	-	0.76	-	-	4.58	-	-	0.09	-	-	-	0.81	6.24
H25	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	0.94	0.94
H27	Yes	-	-	-	-	-	-	5.31	-	-	0.02	-	-	-	0.92	6.24
H29	Yes	-	-	-	-	-	-	4.22	-	-	0.06	-	-	-	0.21	4.48
H31	Yes	4.05	-	-	-	-	-	-	-	-	-	-	-	-	0.24	4.29
H33	Yes	4.29	-	-	-	-	-	-	-	-	-	-	-	-	2.69	6.98
H35	Yes	0.46	-	-	0.40	-	-	-	-	-	-	-	-	-	2.37	3.23
J11	Yes	2.16	-	-	-	-	-	-	-	-	0.05	-	-	-	2.33	4.54
J13	Yes	-	-	-	-	-	-	4.93	-	-	0.15	-	-	-	0.77	5.85
J15	Yes	-	-	-	-	-	-	4.50	-	-	0.13	-	-	-	1.60	6.24
J17	Yes	-	-	-	-	-	-	1.65	-	-	0.06	-	-	-	4.16	5.87
J19	Yes	2.22	-	-	-	-	-	3.07	-	-	0.15	-	-	-	0.80	6.24
J21	Yes	-	-	-	5.69	-	-	-	-	-	-	-	-	-	0.55	6.24
J23	Yes	-	-	-	2.75	-	-	3.64	-	-	-	-	-	-	0.63	7.02
K01	Partially	0.47	-	-	-	-	-	4.21	-	-	0.14	-	-	-	1.42	6.24
K03	Yes	-	-	-	-	-	-	3.00	-	-	0.11	-	-	-	2.74	5.85
K05	Yes	-	-	-	-	-	-	1.15	-	-	0.03	-	-	-	4.45	5.64
K07	No	-	-	-	0.12	-	-	0.58	-	-	0.02	-	-	-	2.28	3.00
K09	No	-	-	-	-	-	-	3.36	-	-	0.10	-	-	-	2.79	6.24
K11	No	-	-	-	-	-	-	5.63	-	-	0.16	-	-	-	0.41	6.20
K13	Yes	-	-	-	-	-	-	2.24	-	-	-	-	-	-	4.00	6.24
K15	Yes	-	-	-	2.15	-	-	3.53	-	-	-	-	-	-	0.47	6.16
K17	Yes	-	-	-	-	-	-	1.46	-	-	-	-	-	-	4.34	5.80
K19	Yes	-	-	-	4.68	-	1.00	-	-	-	-	-	-	-	0.18	5.85
K21	Yes	0.01	-	-	5.18	-	-	-	-	-	-	-	-	-	0.24	5.43
L04	Yes	-	-	-	-	-	-	3.64	-	-	0.40	-	-	-	2.20	6.24
L07	Yes	-	-	-	-	-	-	4.29	-	-	0.14	-	-	-	1.81	6.24
L11	Yes	-	-	-	0.52	-	-	0.00	-	-	0.02	-	-	-	3.93	4.48
L13	Yes	-	-	-	-	-	-	-	-	-	-	0.85	-	-	3.69	4.54
L15	Yes	-	-	-	0.06	-	-	5.19	-	-	0.18	-	-	-	0.41	5.85

Table 12-1 Well Pads that Encroach Within 100 Metres of Wetlands

Well Pad ID	Within Development Area	Amount of Wetland Types[(a)] Directly Disturbed [ha]													Amount of Wetlands Indirectly Disturbed[(b)] [ha]	Total
		BTNN	BUw	FONG	FONS	FOPN	FTNI	FTNN	FTPN	MONG	Sh (wetland)	SONS	STNN	WONN		
L17	Yes	2.09	-	-	-	-	-	0.13	-	-	0.06	-	-	-	3.95	6.24
L19	Yes	-	-	-	-	-	-	3.52	-	-	0.08	-	-	-	2.64	6.24
M01	Yes	-	-	-	-	-	-	4.59	-	-	0.18	-	-	-	0.61	5.38
M03	Yes	-	-	-	-	-	-	5.57	-	-	0.67	-	-	-	-	6.24
M05	Yes	3.01	-	-	-	-	-	0.96	-	-	0.22	-	-	-	-	4.20
M07	Yes	3.88	-	-	-	-	-	1.23	-	-	0.19	-	-	-	-	5.31
M09	Yes	4.82	-	-	-	-	-	-	-	-	0.17	-	-	-	0.08	5.07
M11	Yes	4.47	-	-	0.01	0.82	-	0.05	-	-	0.17	-	-	-	0.69	6.22
M13	Yes	3.54	-	-	1.01	-	-	1.46	-	-	0.18	-	-	-	0.04	6.24
M15	Yes	0.26	-	-	0.03	-	-	6.74	-	-	0.21	-	-	-	0.17	7.41
M17	Yes	5.52	-	-	0.08	-	-	-	-	-	0.18	-	-	-	0.49	6.27
M19	Yes	-	-	-	5.48	-	-	-	-	-	0.17	-	-	-	0.63	6.28
M21	Yes	-	-	-	7.18	-	-	-	-	-	0.23	-	-	-	-	7.41
M23	Yes	-	-	-	3.61	-	-	0.62	-	-	0.13	-	-	-	0.32	4.68
M25	Yes	-	-	-	5.07	-	-	-	-	-	0.20	-	-	-	-	5.27
M27	Yes	4.36	-	-	-	-	-	0.17	-	-	0.18	-	-	-	0.74	5.46
N01	Yes	-	-	-	-	-	4.42	0.97	-	-	0.18	-	-	-	0.19	5.75
N03	Yes	0.66	-	-	-	-	3.28	1.54	-	-	0.17	-	-	-	0.38	6.04
N05	Yes	-	-	-	-	-	3.95	1.16	-	-	0.15	-	-	-	0.57	5.82
N07	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	0.17	0.17
N09	No	-	-	-	-	-	-	0.46	-	-	0.01	-	-	-	2.17	2.64
N11	No	-	-	-	-	-	-	0.06	-	-	0.01	-	-	-	1.41	1.48
N13	No	-	-	-	-	-	-	1.23	-	-	0.04	-	-	-	3.50	4.77
N17	No	-	-	-	-	-	-	2.50	-	-	0.09	-	-	-	3.39	5.99
N19	No	-	-	-	1.76	-	-	0.05	-	-	0.09	-	-	-	1.48	3.38
N21	Partially	-	-	-	0.84	-	-	4.84	-	-	0.21	-	-	-	-	5.90
N23	Partially	-	-	-	-	-	-	3.82	-	-	0.17	-	-	-	2.25	6.24
Q01	Yes	0.01	-	-	-	-	-	-	-	-	-	-	-	-	1.78	1.79
Q03	Yes	0.28	-	-	-	-	-	-	-	-	0.00	-	-	-	3.94	4.23
Q05	Yes	3.23	-	-	-	-	-	0.17	-	-	0.11	-	-	-	2.34	5.86
Q07	Yes	0.02	-	-	-	-	-	0.89	-	-	0.02	-	-	-	3.36	4.28
Q09	Yes	2.91	-	-	-	-	-	2.37	-	-	0.17	-	-	-	0.39	5.85
Q11	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	0.97	0.97
Q13	Yes	5.13	-	-	-	-	-	-	-	-	0.24	-	-	-	0.47	5.85
R01	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	0.65	0.65
R03	No	-	-	-	-	-	-	5.49	-	-	0.15	-	-	-	0.60	6.24
R05	No	-	-	-	0.05	-	-	5.95	-	-	0.18	-	-	-	0.06	6.24
R07	No	0.41	-	-	0.08	-	-	4.60	-	-	0.16	-	-	-	0.59	5.85
R09	No	-	-	-	-	-	-	3.64	-	-	0.12	-	-	-	1.31	5.07
R11	No	-	-	-	-	-	-	2.10	-	-	0.06	-	0.01	-	2.93	5.10
R13	No	-	-	-	-	-	-	2.71	-	-	-	-	-	-	3.53	6.24
R15	No	0.11	-	-	-	-	3.14	0.10	-	-	-	-	-	-	2.89	6.24
R17	No	-	-	-	-	-	-	0.13	-	-	-	-	-	-	2.99	3.11
R19	No	0.53	-	-	-	-	-	2.65	-	-	0.11	-	-	-	1.78	5.07
R21	No	3.15	-	-	-	-	-	-	-	-	-	-	-	-	2.66	5.81
R23	No	-	-	-	-	-	-	5.23	-	-	-	-	-	-	1.01	6.24
R25	No	-	-	-	1.44	-	-	2.49	-	-	0.11	-	-	-	2.20	6.24

Table 12-1 Well Pads that Encroach Within 100 Metres of Wetlands

Well Pad ID	Within Development Area	Amount of Wetland Types[(a)] Directly Disturbed [ha]													Amount of Wetlands Indirectly Disturbed[(b)] [ha]	Total
		BTNN	BUw	FONG	FONS	FOPN	FTNI	FTNN	FTPN	MONG	Sh (wetland)	SONS	STNN	WONN		
R27	No	-	-	-	-	-	-	0.78	-	-	0.03	-	-	-	2.07	2.88
R29	No	-	-	-	0.64	-	-	3.37	-	-	0.09	-	-	-	2.14	6.24
S01	Yes	-	-	1.00	0.13	-	-	2.19	-	-	0.15	-	-	-	2.57	6.04
S03	Yes	-	-	-	-	-	-	2.62	-	-	0.09	-	-	-	1.58	4.29
S05	Yes	-	-	-	-	-	-	3.57	-	-	0.09	-	-	-	2.22	5.88
S07	Yes	-	-	-	-	-	-	3.08	-	-	0.09	-	-	-	3.09	6.26
S09	Yes	-	-	-	-	-	-	1.16	-	-	0.05	-	-	-	3.71	4.92
S11	Yes	0.68	-	-	1.64	-	-	4.10	-	-	0.25	-	-	-	0.16	6.83
S13	Yes	-	-	-	-	-	-	4.42	-	-	0.09	-	-	-	1.72	6.24
S15	Yes	-	-	-	-	-	-	2.91	-	-	0.11	-	-	-	2.45	5.47
S17	Yes	-	-	-	-	-	-	2.43	-	-	0.06	-	-	-	1.99	4.48
S19	Yes	-	-	-	-	-	-	3.82	-	-	0.10	-	-	-	2.32	6.24
U01	No	-	-	-	-	-	4.72	-	-	-	-	-	-	-	1.32	6.04
U03	No	5.75	-	-	-	-	-	0.06	-	-	-	-	-	-	0.24	6.05
U05	Yes	-	-	-	2.81	-	-	1.25	-	-	-	-	-	-	0.62	4.68
U07	No	-	-	-	-	-	0.81	-	-	-	-	-	-	-	4.93	5.74
U09	No	-	-	-	-	-	1.10	2.59	-	-	-	-	-	-	2.17	5.85
U11	Partially	-	-	-	0.31	-	-	5.08	-	-	-	-	-	-	0.46	5.85
U13	Yes	-	-	-	-	-	-	3.26	-	-	-	-	-	-	1.04	4.30
U15	Yes	-	-	-	-	-	-	2.07	-	-	-	-	-	-	3.20	5.27
U17	Yes	-	-	-	-	-	-	2.55	-	-	-	-	-	-	1.94	4.49
U19	Yes	0.91	-	-	-	-	-	3.68	-	-	-	-	-	-	1.26	5.85
U21	Yes	-	-	-	-	-	-	1.73	-	-	-	-	-	-	4.51	6.24
U23	Yes	-	-	-	-	-	-	1.51	-	-	-	-	-	-	4.70	6.21
Y01	No	-	-	-	-	-	-	3.87	-	-	-	-	-	-	1.74	5.61
Y02	No	-	-	-	-	-	-	3.02	-	-	-	-	-	-	2.05	5.07
Y03	No	1.41	-	-	-	-	-	1.32	-	-	-	-	-	-	3.50	6.24
Y08	No	-	-	-	-	-	-	0.74	-	-	-	-	-	-	4.52	5.26
Y09	No	-	-	-	-	-	4.21	-	-	-	-	-	-	-	2.03	6.24
Total		**128.95**	**12.95**	**3.54**	**67.57**	**0.82**	**46.79**	**321.29**	**0.85**	**0.43**	**16.09**	**0.85**	**0.01**	**0.55**	**297.54**	**898.22**

(a) Wetland types: BTNN = wooded bog, BUw = burned wetland, FONG = graminoid fen, FONS = shrubby fen, FOPN = open patterned fen, FTNI = wooded fen with internal lawns, FTNN = wooded fen, FTPN = wooded patterned fen, MONG = marsh, Sh (wetland) = regenerating shrubland wetland, SONS = shrubby swamp, STNN = wooded swamp, WONN = shallow open water.

(b) Amount of well pad located within a 100 m setback of a wetland.

Notes: ha = Hectares, ID = Identification.

13. SIR 1, ESRD Response 67, Pages 148 to 150. Statements of Concern have identified Christina Lake as a significant interest to local stakeholders. Critical or sensitive habitat for spawning, rearing, and feeding for sport and forage fish has been identified along its shoreline (ESRD SIR1 Figure 67-1). Figure 67-2 illustrates that Cenovus proposes to steam beneath the portions identified as sensitive or critical.

a. For the well pads with well pairs proposed to be drilled beneath Christina Lake, provide the conceptual well pad construction and production dates associated with the subject wells.

b. Given the stakeholder concern expressed, and given the critical and sensitive habitat identified, justify, with rationale, the proposed drill paths beneath Christina Lake.

c. If the toes of the proposed drill paths were to end before the lake bed and shoreline, provide an estimate of the resource that would be stranded.

d. Support with rationale, the proposed drill paths beneath Christina Lake by providing a detailed risk assessment of the two scenarios; the currently proposed drill paths, and drill paths that do not extend beneath the lake bed and shoreline.

Response:

a. As provided in ESRD Round 1 SIR 67, Figure 67-1, well pads that have proposed well pairs beneath Christina Lake include F25, F29, L13, L17, M13, M15, M23, Q09 and Q11. The development timing for these pads are provided in ESRD Round 1 SIR 69, Figures 69-6 and to 69-7. At this time, Cenovus anticipates that first construction and production of these pads would not occur until at least 2020 (i.e., Pad Q09), with the remainder of the pads not being developed until after 2025.

b. Cenovus is proposing to develop the resource beneath Christina Lake to ensure resource conservation of the in-place bitumen in the area. As provided in 13c, below, approximately 34 million barrels of resource would be stranded if the well lengths are not completed as proposed. As discussed in ESRD Round 1 SIR 55, Cenovus believes there is a competent caprock in this area that will provide containment of the proposed steam chambers. To ensure steam chamber containment, Cenovus will conduct the following monitoring and mitigation measures:

- all surface and intermediate casing strings will be cemented from total depth to surface and cement-bond logs will be run on intermediate sections;

- well casings and couplings will be engineered to withstand thermal operations and well casing strings will be cemented using thermal cement;
- the thermal compatibility of all wells within 600 m of the proposed steam chambers will be reviewed and mitigated as appropriate;
- bottom hole injector well pressures will be monitored to ensure steam chamber pressures are being maintained below the approved maximum operating pressure, and at expected operating targets;
- steam chamber temperatures will be monitored to ensure steam chamber temperatures are maintained at expected operating targets;
- surface heave measurements will be conducted up to the Christina Lake boundary to ensure surface heave is consistent with other well pads; and
- two to four vertical wells per section (up to the Christina Lake boundary) will monitor pressure and temperature in the geological zones above the caprock to ensure containment.

With this, Cenovus believes that steam chamber containment will be maintained and the possibility of a bitumen-to-surface release and subsequent effects to fish and fish habitat is extremely unlikely to occur.

c. If the toes of the proposed drill paths were to end before the lake bed and shoreline of Christina Lake, approximately 34 million barrels of resource would be stranded.

d. Given the proposed drill paths and development of resources beneath Christina Lake, there are three potential pathways of effects to critical or sensitive fish habitat within Christina Lake:

- bitumen-to-surface release;
- steam interaction with shallow groundwater and the interface with surface water; and
- surface heave.

These pathways of effects were assessed in the EIA in Volume 4, Sections 5-4 and 7-1 and discussed in ESRD Round 1 SIR 55 and 63 and further in ESRD Round 2 SIR 25. There were no valid linkages to hydrology or geomorphology (and hence fish and fish habitat) due to surface heave. As described in Volume 4, Section 5-3, thermal plumes would not be expected to affect Christina Lake and thus there were no valid linkages to water quality.

An accidental bitumen to surface release could result in a decrease of the water quality and is considered a local, negative effect. Monitoring of potential sources of accidental releases provide a measure of the direction and magnitude of the vertical hydraulic gradient and groundwater quality, allowing Cenovus to implement the Emergency Response Plan (Cenovus 2014) before water quality at surface waterbodies is affected.

Cenovus considers this pathway to be a low risk due to the presence of a competent caprock as well as the implementation of the monitoring and mitigation measures discussed in response to AER Round 2 SIR 13b.

If drill paths did not extend below the shoreline and lakebed of Christina Lake, then the risks of affecting critical or sensitive fish habitat from these pathways would be effectively removed.

References:

Cenovus (Cenovus FCCL Ltd.). 2014. *Christina Lake Regulated Emergency Response Plan*. March 2014.

---

14. Volume 4, Table 13, Page 50; Volume 4, Section 3.1.1.4, Page 50; SIR 1, ESRD Response 56: Table 56-1, Page 113. Table 13 identifies that Spoonhead sculpin is recorded within the LSA. It is also identified as potentially present at a couple of the proposed crossing sites (SIR1 Table 56-1).

Species at Risk are discussed in Volume 4, Section 3.1.1.4, but only Arctic grayling is included. Spoonhead sculpin is identified as a species that 'May be at risk' by the government of Alberta (ASRD, *The General Status of Alberta Wild Species*, 2010). Update Section 3.1.1.4 to describe all rare, sensitive or culturally important fish, and their habitats within the assessment area. Include a map of rare and sensitive fish species' habitats (with the fish species labelled). Overlay the map with the project area boundary, development area boundary and footprints.

Response:

The baseline field surveys used study sites to represent the overall habitat variability within the Aquatic LSA. The habitats at each site were surveyed to document (i.e., map) the distribution of habitat features, and based on the distribution and availability of habitat, an assessment of habitat potential for forage species, sucker species and sport fish species was completed, including those considered critical, sensitive or culturally important. The habitat potential is described in the Aquatic Ecology Baseline Report for all of the waterbodies and watercourses identified.

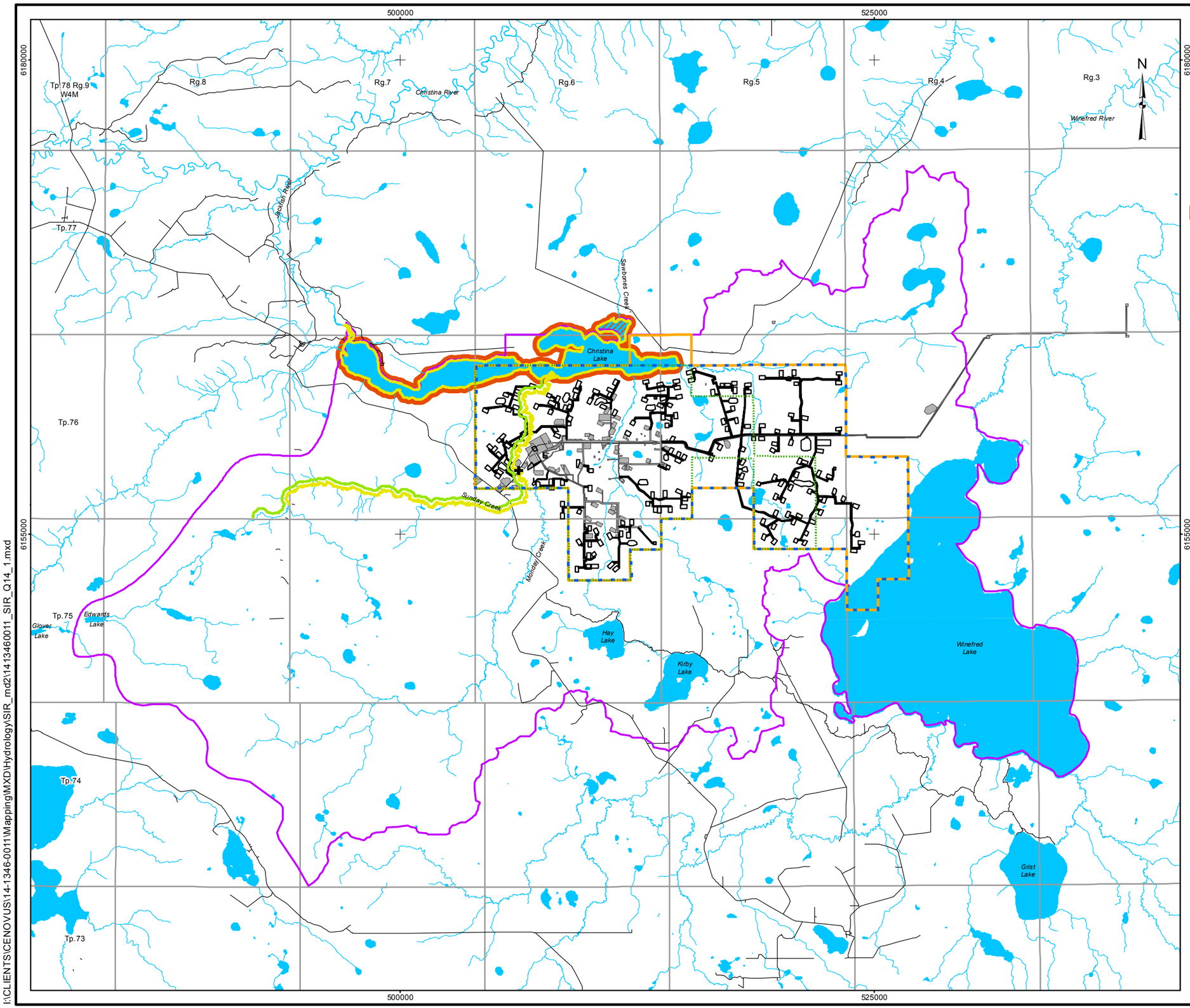
Of the fish species recorded within the LSA (Volume 4, Appendix 4-VIII, Table 13) Arctic Grayling and Spoonhead Sculpin would be considered rare or sensitive fish. Arctic Grayling is listed as a "Species of Special Concern" in Alberta (ESRD 2014). Spoonhead Sculpin are classified as "May be at Risk" in Alberta (ESRD 2014). No fish species recorded within the LSA are listed under the Canadian Species at Risk Act (SARA) (Government of Canada 2012) or by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2012).

Species of cultural importance traditionally fished by Aboriginal Groups found in the LSA include Arctic Grayling, Burbot, Cisco, Lake Chub, Lake Whitefish, Northern Pike, White Sucker, Walleye and Yellow Perch.

The known distribution of Arctic Grayling and assumed distribution of Spoonhead Sculpin within the LSA is indicated in Figure 14-1. In addition, Figure 14-1 notes critical or sensitive habitat in Christina Lake for spawning, rearing and feeding of many of the culturally important fish species in the LSA, including Cisco, Lake Whitefish, Northern Pike, Walleye, White Sucker and Yellow Perch (AEP 1991). Fish species distribution is based on the information compiled in the Aquatic Ecology Baseline Report and catch records from the provincial Fish and Wildlife Information Management System (FWMIS) database (http://esrd.alberta.ca/fish-wildlife/fwmis/access-fwmis-data.aspx).

As noted in the Aquatics Resources Baseline (Volume 4, Appendix 4-VIII), Christina Lake has historically been a high-quality sport fishing destination for many of the same species listed above as culturally important, including Walleye and Northern Pike, although Yellow Perch, Lake Whitefish and Burbot are also targeted for fishing.

Arctic Grayling are documented as occurring in the LSA and are present in Christina Lake and Sunday Creek, as well as the Jackfish River (the outlet of Christina Lake). Arctic Grayling has not been recorded in any of the unnamed waterbodies and are unlikely to occur in the unnamed tributaries, except locally near the mouths (i.e., at the confluence with Christina Lake) due to the lack of higher gradient, riffle-pool habitat conditions at these locations. Arctic Grayling are considered “sensitive” to human activities or to natural events in Alberta by ESRD (ESRD 2014).



LEGEND

- ROAD
- WATERCOURSE
- AQUATICS RESOURCES LOCAL STUDY AREA
- CENOVUS PHASE H FOOTPRINT
- CLTP PROPOSED DEVELOPMENT AREA
- CLTP PROPOSED PROJECT AREA (PPA)
- LEASE AREA
- CRITICAL OR SENSITIVE HABITAT FOR SPAWNING, REARING, AND FEEDING FOR WALLEYE. THIS INCLUDES THE AREA LOCALLY KNOWN AS "SAWBONES BAY" (AEP 1991).
- CRITICAL OR SENSITIVE HABITAT FOR SPAWNING, REARING, AND FEEDING FOR SPORT FISH AND FORAGE FISH INCLUDING CISCO, LAKE WHITEFISH, NORTHERN PIKE, WALLEYE, WHITE SUCKER AND YELLOW PERCH. THIS INCLUDES THE ENTIRE SHORELINE OF CHRISTINA LAKE (AEP 1991).
- EXISTING/APPROVED SURFACE DISTURBANCE
- WATERBODY

FISH SPECIES KNOWN DISTRIBUTION

- ARCTIC GRAYLING
- SPOONHEAD SCULPIN (DISTRIBUTION AS ASSUMED FROM SLIMY SCULPIN COLLECTIONS)
- LOCATION OF REPORTED SPOONHEAD SCULPIN COLLECTION (Van Horne 1998)

NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
AEP (ALBERTA ENVIRONMENTAL PROTECTION). 1991. CHRISTINA LAKE MANAGEMENT PLAN FINAL DRAFT. 67 PP.
ESRD (ALBERTA SUSTAINABLE RESOURCE DEVELOPMENT). 2006. LAC LA BICHE MANAGEMENT AREA MAP. AVAILABLE ONLINE AT: HTTP://ENVIRONMENT.ALBERTA.CA/DOCUMENTS/LACLABICHE.PDF. ACCESSED FEBRUARY 12, 2014.
VAN HORNE, PANCANADIAN RESOURCES. 1998. CHRISTINA LAKE THERMAL PROJECT SUPPLEMENTAL SPRING FISHERIES ASSESSMENT. SUBMITTED TO ALBERTA ENVIRONMENTAL PROTECTION. 19 PP.

DATUM: NAD 83 PROJECTION: UTM ZONE 12

7 0 7

SCALE 1:200,000 KILOMETRES

PROJECT

cenovus ENERGY

CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

TITLE

CRITICAL, SENSITIVE OR CULTURALLY IMPORTANT FISH DISTRIBUTION WITHIN THE LOCAL STUDY AREA

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	JR	08 Dec. 2014	SCALE AS SHOWN	REV. 0
GIS	GU	12 Jan. 2015		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 14-1

I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\Hydrology\SIR_md2\1413460011_SIR_Q14_1.mxd

Spoonhead Sculpin are documented as occurring in the LSA and have been reported in Sunday Creek (Van Horne 1998). Spoonhead Sculpin are classified as “May be at Risk” in Alberta (ESRD 2014) and occurs in small populations with data lacking on most populations. A review of the FWMIS database for Sunday Creek does not indicate Spoonhead Sculpin as present but instead reports collections of Slimy Sculpin. Fish assemblage studies conducted by RAMP in Christina River, Jackfish River and Sunday Creek have also only reported Slimy Sculpin in the catch data as reported on the online database (http://www.ramp-alberta.org/data/Fisheries/default.aspx). Slimy Sculpin and Spoonhead Sculpin can be misidentified in the field. The occurrence of Spoonhead Sculpin was initially reported by Van Horne (1998) and subsequently in the Devon Jackfish baseline review (Devon 2003) and the fisheries baseline for this Project (Appendix VIII, Volume 4). Cenovus has included an assumed distribution for Spoonhead Sculpin in Figure 14-1 based on the distribution derived from current Slimy Sculpin observations found in the FWMIS database.

References:

AEP (Alberta Environmental Protection). 1991. *Christina Lake Management Plan Final Draft*. Edmonton, AB. 67 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2012. *Canadian Wildlife Species at Risk*. Committee on the Status of Endangered Wildlife in Canada. http://www.cosewic.gc.ca/eng/sct3/index_e.cfm#3. Accessed December 4, 2014.

Devon (Devon Canada Corporation). 2003. *Application for the Approval of the Devon Jackfish Project Including Supplementary Information Request, Volume 2*. Submitted to Alberta Energy and Utilities Board and Alberta Environment. Calgary, AB.

ESRD (Alberta Environment and Sustainable Resource Development). 2014. *Species at Risk, Alberta. A Guide to Endangered and Threatened Species, and Species of Special Concern in Alberta, Version 1, 2014*. Accessed online at http://esrd.alberta.ca/fish-wildlife/species-at-risk/species-at-risk-publications-web-resources/documents/SpeciesAtRiskGuide-Aug27-2014.pdf. Accessed December 4, 2014.

Government of Canada. 2012. *Shedule 1 – List of Wildlife Species at Risk.*. http://www.sararegistry.gc.ca/species/schedules_e.cfm?id=1. Accessed December 4, 2014.

Van Horne, PanCanadian Resources. 1998. *Christina Lake Thermal Project Supplemental Spring Fisheries Assessment*. Submitted to Alberta Environmental Protection. 19 pp.

ENVIRONMENT PROTECTION AND ENHANCEMENT ACT (EPEA)

15. SIR1, ESRD Response 79.a., Page 186; SIR1, ESRD Response 80: Table 80-1, Page 187. In response to SIR1, question 79, Cenovus states that "The deep peat areas within the Field House and borrow areas will be salvaged to average depths of 150 cm and 40 cm, respectively…" However, Table 80-1 shows average soil salvage depths of 150 cm for both Field House and Borrow Areas in deep peat.

a. Clarify the discrepancy between the above response and the data on Table 80-1.

b. Revise Table 80-1 or the above response to ensure consistency.

Response:

a. The deep peat areas within the Field House and borrow areas will be salvaged to average depths of 150 cm and 40 cm, respectively, or to mineral surface contact. Table 80-1 from ESRD Round 1 SIR 80 is incorrect.

b. Table 80-1 has been amended and presented below as Table 15-1.

Table 15-1 Average Soil Salvage Depths for Each Soil Type by Texture and Facility

Project Facility	Average Fine/Medium Textured Upland Topsoil Salvage Thickness [cm]	Average Coarse Textured Upland Topsoil Salvage Thickness [cm]	Average Upland Subsoil Salvage Thickness [cm]	Average Shallow Peat/ Transitional[a] Soil Salvage Thickness [cm]	Deep Peat[b] Salvage Thickness [cm]
Dominant SMU Texture Correlation	**DOV2, DOV6, HRR1, HRR2, HRR6, PEA6**	**MIL2, MIL5, SUT2, SUT5, SUT6,**	**All upland soils**	**BMT3, ELS3, MWM3, STP3, MLD1-U, MUS1-U, MUS1**	**MLD1, MLD2-3, MUS2-3**
Well pads	25	15	30	40	0
Borrow Areas[c]	25	15	30	40	40
Water Wells	25	15	30	40	0
Field House	25	15	30	40	150
Roads[d]	25	15	0	40	0
Linear Disturbances[e]	0	0	0	0	0

(a) Organic soils <40 cm thick. Shallow peats salvaged to 40 cm topsoil and 0 cm to subsoil.

(b) Organic soils >40 cm thick.

(c) Borrow pit organic salvaged topsoil salvaged to depth.

(d) Topsoil will be salvaged in upland and transitional areas on roads; there will be no subsoil salvage on roads.

(e) Linear disturbances include expansion loop, above-ground pipeline, underground pipeline, power line and ROW clearing.

16. SIR1, ESRD Response 86, Page 194. Cenovus' response to SIR1, question 86, indicates no peat salvage in well pad areas on deep peat. Pursuant to condition 2 (b) and (c) of *EPEA* Approval No. 48522-01-00, the approval holder is required to salvage topsoil in deep peat areas where pad material will be left in place. No topsoil salvage in deep peat areas where pad material will be removed.

a. Confirm all well pad materials on deep peat areas will be removed during land reclamation.

b. If pad material will be left in place (partial pad removal) during land reclamation, justify why the above response should not be considered a contravention of condition 2 (l) of schedule IX of your *EPEA* approval?

Response:

a. Condition 2 of Schedule IX of EPEA approval No. 48522-01-00 does not outline the requirement to remove all pad materials on deep peat areas during land reclamation. On the contrary, pad materials may be left in place if conservation activities include the removal of 'topsoil' to a minimum depth of 40 cm prior to pad material placement. Alternatively, a plan to obtain topsoil by other means for final reclamation may be provided to the Director for authorization. Final reclamation techniques for well pads in deep peat will be determined on a site by site basis.

b. Cenovus assumes that the AER is referencing Condition 2(b)(i). This condition outlines the requirement to salvage the uppermost 40 cm of the deep peat unit if the pad materials are to be left in place during final reclamation. Condition 2(b)(ii) accommodates alternative approaches to the one outlined in condition 2(b)(i). It gives consideration to advances in reclamation technologies and clay pad treatment/management options that are likely to be realized as a result of on-going industry-led wetland reclamation trials (Condition 42 of Schedule IX). Condition 2(b)(ii) allows for the submission of alternative plans should the initial reclamation plans prove to be unsuitable for the surrounding environment during the time of final reclamation. In such a scenario the above response should not be considered a contravention of EPEA Approval No. 48522-01-00.

17. SIR1, ESRD Response 158, Page 370. In order to comply with condition 2 (b) and (c) of schedule IX of *EPEA* Approval No. 48522-01-00, it is the responsibility of the approval holder to assess deep peat and determine the areas where pad material will be removed or left in place. An effective reclamation program depends on detailed data collection prior to construction.

a. Provide a map indicating areas where pad material will be removed and areas where pad material will be left in place.

b. Confirm the depth of deep peat in all areas where pad material will be placed.

c. On page 370 Cenovus states that "The reclamation approach for pad and fill removal will be determined on a site by site basis and will be provided prior to each site closure." Confirm that Cenovus intends to make this determination prior to site construction to correspond with Pre-Disturbance Assessment requirements.

Response:

a. The proposed Project is not currently subject to EPEA Approval No. 48522-01-00 as it has not yet been approved by the AER and is still in the application phase of the regulatory process. More detailed data will be collected as part of the Pre-Disturbance Assessment (PDA) soil and vegetation surveys. Site specific conservation and reclamation plans, including maps showing areas where pad material will be removed and areas where pad material will be left in place, will be developed and submitted to the AER prior to construction of any facility. Any planning done with the current level of information would be conceptual and subject to change as understanding of the preferred exploitation strategy of the subsurface resource and the related surface facilities locations is refined.

b. Depth measurements for all soil points collected in the Project Area are available in the Soils and Terrain Baseline Report. Detailed measurements for each facility will be collected and submitted to the AER as part of the PDA soil surveys.

c. It is anticipated that the future approval related to the proposed Project will outline conservation requirements linked to decommissioning expectations during the time of final reclamation of a particular facility. Cenovus will prepare and submit PDA/C&R Plans that will be consistent with the AER endorsed PDA/C&R Guidelines prior to the construction. Presently, the Guidelines require a proponent to consider the baseline information collected and the construction and conservation plan to be employed when proposing the future reclamation strategy. Cenovus follows this recommended process in the development of its PDA/C&R Plans and intends to follow this guidance as long as it remains part of the Guidelines.

18. SIR1, ESRD Response 159, Pages 370-374.

a. Explain how the reclamation option of partial pad removal will comply with condition 2 (b) (I) of schedule IX of your approval?

b. Confirm whether or not there will be topsoil salvage in areas considered for partial pad removal.

Response:

a. The proposed Project is not currently subject to EPEA Approval No. 48522-01-00 as it has not yet been approved by the AER and is still in the application phase of the regulatory process. If at time of reclamation, Cenovus decides to pursue the option of partial pad removal Cenovus will engage the AER to determine acceptability of this approach and to obtain the necessary amendments to ensure that Cenovus remains in compliance with the Project EPEA Approval.

b. As given in the response to AER Round 2 SIR 15b), topsoil salvage is not currently planned for areas of deep organic soil where pad materials will be removed during land reclamation.

19. SIR1, ESRD Response 160.b, Page 374.

a. What is Cenovus' level of confidence in the estimated reclamation material balance?

b. Confirm if reclamation material shortage is anticipated. If yes, explain why.

Response:

a. The estimated reclamation material balance is a conceptual exercise based on 1:20,000 soil mapping and predicted locations of facilities on the Project Area. This balance is not meant to be a detailed depiction of soil availability, but rather a high level planning tool to demonstrate that Cenovus's planned salvage, storage and placement techniques will result in sufficient material to effectively reclaim the Project disturbances.

Cenovus is confident that the material balances are accurate based on the information that is currently available. Cenovus believes that these balances will contribute to a reclamation plan that will result in effective reclamation of project disturbances.

b. Reclamation material shortages are not anticipated for several reasons:

- detailed reclamation material balances will be developed for each facility prior to its construction;
- qualified soil salvage monitors will be present on site during salvage and stockpiling to ensure that the soil salvage plan is executed correctly;
- Cenovus's strategy is to conserve soil on the site it was salvaged from and to replace it on the same site at the time of final reclamation, where possible;
- Cenovus's years of experience on other operations has led to the development of effective stockpile maintenance, stockpile signage and material tracking processes that will be implemented on the Project;
- planning to reclaim borrow areas as open water features will allow for the retention of excess reclamation material to be used if any deficits are calculated for other facilities; and
- typically soil placement is based on replacing a percentage of what was salvaged, not on replacing a pre-determined volume or depth of material, allowing for adaptation of placement to match pre-disturbance conditions on a site by site basis.

---

20. SIR1, ESRD Response 201: Table 201-1, Page 439. Some soil map units (Horse River, Mildred, Mamawi, Peavine, and Sutherland) have been identified with medium to high wind and water erosion risk.

a. Provide wind and water erosion preventive measures for the above sensitive soil map units.

b. Discuss some mitigation measures that would be used in the event of wind or water erosion.

Response:

a. Cenovus follows the Alberta PDA guidelines (AENV 2014) which considers the following preventive measures:

- Work spaces and access roads will be monitored periodically for evidence of erosion or ponding. Enhanced monitoring will be implemented in times of heavy rainfall and heavy winds when the risk of soil erosion increases, especially in the areas identified as having medium to high risk erosion risk.
- Topsoil and subsoil will be salvaged and replaced as soon as it is reasonable to do so.

- To prevent soil structure damage, soil salvage will be postponed if soils are excessively wet, or if high winds occur during salvage or replacement activities.
- Soil stockpiles will be constructed to be stable and will be re-vegetated with an approved native grass seed mix, to manage wind and water erosion.
- Soil stockpiles will be sloped to be geotechnically stable, and silt fencing and erosion control matting will be utilized if required to stabilize the stockpiles.
- Culverts will be installed along the roads where required, to facilitate cross-road drainage and maintain wetlands drainage.
- Soil salvage and construction activities, if practical, will be avoided during the spring when runoff and rainfall are highest.
- To the extent possible, disturbed areas will be progressively reclaimed to minimize soil erosion.
- Where possible, the reclaimed surface will be left rough and loose to allow microsites to develop, to control erosion, and to assist in seed capture.

b. The following mitigation measures will be implemented as directed by PDA guidelines (AENV 2014) and advised by the publication *Best Management Practices for Conservation of Reclamation Materials in the Mineable Oil Sands Region of Alberta* (AEW 2012):

- Dust suppression will be implemented to control wind erosion.
- Silt fencing and erosion control matting will be utilized to stabilize disturbed areas where required to minimize erosion before vegetation establishment.
- Vegetation cover will be maintained as long as practical during construction.
- Woody debris could be utilized as erosion control material.

References:

AENV (Alberta Environment). 2014. *Guidelines for Submission of a Pre-Disturbance Assessment and Conservation & Reclamation Plan Under an Environmental Protection and Enhancement Act Approval for an Enhanced Recovery In Situ Oil Sands and Heavy Oil Processing Plant and Oil Production Site*. October 2014. Edmonton, AB.

AEW (Alberta Environment and Water). 2012. *Best Management Practices for Conservation of Reclamation Materials in the Mineable Oil Sands Region of Alberta*. Prepared by MacKenzie, D. for the Terrestrial Subgroup, Best Management Practices Task Group of the Reclamation Working Group of the Cumulative Environmental Management Association. March 9, 2011. Fort McMurray, AB. 161 pp. ISBN: 978-1-4601-0048-6 (online).

ALBERTA ENVIRONMENT & SUSTAINABLE RESOURCE DEVELOPMENT

PUBLIC ENGAGEMENT AND ABORIGINAL CONSULTATION

21. AER Supplemental Information Request Round 1, SIR 7, Page 19, ESRD Supplemental Information Request Round 1, SIR 5, Page 11.
Figure 7-1 in AER SIR 7 shows the proposed drainage boxes. The drainage box for Pad Y09 is beneath Winefred Lake.

In ESRD SIR 5 it is stated "Cenovus offered to continue dialogue with FMFN [Fort McMurray First Nation] to ensure they receive accurate information regarding the Project, and that their questions and concerns would be addressed in a timely manner."

At the meeting, FMFN presented two questions to Cenovus. The first question was regarding drilling under Winefred Lake, to which Cenovus replied that there were no plans to do so at this time.

a. Discuss accuracy of the information provided to the Fort McMurray First Nation given the above contradiction.

Response:

a. For additional context regarding the March 2013 meeting with Fort McMurray First Nation (FMFN), the question that FMFN asked was does Cenovus have any immediate plans to drill under Winefred Lake. In response to this, Cenovus stated that there were no immediate plans to do so at this time. Cenovus's near term plans at the CLTP are to continue to recover oil sands within Townships 75 and 76, Range 6. The Pad Y09 well pairs illustrated in ESRD Round 1 SIR 7, Figure 7-1 are conceptual and additional resource delineation would be required before the final well pair pattern could be completed for the pad. Development of this pad would not occur prior to 2025, as per Table 5.6-3 of Volume 1 of the Application.

   On April 3, 2014, FMFN provided a letter to Cenovus withdrawing its Statement of Concern regarding the Project. Within the letter, FMFN stated that Cenovus has satisfactorily and adequately consulted with FMFN and dealt with the effects of the Project on FMFN's rights, interests and traditional activities. Cenovus will continue to engage FMFN as part of its ongoing stakeholder engagement related to its long term operations in the area.

22. ESRD Supplemental Information Request Round 1, SIR 8, Page 16. Cenovus is prepared to provide copies and discuss the contents of the Christina Lake Thermal Project Wildlife Mitigation and Monitoring Program (Golder 2012) to Aboriginal groups that express an interest. Cenovus would also be willing to provide the most recent Caribou Protection Plan with Aboriginal groups that express an interest.

a. Will Cenovus also provide the Caribou Mitigation and Monitoring Program (Wildlife Infometrics Inc., Cortex Consultants Inc., Matrix Solutions Inc. 2013)?

b. To express an interest in these programs, Aboriginal groups would have to be aware of them. Describe how Aboriginal groups will be made aware of the programs. Discuss how all inquiries regarding wildlife mitigation will trigger discussion of the Wildlife Mitigation and Monitoring Program, the Caribou Mitigation and Monitoring Program, and the Caribou Protection Plans.

Response:

a. Cenovus will also provide and discuss the contents of the *Christina Lake Thermal Project Woodland Caribou Mitigation and Monitoring Program* (Wildlife Informetrics Inc., Cortex Consultants Inc., Matrix Solutions Inc., 2013) to Aboriginal Groups that express an interest.

b. Cenovus will continue to meet with Aboriginal Groups to discuss the Christina Lake Thermal Project for the life of the Project. If during these meetings Aboriginal Groups raise any questions or concerns regarding wildlife, including caribou, Cenovus will discuss, make reference to and subsequently provide upon request, the AER approved *Christina Lake Thermal Project Wildlife Mitigation and Monitoring Plan* (Golder 2012)*, Christina Lake Thermal Project Woodland Caribou Mitigation and Monitoring Program* (Wildlife Informetrics Inc., Cortex Consultants Inc., Matrix Solutions Inc. 2013) and the Caribou Protection Plans, as these documents provide a comprehensive description of Cenovus's approach to overall wildlife management.

References:

Golder (Golder Associates Ltd.). 2012. *Christina Lake Thermal Project 2011 Wildlife Monitoring Program*. Submitted to Cenovus FCCL Ltd. April 2012. Calgary, AB. 41 pp.

Wildlife Infometrics, Cortex and Matrix (Wildlife Infometrics Inc., Cortex Consultants Inc., and Matrix Solutions Inc.). 2013. *Cenovus FCCL Ltd. Christina Lake Thermal Project Woodland Caribou Mitigation and Monitoring Plan*. Approval 48522-01-00. February 22, 2013. 82 pp.

AIR

Air Quality Assessment

23. ESRD Supplemental Information Request Round 1, SIR 1, Pages 1 and 2. ESRD Supplemental Information Request Round 1, SIR 2, Page 3. Cenovus has not responded to SIR 1 and SIR 2 with respect to the air discipline.

a. Describe for each EIA discipline the lessons learned from the planning, design, construction, operation, mitigation and monitoring of the existing Christina Lake Development.

b. Describe how the lessons learned have been incorporated into the design of the Phase H and Eastern Expansion.

Response:

a. As discussed in the response to ESRD Round 1 SIR 1, Cenovus has gained significant experience and learnings during the development and operations of its Christina Lake and Foster Creek facilities that will be applied to the Project. The lessons learned and continuous improvement opportunities that relate to Air Quality include the following:

- Facility Planning, Design and Operations:
  - Low oxides of nitrogen (NOx) burners and flue gas recirculation will be used to reduce Once Through Steam Generator (OTSG) NOx emissions.
  - A Vapour Recovery Unit (VRU) will be incorporated to capture vapours from the process vessels and storage tanks, thereby reducing fugitive tank emissions.
  - Common sulphur removal facilities will be installed within the Central Processing Facility (CPF) to capture sour gas from the well pads for treatment to reduce sulphur dioxide (SO2) emissions.
  - Produced gas in the OTSGs will be combusted as opposed to flaring, which will provide more reliable and complete combustion of sour gas and hydrocarbons.
  - The pop tanks and pressure relief valves will be connected to the flare system to reduce hydrogen sulphide (H2S) and hydrocarbon emissions.
  - Steam lines will be insulated to minimize heat losses associated with the transport of steam to the well pads, and reduce steam requirements.
- Reservoir Planning, Design and Operations:
  - Enhanced start-up techniques (e.g., dilation, solvent soak) will be used to reduce well pair start-up times, Steam to Oil Ratios (SORs), and subsequent energy and emission intensities.

  - Steam ramp down/blow down operations will be piloted on B01 and B02 pads to reduce well pad steam injection and subsequent air emissions from the OTSGs and Heat Recovery Steam Generators (HRSGs) (with the intent of wider-scale employment of this technique on future mature pads, including obtaining the necessary regulatory approvals).
  - Wedge Well™ technology will be incorporated at well pads to reduce SORs, achieve higher ultimate resource recovery, and reduce energy and emission intensities.
  - Solvent Aided Process (SAP) will be used on the A02-1 and A02-2 well pairs for improved resource recovery to reduce SORs, and energy and emission intensities (A02-1 to start up in Q4 2014).

- Air Quality Monitoring and Mitigation:
  - On-site personnel will be trained in regards to air emission limits and air monitoring requirements given in the EPEA approval and applicable AER directives.
  - Manual Stack Surveys and Continuous Emissions Monitoring Systems will be conducted on selected OTSGs/HRSGs to ensure compliance with EPEA air emission limits.
  - Volumetric flow rates of produced and fuel gas to flare stacks and steam generators will be monitored continuously, and produced gas or combined fuel gas (H_2S and heating value) will be analyzed monthly.
  - Programmed logic will be used within the Distributed Control System (DCS) to alert operators of potential air emission limit exceedances in order to implement mitigative measures prior to an exceedance.
  - Ambient air monitoring programs that follow procedures and standards as adopted by the Wood Buffalo Environmental Association (WBEA) will be used.
  - Direct inspection and maintenance techniques will be implemented to achieve efficient management of fugitive emissions from equipment leaks, which includes daily walk-throughs by operations personnel, use of gas detection monitoring systems, and effective repairs and after-repair monitoring programs.
  - Leak Detection and Repair (LDAR) studies that include the CPFs and well pads will be done annually. The LDAR study detects leaks with an infra-red camera and work orders are prepared to repair found leaks. This study reduces the chance of odour issues related to leaks on well pads or within the CPFs.

Cenovus has developed and implemented the Cenovus Operations Management System (COMS) to develop a system of standards, controls and procedures that are being implemented to establish methods for consistently applying current best practices and incorporating new thinking to achieve the highest safety, environmental and operating performance.

b. The lessons learned and continuous improvement opportunities discussed in the response to ESRD Round 2 SIR 23a) are included in the detailed engineering design phase of the Project and will be incorporated as appropriate.

WATER

Aquatics

24. AER Supplemental Information Request Round 1, SIR 3, Page 12. AER SIR 3a asks that "Cenovus describe and map each footprint that are proposed to be located less than 100m from a water body and indicate the fluids involved. Include neighbouring water body identification and setback distance in metres."

The response indicates 15 locations that are within 100m of a watercourse: 9 wellpads, 1 corridor, and 5 watercourse crossings. The figure requested is provided, however, there are no distances provided or discussion of fluids involved.

a. Provide distances from the watercourse for the pads and corridor. Provide fluids that would be present at the sites.

Part d) of the same response asked Cenovus to "Contrast the above identified locations with potential alternate locations outside of the 100m setback. Include a discussion of the surface and subsurface constraints that were considered."

Cenovus stated "all proposed well pads have a 100 m setback from watercourses and waterbodies and will be further assessed during Pre-Disturbance Assessment (PDA) process." This response contradicts the information provided above and does not answer the question for the proposed infrastructure that is within the 100 m setback.

b. Contrast the identified locations with potential alternate locations outside of the 100m setback. Include a discussion of the surface and subsurface constraints that were considered.

Cenovus states that the 100 m setback of wellpads and facilities from watercourses and waterbodies is a mitigation that will minimize risk if a spill were to occur.

c. What additional precautions would be implemented if the footprint could not be adjusted to be outside of the 100 m footprint?

Response:

a. Cenovus has reviewed the footprint relative to the waterbody and watercourse setback requirements and has prepared an alternate proposed footprint as shown in Figure 24-1A (overview) and Figures 24-1B to 24-1F (detailed views). Well pads previously located within the 100 m buffer have been relocated outside of the buffer. The updated distances from the watercourse or waterbody are provided in ESRD Round 2 SIR 26, Table 26-1.

b. The proposed alternative well pad locations are provided in Figures 24-1A to 24-1F. Subsurface and surface constraints considered are discussed in the response to ESRD Round 2 SIRs 7 and 11.

c. Cenovus has reviewed the Project footprint in relation to the required water setbacks and has proposed alternative locations outside of the setback requirements. Additional footprint and siting rationale is provided in the response to ESRD Round 2 SIR 26.

500000

525000

6180000

6155000

Tp.78
Rg.9
W4M

Rg.8

Rg.7

Rg.6

Rg.5

Rg.4

Rg.3

N

Christina River

Winefred River

Tp.77

Jackfish River

Sawbones Creek*

Christina Lake

Tp.76

Crossing: 1

Crossing: 2

Crossing: 3

Crossing: 4

Crossing: 5

MW6

Sunday Creek

Monday Creek

Tp.75

Edwards Lake

Glover Lake

Hay Lake

Kirby Lake

Winefred Lake

Tp.74

Grist Lake

Tp.73

LEGEND

- LOCATION WHERE VALLEY BRAKE IS WITHIN 100 m OF INFRASTRUCTURE
- WATERCOURSE CROSSING LOCATION
- ROAD
- WATERCOURSE
- AQUATICS RESOURCES LOCAL STUDY AREA
- CENOVUS PHASE H ALTERNATE FOOTPRINT
- WATERBODY

NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

7 0 7

SCALE 1:200,000 KILOMETRES

PROJECT

cenovus ENERGY

CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

TITLE

ALTERNATIVE PROJECT FOOTPRINT IN RELATION TO WATERCOURSE/WATERBODY SETBACK REQUIREMENTS

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	JR	04 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	JE	15 Jan. 2015		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 24-1A

I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\Hydrology\SIR_md2\14134600011_SIR_Q24_1a.mxd

505000

6160000

A25

A27

MW4

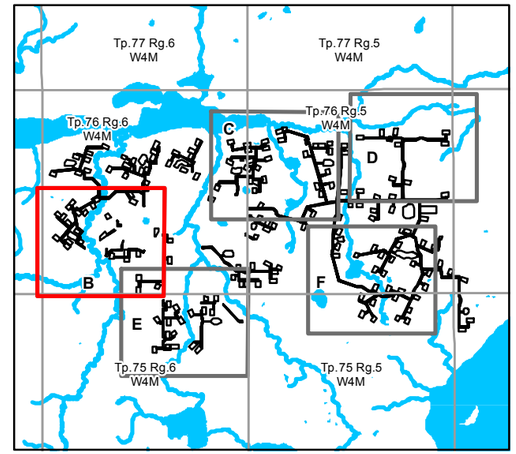
A11

505000

N

LEGEND

- ROAD
- WATERCOURSE
- LEASE BOUNDARY
- WELL PAD
- CENOVUS PHASE H FOOTPRINT
- CENOVUS PHASE H ALTERNATIVE FOOTPRINT
- WATERBODY
- 100 m BUFFER OF VALLEY BREAK, WATERBODY OR WATERCOURSE



NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

DATUM: NAD 83 PROJECTION: UTM ZONE 12

750 0 750

SCALE 1:20,000 METRES

PROJECT

cenovus ENERGY

CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

TITLE

ALTERNATIVE PROJECT FOOTPRINT IN RELATION TO WATERCOURSE/WATERBODY SETBACK REQUIREMENTS WELL PAD A11, A25, A27 AND MW4

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	JR	04 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	AJW	15 Jan. 2015		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 24-1B

I:\CLIENTS\CENOVUS\14-1346-0011\MappingMXD\Hydrology\SIR_md2\14134600 11_SIR_Q24_1b_f.mxd

515000

N

N19

N21

F21

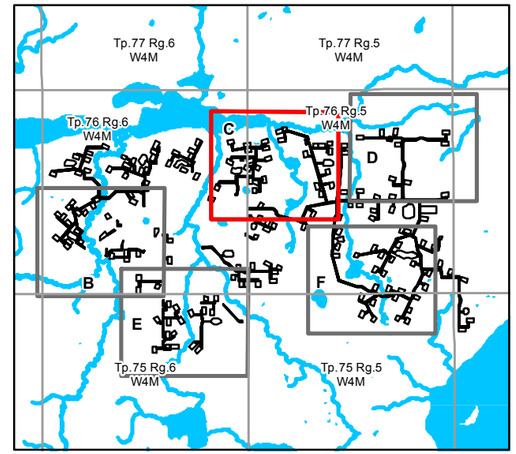
N03

6160000

515000

LEGEND

- ROAD
- WATERCOURSE
- LEASE BOUNDARY
- WELL PAD
- CENOVUS PHASE H FOOTPRINT
- CENOVUS PHASE H ALTERNATIVE FOOTPRINT
- WATERBODY
- 100 m BUFFER OF VALLEY BREAK, WATERBODY OR WATERCOURSE



NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

750 0 750

SCALE 1:20,000 METRES

PROJECT

cenovus ENERGY

CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

TITLE

ALTERNATIVE PROJECT FOOTPRINT IN RELATION TO WATERCOURSE/WATERBODY SETBACK REQUIREMENTS WELL PAD F21, N03, N19 AND N21

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	JR	04 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	AJW	15 Jan. 2015		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 24-1C

I:\CLIENTS\CENOVUS\14-1346-0011\MappingMXD\Hydrology\SIR_md2\14134600 11_SIR_Q24_1b_f.mxd

520000

6165000

N

R27

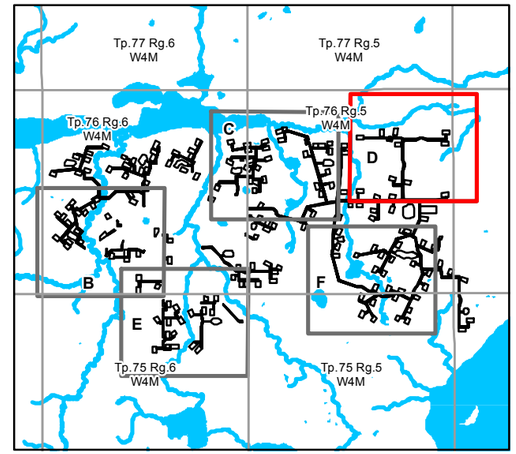
R21

520000

6165000

LEGEND

- ROAD
- WATERCOURSE
- LEASE BOUNDARY
- WELL PAD
- CENOVUS PHASE H FOOTPRINT
- CENOVUS PHASE H ALTERNATIVE FOOTPRINT
- WATERBODY
- 100 m BUFFER OF VALLEY BREAK, WATERBODY OR WATERCOURSE



NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

750 0 750

SCALE 1:20,000 METRES

PROJECT

cenovus ENERGY

CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

TITLE

ALTERNATIVE PROJECT FOOTPRINT IN RELATION TO WATERCOURSE/WATERBODY SETBACK REQUIREMENTS WELL PAD R21 AND R27

Golder Associates

PROJECT	14-1346-0011		FILE No.	
DESIGN	JR	04 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	AJW	15 Jan. 2015		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 24-1D

I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\Hydrology\SIR_md2\14134600 11_SIR_Q24_1b_f.mxd

510000

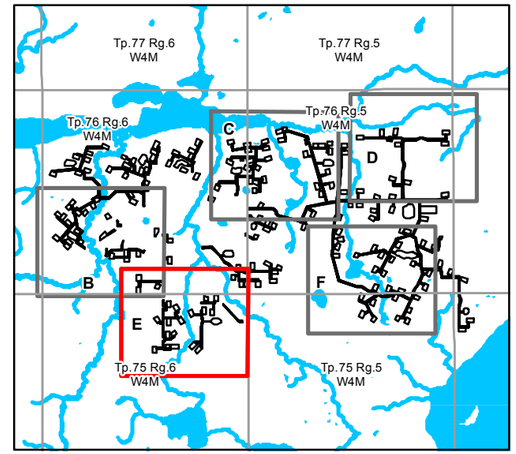
6155000

H33

510000

LEGEND

- ROAD
- WATERCOURSE
- LEASE BOUNDARY
- WELL PAD
- CENOVUS PHASE H FOOTPRINT
- CENOVUS PHASE H ALTERNATIVE FOOTPRINT
- WATERBODY
- 100 m BUFFER OF VALLEY BREAK, WATERBODY OR WATERCOURSE



NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

750 0 750

SCALE 1:20,000 METRES

PROJECT

cenovus ENERGY

CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

TITLE

ALTERNATIVE PROJECT FOOTPRINT IN RELATION TO WATERCOURSE/WATERBODY SETBACK REQUIREMENTS WELL PAD H33

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	JR	04 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	AJW	15 Jan. 2015		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 24-1E

I:\CLIENTS\CENOVUS\14-1346-0011\MappingMXD\Hydrology\SIR_md2\14134600 11_SIR_Q24_1b_f.mxd

520000

6155000

C25

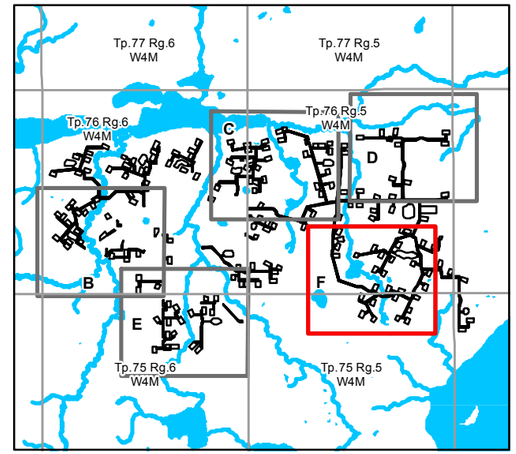
C27

K21

N

LEGEND

- ROAD
- WATERCOURSE
- LEASE BOUNDARY
- WELL PAD
- CENOVUS PHASE H FOOTPRINT
- CENOVUS PHASE H ALTERNATIVE FOOTPRINT
- WATERBODY
- 100 m BUFFER OF VALLEY BREAK, WATERBODY OR WATERCOURSE



NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

750 0 750
SCALE 1:20,000 METRES

PROJECT
cenovus ENERGY
CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

TITLE
ALTERNATIVE PROJECT FOOTPRINT IN RELATION TO WATERCOURSE/WATERBODY SETBACK REQUIREMENTS WELL PAD C25, C27 AND K21

Golder Associates

PROJECT	14-1346-0011		FILE No.	
DESIGN	JR	04 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	AJW	15 Jan. 2015		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 24-1F

I:\CLIENTS\CENOVUS\14-1346-0011\MappingMXD\HydrologySIR_md2\14134600 11_SIR_Q24_1b_f.mxd

25. ESRD Supplemental Information Request Round 1, SIR 55, Page 106. AER Supplemental Information Request Round 1, SIR 1, Page 1. AER Supplemental Information Request Round 1, SIR 7, Page 19. ESRD Supplemental Information Request Round 1, SIR 67, Page 147.

Figure 7-1 in AER SIR 7 shows the proposed drainage boxes beneath Winefred Lake, Christina Lake, and several tributaries including Sunday Creek. These waters are regionally significant aquatic habitats for fish including Arctic grayling, which are listed as a Species of Special Concern by Alberta's Endangered Species Conservation Committee and Sensitive in the General Status of Alberta Wild Species.

Several First Nation groups have expressed concern regarding the protection of the watercourses and waterbodies on the Cenovus Christina Lake lease. The fisheries are important for subsistence harvest.

a. Cenovus was asked to describe both the likelihood and the potential magnitude of impact if a bitumen release were to affect a waterbody or watercourse. The potential magnitude was not described. It is important for risk assessment and decision making that the potential magnitude of effect, even if the likelihood is limited, be considered.

Provide a description of the magnitude of the impact should an event occur. Include extent of impact, biological response and long term outcomes for the riparian and aquatic systems. Describe potential effects on species that use waterbodies for all or part of their life cycle (e.g., fishes, amphibians, waterfowl). Describe the effects to domestic, recreational and commercial fisheries.

Response:

a. As described in Section 4.7 of Volume 2 of the EIA, the effect analyses focused on an assessment of potential changes to receptors within the environment due to the construction, operation and reclamation of the Project. The effect analysis includes validation of causal linkages between particular Project activities and potential environmental effects. As per Section 4.8 of Volume 2, the residual environmental effects resulting from the Project activities are assessed in terms of quantitative impact criteria. The impact assessment methods and criteria are, therefore, based on assessing the potential effects of Project activities on the environment.

As given in ESRD Round 1 SIR 55, Cenovus has undertaken caprock and wellbore thermal compatibility studies to confirm the competency of the overlying caprock and believes that a bitumen–to-surface release would be extremely unlikely to occur.

Cenovus considers this pathway to be a low risk due to the presence of a competent caprock as well as the implementation of the monitoring and mitigation measures discussed in response to AER Round 2 SIR 13b). In the extremely unlikely event that a bitumen release to an aquatic environment were to occur, the magnitude of the potential effects on the aquatic environment (including fish, amphibians, waterfowl) would vary depending on the amount of the release, type of spill, the sensitivity of the receptors at or near the point of release and implementation of mitigation measures. In the absence of specific details regarding a hypothetical release to a surface waterbody (i.e., location, volume) it is not possible to use the magnitude effect description criterion to assess residual effects to environmental receptors and therefore to confidently or accurately present the magnitude of effect.

Although the magnitude of a bitumen-to-surface event cannot be predicted, Cenovus is confident the magnitude of effect can be effectively managed and minimized by the implementation of the measures discussed in ESRD Round 1 SIR 55 and as a result no long-term effects to aquatic resources would be anticipated.

Based on Cenovus's environmental management programs, procedures and spill mitigation, effects from a bitumen release on the aquatic environment would be expected to be local, short or medium-term and reversible based on spill response and remediation efforts. No long-term effects to domestic, recreational and commercial fisheries would be expected.

References:

Cenovus (Cenovus FCCL Ltd.). 2014. *Christina Lake Regulated Emergency Response Plan*. March 2014.

ESRD (Alberta Environment and Sustainable Resource Development). 2013. *Guide to Preparing Environmental Impact Assessment Reports in Alberta*. Edmonton, AB. 26 pp.

---

26. ESRD Supplemental Information Request Round 1, SIR 57, Page 116.

The *Guide to Preparing Environmental Impact Assessment Reports in Alberta (Updated March 2013)* (section 3.3.3) states "Setbacks should be measured from the edge of proposed disturbance to the top of the escarpment for watercourses. Clearly outline the targets, goals and commitments around setbacks from watercourses. Provide a rationale for any infrastructure within 100 metres of the top of the watercourse escarpment."

Further, the Enhanced Approval Process, Integrated Standards and Guidelines 2013, Government of Alberta (part 2A, section 4; appendix D) states "Setbacks from watercourses are measured from the edge of disturbance (e.g. clearing) to the top of the (valley) break, or where undefined, from the top of the bank. Setbacks from waterbodies are measured from the edge of the disturbance to the defined bank or outer margin of the last zone of (woody) vegetation if there is not a defined bank."

The response to ESRD SIR 57c with reference to 10 m buffer and dismissal of the valley break (i.e., escarpment) as the endpoint measurement confuses the remainder of the response.

Cenovus states in parts e) and f) that the footprint components that are currently sited within the setback distance will be reviewed and adjusted, where possible, to meet the setback requirements and maximize the setback from the valley break.

a. Provide an update regarding siting of the footprint. Provide rationale for any locations that could not be sited outside of the 100 m setback (provide measurement endpoints). Give distances to the watercourse valley break or top of bank/outer edge of woody vegetation where there is no valley break present.

b. Discuss the risk of sediments reaching watercourses if pads are sited closer than 100 m.

c. Discuss the risk of spills reaching watercourses if pads are sited closer than 100 m.

d. Discuss the risk of thermal plumes reaching watercourses if pads are sited closer than 100 m.

Response:

a. Alternate proposed well pad and ROW clearing locations to avoid the 100 m buffer, as defined in Enhanced Approval Process (EAP), Integrated Standards and Guidelines 2013 (Government of Alberta 2013; Part 2A, Section 4; Appendix D) are shown in overview (Figure 24-1A) and detail (Figures 24-1B through 24-1F). Alternate locations outside of the 100 m buffer have been identified for all footprint components, with the exception of brackish well pad MW4. The proposed location for MW4 is within the 100 m buffer, however is located on a previously approved land disposition. The proposed locations that were within the 100 m setback, as defined under EAP, and updated locations with distances are listed in Table 26-1.

Table 26-1 Updated Well Pads and Corridor Location Distances from Watercourse/Waterbody Setbacks

Well Pad / Corridor Identifier	Mapped Water Feature Type[a]	Type	Proposed Distance from Valley Break/ Watercourse	Updated Distance from Valley Break/ Watercourse
A25	Watercourse	well pad	44	> 100
A27	Watercourse	well pad	(14)[b]	> 100
A11	Watercourse	brackish pad	70	> 100
C25	Waterbody	well pad	66	> 100
C27	Waterbody	well pad	45	> 100
F21	Watercourse	well pad	0	> 100
H33	Watercourse	well pad	84	> 100
K21	Waterbody	well pad	87	> 100
N03	Waterbody	well pad	52	> 100
N19	Watercourse	well pad	90	> 100
N21	Watercourse	well pad	93	> 100
R27	Watercourse	well pad	90	> 100
A25 to A27 corridor	Watercourse	row clearing	50	removed
MW4	Watercourse	well pad	25	76[c]
R21	Waterbody	well pad	23	> 100

(a) The presence of the waterbody or watercourse and its specific location to a Project facility will be confirmed during the detailed design stage of the Project.

(b) Original location was inside of identified valley break.

(c) Updated location moved to an approved disposition east of the watercourse, with crossing removed.

Cenovus has sought to locate well pads with a setback of 100 m from watercourses and waterbodies, as defined under EAP. Well pad locations were selected to optimize recovery of the bitumen resource based on the reservoir and geological characteristics of the bitumen bearing formations. The well pad locations have; therefore, been located to balance resource recovery and environmental protection. Note that the actual locations of the facilities will be determined during the detailed planning stage of the Project and the 100 m setback will be maintained, where possible from field verified watercourses and waterbodies.

As part of detailed planning, actual distances from potential facilities to the watercourse or waterbody will be measured in the field and adjusted to maintain the setback where possible as part of the Pre Disturbance Assessment (PDA) process. As well, the type, width, and channel characteristics of the watercourse (Table 26-2) will be determined to establish the appropriate setback distance based on the size and characteristics of the watercourse as per Appendix D of the Enhanced Approval Process, Integrated Standards and Guidelines (Government of Alberta 2013).

Table 26-2 Setback Requirements According to the Alberta Enhanced Approval Process, Integrated Standards and Guidelines

Type	Width	Channel Characteristics	Setback Requirement[(b)]
Large Permanent[(a)]	> 5 m	Defined Channel	100 m
Small Permanent[(a)]	0.7 to 5 m	Defined Channel	45 m
Intermittent/Spring[(a)]	< 0.7 m	Defined Channel	45 m
Ephemeral	-	No Defined Channel	15 m

(a) May or may not contain continuous flow.

(b) The setback for watercourses is measured from the top of break (valley), or where undefined, from the top of the bank.

Source: Enhanced Approval Process, Integrated Standards and Guidelines (Government of Alberta 2013).

- = Not applicable.

Field measurements will be made to the appropriate feature of the watercourse or waterbody. For example, for large, defined channels, the valley break would be used, but for smaller channels without a valley, the top of the defined bank would be the appropriate feature. For channels without defined bed or banks, the centerline of the channel may be used. For waterbodies without defined banks, the outer margin of the last zone of (woody) vegetation may be used.

As per the response to ESRD Round 1 SIR 57, Cenovus commits to conducting the necessary site-specific field assessment work and will file any non-routine development applications including facility-specific mitigation plans as per the guidelines presented in *Directive 056* (ERCB 2011) should this be necessary as development occurs.

b. As discussed in part a), alternative well pad locations outside of the 100 m buffer have been selected for well pads that were previously located within the 100 m buffer, as shown in Figures 24-1A through 24-1F. The proposed location for brackish well pad MW4 is within the 100 m buffer however is located on a previously approved land disposition.

c. See the response to part b) above. Berms or curbs will be placed around well pads to contain potential spills. Facilities, structures and work areas will be regularly inspected and maintained to address potential leaks and minimize the risk of spill. In the unlikely event of spill, Cenovus will promptly implement its Spill Response Plan.

d. As described in response to 26a) an alternate footprint for the project is proposed so that well pads will not be located closer than 100 m to watercourses or waterbodies. Given the predicted rates of thermal plume migration (ESRD Round 1 SIR 38i) it is likely that groundwater temperatures will not exceed temperature changes of more than 2°C at a distance of 100 m away from SAGD wells in the Ethel Lake Aquifer. This aquifer was chosen for the assessment as the potential connection of the aquifer to Christina Lake is the only aquifer-surface waterbody connection identified for the Project.

References:

ERCB (Energy Resources Conservation Board). 2011. *Directive 056: Energy Development Applications and Schedules*. Calgary, AB.

Government of Alberta. 2013. *Integrated Standards and Guidelines: Enhanced Approval Process (EAP). Effective: December 1, 2013*. Alberta Environment and Sustainable Resource Development. 94 pp. Available online at: http://esrd.alberta.ca/forms-maps-services/enhanced-approval-process/eap-manuals-guides/documents/EAP-IntegratedStandardsGuide-Dec01-2013.pdf. Accessed on November 24, 2014.

27. ESRD Supplemental Information Request Round 1, SIR 56, Page 114. ESRD Supplemental Information Request Round 1, SIR 62, Page 132.

There is one underground pipeline crossing proposed on Sunday Creek. SIR 56 part d) states buried pipelines will be installed using an isolation method.

This statement contradicts information presented in SIR 62: *Pipeline crossings may be aerial pipelines, or will be installed by a trenchless construction method where technically feasible, which will avoid any disturbance to the active channel of the watercourse during construction.*

Fish presence listed for Sunday Creek are Arctic grayling, northern pike, white sucker, spoonhead sculpin, lake chub, and brook stickleback. Trenchless installation of the pipeline is recommended.

a. Clarify the proposed method for the buried pipeline proposed to cross Sunday Creek.

b. Has geotechnical investigation been done to determine if the site would be conducive to drilling?

Response:

a. As shown in ESRD Round 2 SIR 24, Figures 24-1A and 24-1B, the recommended location for the MW04 brackish well pad is now to the east side of Sunday Creek. This location effectively eliminates the need for the referenced underground pipeline crossing.

b. As provided in part a), the recommended location for brackish well pad MW04 is to the east of Sunday Creek; and therefore, the underground crossing is no longer proposed.

28. ESRD Supplemental Information Request Round 1, SIR 66, Page 146

The Terms of Reference state:

10 Monitoring

[C] Discuss the Proponent's current and proposed monitoring programs, including:

how the monitoring program will assess any project impacts and measure the effectiveness of mitigation plans. Discuss how the Proponent will address any Project impacts identified though the monitoring program.

Monitoring is required to confirm predictions made in the EIA are accurate and measure effectiveness of the mitigations. Monitoring of fish and invertebrate populations and community structure can indicate multi-year effects and changes to habitat conditions. Water quality and quantity information, though important, does not give direct indication of change in the biotic conditions.

a. Provide a conceptual monitoring plan for fisheries and aquatics.

Response:

a. Cenovus is a participant of and provides funding, through AEMERA to the Regional Aquatics Monitoring Program (RAMP). RAMP monitors aquatic environments to detect and evaluate changes due to cumulative resource development. The location of the Project is within the RAMP focus study area, and includes both baseline (Christina Lake, Christina River and Sunday Creek) and test (Sawbones Creek and unnamed tributaries to Christina Lake) monitoring locations for aquatic biota, including fisheries (RAMP 2014). Using effect predictions from environmental impact assessments, RAMP uses specific potential stressors that are identified and monitored to document baseline conditions, as well as potential changes related to the development (RAMP 2014). In addition, Christina Lake is monitored by ESRD through their Fall Walleye Index Monitoring (FWIN) program, which includes fish population and tissue monitoring (RAMP 2014).

   When determining the need to develop a Project-specific monitoring program one of the key considerations is the potential for residual effects to occur as a result of the Project. In the case of aquatic biota and habitat, the EIA concluded there was no predicted residual effect due to the Project. As a result, no trigger was identified that suggested broad monitoring of aquatic biota and fisheries (e.g., fish, fish habitat and benthic

invertebrates) should be implemented over and above local monitoring/mitigation associated with best practices (e.g., watercourse crossings). The largest potential effect to aquatic biota and habitat from SAGD developments is from the development of linear infrastructure (i.e., road and pipeline crossings across watercourses). Cenovus has committed to monitoring the construction and operation of watercourse crossings. This includes following appropriate regulatory guidance (e.g., ESRD Codes of Practice, Fisheries and Oceans Canada's Measures to Avoid Causing Harm to Fish and Fish Habitat), developing an appropriate design for the crossings and implementing a watercourse crossing inspection program.

If results from monitoring indicate that additional Project-specific monitoring is required for aquatic biota and fisheries a plan will be developed in consultation with the AER. In developing the monitoring plan Cenovus will consider the use of thresholds or targets based on scientific rationale and include indicators to evaluate changes in the aquatic ecosystem. The sampling methodology would be consistent, where appropriate, with standard methods for inventory and habitat data collection, which were employed for baseline sampling. It is anticipated that thresholds or targets developed would provide a means of measuring performance and would be intended to encourage adaptation and innovation.

References:

RAMP (Regional Aquatics Monitoring Program). 2014. *Regional Aquatics Monitoring Program, 2013 Technical Report*. Prepared for Ramp Steering Committee in support of the JOSMP by the RAMP 2013 Implementation Team. April 2014. Available at: http://www.ramp-alberta.org/UserFiles/File/AnnualReports/2013/_RAMP_2013_Final.pdf. Accessed online January 5, 2014.

TERRESTRIAL

Land Use and Land Management

29. AER Supplemental Information Request Round 1, SIR 4, Page 16. The Lower Athabasca Region is the northeastern region of Alberta and includes the Regional Municipality of Wood Buffalo, Lac La Biche County, I.D. 349 (Cold Lake Air Weapons Range), and the Municipal District of Bonnyville. The entirety of the Cenovus Christina Lake project is within the Lower Athabasca Region and would be under the Lower Athabasca Regional Plan (LARP).

a. Consult LARP and provide responses to the SIR.

Response:

a. Cenovus acknowledges that the Christina Lake Thermal Project is within the Lower Athabasca Regional Plan (LARP). The Christina Lake Thermal Project Phase H footprint is not located in either a designated provincial recreational area or conservation area as defined in the LARP (Government of Alberta 2012).

The proposed Project activities and environmental mitigation efforts are consistent with the land use planning and regional outcomes detailed in the LARP which balance economic, environment and social objectives. Cenovus is actively engaged in ensuring consistency with the LARP as it relates to CLTP development. For example:

- Cenovus's Phase H footprint is designed to be outside of any provincial recreation areas or conservation areas as defined in the LARP and discussed above.
- Land disturbance will be minimized as discussed in Volume 1A, Section 13.3.7.
- Many of the objectives laid out in the LARP are consistent with the objectives of the Conservation and Reclamation Plan (see Volume 1A, Section 14.3.1).

Reference:

Government of Alberta. 2012. *Lower Athabasca Regional Plan 2012-2022*. Edmonton, AB. 98 pp. ISBN: 978-1-4601-0537-5 (Printed Version); 978-1-4601-0538-2 (Online Version).

Conservation and Reclamation

30. ESRD Supplemental Information Request Round 1, SIR 78a, Page 185. In response to SIR 78a, Cenovus states "if excess woody debris is burned on the surface soils, the ashes and propagules will be salvaged with the topsoil."

a. Discuss Cenovus' protocols for burning woody debris on areas where topsoil has not been salvaged.

Response:

a. For the management of woody debris Cenovus will follow the guidance outlined in *Management of Wood Chips on Public* Land (ASRD 2009), which indicates that *burning of the material remains a sound management option*. As discussed in the response to ESRD Round 1 SIR 78, when burning woody debris on topsoil that is planned to be salvaged the protocol will be to salvage the ashes and propagules with the topsoil. If topsoil salvage is not required, no further management of the area is expected following burning.

Reference:

ASRD (Alberta Sustainable Resource Development). 2009. *Industry Directive Number: ID 2009-01 Management of Wood Chips on Public Land*. External Directive. Lands Division. Land Management Branch. Petroleum Land Use & Reclamation Section. July 20, 2009. Edmonton, AB. 3 pp.

31. ESRD Supplemental Information Request Round 1, SIR 81, Page 188. In response to SIR 81, Cenovus refers to the revised Figure 81-1 and states the figure "shows the Winefred and Namur dominant Soil Map Units in the LSA."

a. There are no Winefred or Namur dominant soil map units in the legend for Figure 81-1 and these units do not appear on the figure. Explain this discrepancy.

b. Neither the Winefred nor Namur soil map units appear in Table 80-1 in the response to SIR 80a. Explain this discrepancy.

c. The legend for Figure 81-1 indicates the presence of an HRR 5 soil map unit but this does not appear in Table 80-1. Explain this discrepancy.

Response:

a. The Winefred soil series is included as a significant soil within the Horse River 6 (HRR6) and Sutherland 5 (SUT5) soil map units (SMUs). The Namur soil series is included as a significant soil within the Mamawi (MMW3) soil map unit. As these soil series form part of the soil map unit assemblages but are not the listed dominant soil series in these map units, they are not presented on the soil map unit Figure 81-1 as indicated in the response to ESRD Round 1 SIR 81-1. Table 6.1-4 in the Soil and Terrain assessment should read, "Predicted Changes to Soil Series in the Local Study Area," instead of referring to soil map units.

b. Table 80-1 presents average soil salvage depths for the dominant soil series of the soil map units (SMUs), grouped by texture for those dominant soil series. As stated in the response to 31a, the Winefred and Namur soil series form part of the soil map unit assemblages but are not the listed dominant soil series in these map units, so they are not presented in Table 80-1.

c. The HRR5 map unit is considered under Table 80-1 under 'Average Fine/Medium Textured Upland Topsoil Salvage Thickness'.

Terrain and Soils

32. ESRD Supplemental Information Request Round 1, SIR 108, Page 216. As stated in SIR 108, the soil program sampling distribution is skewed towards areas of easier access, with only about 24% of polygons containing sample points. Assuming soil mappers have adequate experience in the project area, this may be sufficient for EIA purposes, however the level of detail is insufficient for the preparation of detailed C&R plans.

a. To provide the detailed baseline data necessary for the preparation of site specific C&R plans, discuss Cenovus' plans to complete a soils field program that adequately fills data gaps prior to project development.

Response:

a. Access restrictions remain a major challenge when it comes to meeting the polygon coverage on a 1:20,000 scale map in the boreal zone. The soil map for the Terrestrial Local Study Area (LSA) is sufficient for soil impact assessment and, by extension, Project-level conceptual Conservation and Reclamation (C&R) planning. The large volume of existing soil data in the Cenovus Christina Lake Thermal Project area, existing as clustered, transect and widely distributed data, provides a sufficient data set for understanding the soil landscapes throughout the Terrestrial LSA. At the Environmental Impact Assessment (EIA) stage of the Project, additional field data are not expected to improve the reliability of the map or the Project-level conceptual C&R Plan.

Cenovus follows the PDA guidelines (AENV 2014) for detailed planning of Project surface developments including site-specific, detailed C&R plans. The PDAs are completed before construction of Project facilities or infrastructure. The PDAs include revisiting, re-sampling and remapping project footprints at a larger scale (a minimum of SIL1) than the EIA, with an increased intensity of soil inspections. The PDAs are completed and implemented throughout the course of Project development, and the additional level of detail in the mapping may be tied in with the Project-level mapping as appropriate.

Reference:

AENV (Alberta Environment). 2014. *Guidelines for Submission of a Pre-Disturbance Assessment and Conservation & Reclamation Plan Under an Environmental Protection and Enhancement Act Approval for an Enhanced Recovery In Situ Oil Sands and Heavy Oil Processing Plant and Oil Production Site*. October 2014. Edmonton, AB.

Wildlife

33. ESRD Supplemental Information Request Round 1, SIR 4, Page 5. Cenovus states that "constraints-mapping related to TEK and TLU will be conducted to identify key wildlife species and traditional sites."

a. Describe how constraints mapping (or other method) was used to minimize Project impacts to sensitive habitats in the LSA (i.e., old growth forest, uncommon ecosites such as a1 and c1, wetlands, wildlife features, etc.) If constraints mapping was not used, describe what other methods were employed to avoid sensitive habitat types and wildlife features.

Response:

a. Constraints mapping was undertaken early in the design stage of the Project to delineate the development footprint. Several sensitive habitat map layers, such as caribou ranges, wetlands and old growth forest, were superimposed to identify where such sensitive habitats existed in the LSA, such that effects on them could be avoided or minimized, where possible. For additional information about how constraints mapping was used to minimize Project effects to sensitive habitats, refer to the response to AER Round 2 SIR 11.

---

34. ESRD Supplemental Information Request Round 1, SIR 56, Page 109. ESRD Supplemental Information Request Round 1, SIR 58, Page 121.

Cenovus describes the use of culverts and clear-span bridges as their primary drainage strategy. Though these mitigations may be adequate for maintaining water flow and fish passage, they are often not suitable for maintaining wildlife passage.

The Western toad is a federally listed species of concern, a population of which was detected within the terrestrial LSA. Western toads are known to travel several kilometres between breeding ponds, foraging areas, and hibernation sites. Since toads have a tendency to cross over top of roads rather than through standard culverts, roads can result in direct mortality during these dispersal periods if suitable amphibian passage is not provided and maintained.

a. Discuss the steps that Cenovus will take to maintain a viable Western toad population within the LSA. How will Western toad dispersal patterns within the LSA be identified and maintained?

Response:

a. Cenovus's approved *Wildlife Monitoring Program* (Golder 2012) for the Christina Lake Thermal Project includes an amphibian call survey component. The study area includes the Cenovus Narrows Lake, Christina Lake and future expansion areas, such as Phase H, to gain a regionalized perspective on amphibian populations and breeding locations. The purpose of this survey is to compare amphibian relative abundance and occurrence between various levels of disturbance (e.g., linear disturbance density). Amphibian call surveys are scheduled to occur every three years, with the first survey completed in the spring/summer of 2014. The results will be reported as part of Cenovus's Comprehensive Monitoring Report. These surveys will help Cenovus understand the potential effect of Project disturbance on Western toad populations. If effects to Western toad populations are identified as a result of Project disturbance, Cenovus will develop an appropriate mitigation plan, which may include measures to enhance amphibian passage across roads.

   In addition, Cenovus utilizes an application called Wild Watch that enables all on-site staff and contractors to easily report incidental wildlife observations, including the location and the condition they are found in (i.e., dead or alive). Data pooled from Wild Watch will further aid Cenovus in identifying Western toad occurrence and habitat use in relation to the Project, and help to determine areas of high use to focus mitigation and monitoring.

References:

Golder (Golder Associates Ltd.). 2012. Cenovus FCCL Ltd. Wildlife Monitoring Program Christina Lake Thermal Project. Submitted to Alberta Environment and Sustainable Resource Development, September 10, 2012. 23 pp.

---

35. ESRD Supplemental Information Request Round 1, SIR 124, Page 240. Cenovus states that clearing during Restricted Activity Periods (RAPs) "may be necessary in extenuating circumstances; but that the intent is to strive for zero new clearing during the designated RAPs once the initial construction phase is complete. However, it is believed that no more than 10% of new annual clearing activity occurring within RAPs is an achievable target." These statements seem contradictory and give the impression that Cenovus believes that 10% of annual clearing within the RAPs is an acceptable practice.

a. Identify the RAPs for vegetation clearing that Cenovus will abide by for:

i. Migratory birds;

ii. Non-migratory birds; and

iii. Woodland caribou.

b. Discuss what would be considered *extenuating circumstances* that would necessitate vegetation clearing within each RAP.

c. What plans or contingency measures does Cenovus plan to implement to ensure that extenuating circumstances do not arise and that vegetation clearing within the RAPs is avoided?

Response:

a. As per Cenovus's existing and approved *Wildlife Mitigation Plan* (Golder 2012) and *Woodland Caribou Mitigation and Monitoring Plan* (Wildlife Infometrics et al. 2013), the RAPs for vegetation clearing that Cenovus is, and will abide by, for the Project are the following:

   i. April 15 to August 30 for migratory birds. This RAP falls in the 0% to 5% nesting probability category as presented in Environment Canada's *General Nesting Periods of Migratory Birds in Canada* (Environment Canada 2014).

   ii. March 1 to August 15 for non-migratory birds. The intent of this RAP is to detect the nests of early nesting birds.

   iii. February 15 to July 15 for woodland caribou.

b. As discussed in the response to ESRD Round 1 SIR 124, Cenovus's development schedule takes into consideration the RAPs identified in the response to ESRD Round 2 SIR 35a), with the intent that zero clearing will occur during the RAP. While Cenovus plans for zero clearing during the RAP, there are extenuating circumstances that can affect schedule and the need for Cenovus to consider clearing during the RAP. These extenuating circumstances include unforeseen or unexpected weather events, equipment issues (e.g., procurement and/or malfunction), and delays in obtaining regulatory approvals. Clearing during the RAP as a result of these circumstances would only occur if the alternative jeopardizes the overall schedule (e.g., one or more Project components are affected) and timely resource recovery, or if there are negative and significant implications to overall Project cost. The mitigation measures Cenovus will implement, should clearing during the RAP be required, are discussed in response to ESRD Round 1 SIR 124.

c. Extenuating circumstances are by nature circumstances that are challenging to impossible to prevent because they are unexpected or out of Cenovus's control. However, Cenovus does and will continue to implement measures that will help to ensure these extenuating circumstances do not result in clearing during the RAP. For example, Cenovus will, where possible, schedule all clearing to begin as soon as possible once the RAPs have ended and conditions are favorable so that the amount of time available for clearing is maximized. Cenovus will also ensure appropriate time is allotted in the schedule for obtaining regulatory approvals based on current trends, that stand-by equipment is available where possible, and that equipment is procured as much in advance as possible.

References:

Environment Canada. 2014. *General Nesting Periods of Migratory Birds in Canada.* Available at: https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1. Accessed on December 10, 2014.

Golder (Golder Associates Ltd.). 2012. *Christina Lake Thermal Project 2011 Wildlife Monitoring Program*. Submitted to Cenovus FCCL Ltd. April 2012. Calgary, AB. 41 pp.

Wildlife Infometrics, Cortex and Matrix (Wildlife Infometrics Inc., Cortex Consultants Inc., and Matrix Solutions Inc.). 2013. *Cenovus FCCL Ltd. Christina Lake Thermal Project Woodland Caribou Mitigation and Monitoring Plan*. Approval 48522-01-00. February 22, 2013. 82 pp.

36. ESRD Supplemental Information Request Round 1, SIR 138e, Page 278. Cenovus was asked to provide detailed information regarding proposed 3D exploration programs. Instead, Cenovus described only existing and approved linear disturbances. As per TOR 3.7.2[A]f), proponents must describe and assess the potential impacts of the Project to wildlife and wildlife habitat considering the potential effects on wildlife from the Proponent's proposed and planned exploration, seismic and core hole activities, including monitoring/4D seismic.

a. Provide a figure(s) illustrating the proposed and planned exploration activities required for Cenovus to develop the Phase H and the Eastern Expansion project.

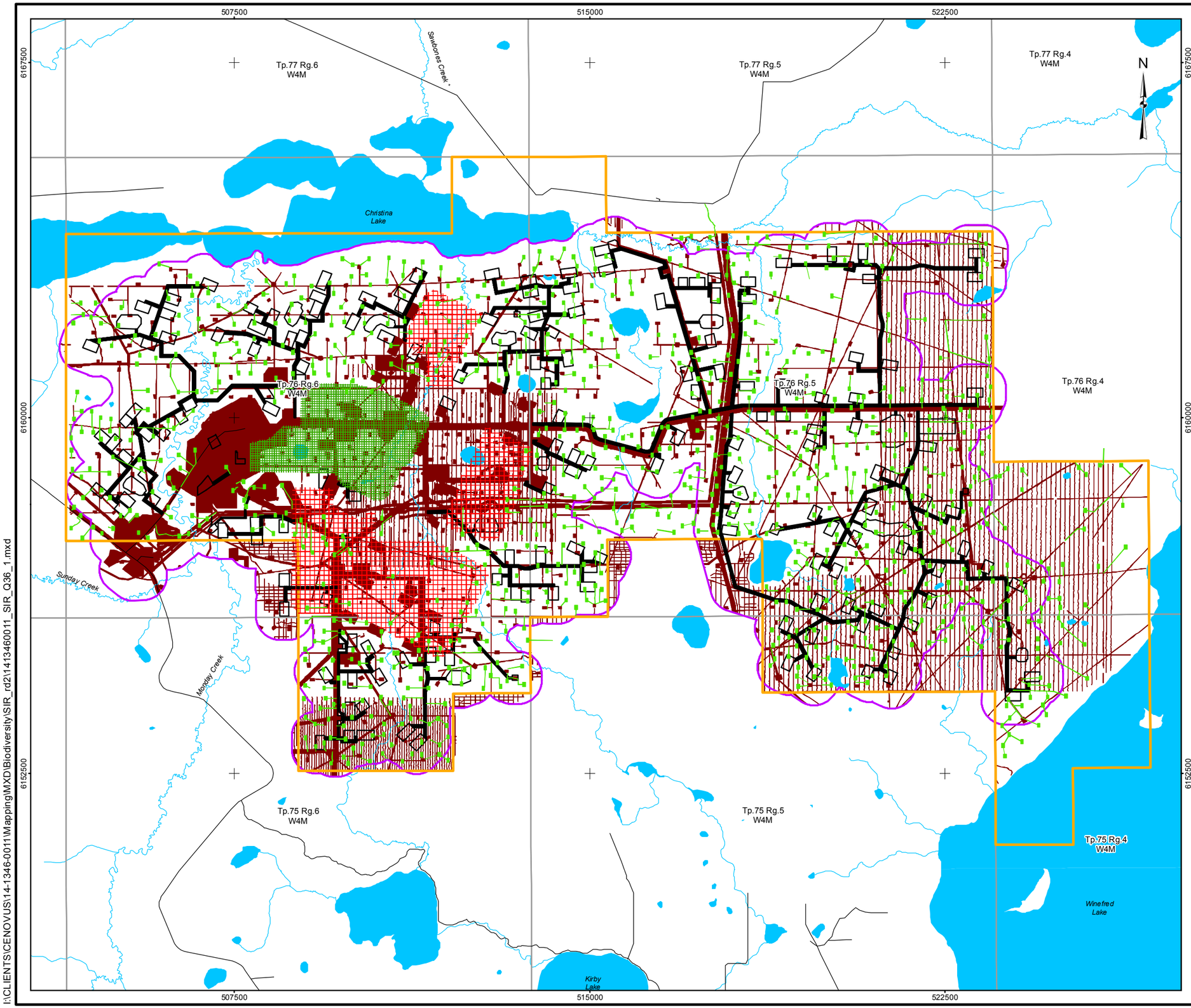
b. Provide a table showing the estimated habitat loss, by ecosite, of the proposed and planned exploration activities, including all likely-to-occur seismic activities, core hole activities, and exploratory and monitoring wells. For exploration activities that are likely to occur but that have not yet been spatially articulated, use quantitative predictions of the footprint based on known exploration footprints from other in-situ projects in the region. How much additional old growth habitat will be lost as a result of these exploration activities?

c. Revise the Application and Planned Development Case assessments to include the estimated habitat loss resulting from the proposed and planned exploration activities. Describe and assess the potential impacts of this additional habitat loss on wildlife.

Response:

a. See Figure 36-1 for an illustration of the proposed and planned exploration activities required for Cenovus to develop the Phase H and the Eastern Expansion Project.

b. The estimated habitat loss by ecosite due to proposed and planned exploration activities is presented in Table 36-1 and losses to old growth forest are presented in Table 36-2. The "% of Type" shown in the last column of Tables 36-1 and 36-2 indicate percent habitat loss in the LSA. A buffer for exploration activities located outside of the LSA was not applied; therefore, the percentages presented are considered conservative as they are greater than they would have been if a buffered LSA was used. Exploration activities add 23 ha of disturbance to old growth, and increase overall disturbance to old growth by 5% (Table 36-2).



LEGEND

- ROAD
- WATERCOURSE
- LEASE AREA
- TERRESTRIAL RESOURCES LOCAL STUDY AREA
- WATERBODY
- CENOVUS PHASE H FOOTPRINT
- PROPOSED OSE WELLS
- PROPOSED 4D SEISMIC
- PROPOSED 3D SEISMIC

DISTURBED

- EXISTING AND APPROVED URBAN AND INDUSTRIAL DISTURBANCE
- EXISTING AND APPROVED URBAN AND INDUSTRIAL LINEAR DISTURBANCE

NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC. IMAGERY OBTAINED FROM CLIENT NOVEMBER 4, 2011.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

3 0 3
SCALE 1:80,000 KILOMETRES

PROJECT
cenovus ENERGY
CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

TITLE

PROPOSED AND PLANNED EXPLORATION ACTIVITIES

Golder Associates

PROJECT		10-1346-0044	FILE No.	
DESIGN	JG	05 Dec. 2014	SCALE AS SHOWN	REV. 0
GIS	AJW	05 Dec. 2014	FIGURE: 36-1	
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\Biodiversity\SIR_rd21141346011_SIR_Q36_1.mxd

Table 36-1 Habitat Loss/Alteration by Ecosite Due to the Phase H and the Eastern Expansion Project Including Exploration Activities

Land Cover Type	Description	Baseline Case		Loss/Alteration due to the Project as per the EIA		Loss/Alteration due to Exploration Activities		Loss/Alteration due to the Project including Exploration	
		[ha]	% of LSA	[ha]	% of Type	[ha]	% of Type	[ha]	% of Type
Terrestrial Vegetation									
a1	lichen jack pine	58	<1	4	7	3	5	7	12
b1	blueberry jack pine-aspen	342	2	35	10	19	6	54	16
b2	blueberry aspen (white birch)	26	<1	3	13	<1	2	4	14
b3	blueberry aspen-white spruce	53	<1	2	4	5	10	7	14
b4	blueberry white spruce-jack pine	10	<1	<1	9	<1	6	1	15
c1	Labrador tea-mesic jack pine-black spruce	1,509	9	199	13	63	4	262	17
d1	low-bush cranberry aspen	991	6	141	14	39	4	179	18
d2	low-bush cranberry aspen-white spruce	368	2	31	8	14	4	45	12
d3	low-bush cranberry white spruce	63	<1	3	5	3	5	6	10
e1	dogwood balsam poplar-aspen	43	<1	4	10	1	3	6	13
e2	dogwood balsam poplar-white spruce	24	<1	1	5	<1	2	2	7
e3	dogwood white spruce	5	<1	-	-	-	-	-	-
f3	horsetail white spruce	5	<1	2	30	-	-	2	30
g1	Labrador tea-subhygric black spruce-jack pine	1,318	8	175	13	55	4	230	17
h1	Labrador tea/horsetail white spruce-black spruce	137	<1	13	10	4	3	18	13
BUu	burn uplands	68	<1	13	19	2	3	15	22
Sh (upland)	regenerating shrubland upland	110	<1	15	14	5	5	20	18
	terrestrial subtotal	*5,129*	*31*	*642*	*13*	*215*	*4*	*857*	*17*

Table 36-1 Habitat Loss/Alteration by Ecosite Due to the Phase H and the Eastern Expansion Project Including Exploration Activities

Land Cover Type	Description	Baseline Case		Loss/Alteration due to the Project as per the EIA		Loss/Alteration due to Exploration Activities		Loss/Alteration due to the Project including Exploration	
		[ha]	% of LSA	[ha]	% of Type	[ha]	% of Type	[ha]	% of Type
Wetlands									
BFNN	forested bog	14	<1	<1	6	<1	<1	<1	6
BTNN	wooded bog	1,341	8	204	15	57	4	261	19
FFNN	forested fen	4	<1	-	-	-	-	-	-
FONG	graminoid fen	352	2	6	2	11	3	17	5
FONS	shrubby fen	1,145	7	118	10	38	3	157	14
FOPN	open patterned fen	28	<1	1	4	3	11	4	15
FTNI	wooded fen with internal lawns	532	3	88	16	21	4	109	20
FTNN	wooded fen	4,272	26	584	14	178	4	762	18
FTPN	wooded patterned fen	161	<1	6	3	8	5	14	8
MONG	marsh	28	<1	<1	2	<1	2	1	4
SONS	shrubby swamp	194	1	1	<1	6	3	8	4
STNN	wooded swamp	11	<1	2	15	<1	6	2	21
WONN	shallow open water	25	<1	<1	2	<1	<1	<1	2
BUw	burn wetlands	350	2	41	12	17	5	58	17
Sh (wetland)	regenerating shrubland wetland	227	1	27	12	14	6	41	18
	wetlands subtotal	*8,682*	*53*	*1,080*	*12*	*354*	*4*	*1,434*	*17*
Miscellaneous Land Cover Types									
lake	lake	200	1	-	-	-	-	-	-
Me	meadow	7	<1	<1	13	<1	9	2	22
	miscellaneous subtotal	*207*	*1*	*<1*	*<1*	*<1*	*<1*	*2*	*<1*
Disturbances									
DIS	disturbance (urban and industrial)	2,334	14	155	7	111	5	265	11
	disturbances subtotal	*2,334*	*14*	*155*	*7*	*111*	*5*	*265*	*11*
Total		**16,352**	**100**	**1,878**	**11**	**681**	**4**	**2,558**	**16**

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Table 36-2 Old Growth Loss/Alteration Due to the Phase H and the Eastern Expansion Project Including Exploration Activities

Baseline Case		Loss/Alteration due to the Project as per the EIA		Loss/Alteration due to Exploration Activities		Total Loss/Alteration due to the Project Including all Exploration Activities	
[ha]	% of LSA	[ha]	%	[ha]	%	[ha]	%
436	3	24	5	23	5	47	11

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

c. The net magnitude and environmental consequence of habitat loss during operations was considered negligible for woodland caribou, moderate for fisher, moose, and horned grebe and high for all other KIRs at the LSA scale (EIA, Volume 5, Section 6.3, Table 6.3-4). For those wildlife KIRs that were already considered to have a high environmental consequence of habitat loss, additional disturbance from exploration activities in the Application Case does not change the high rating.

Woodland caribou have no high quality habitat identified in the Baseline Case (EIA, Volume 5, Section 6.3, Table 6.3-3). Therefore, additional disturbance from exploration activities in the Application Case will not change the negligible environmental consequence rating of habitat loss for woodland caribou.

The horned grebe model considers areas of lakes within 25 m of the shoreline to be high suitability habitat, as well as shallow open water (WONN) and graminoid marsh (MONG) at the LSA scale (EIA, Volume 5, Appendix 5-V, Section 1.2.5). Exploration activities will increase overall disturbance to these land cover types by 1% (Table 36-1). Given that exploration activities occur in winter during frozen ground conditions, exploration disturbance of these land cover types is unlikely to affect their suitability for nesting by grebes in the summer. Therefore, this additional disturbance from exploration activities in the Application Case will not change the moderate environmental consequence rating of habitat loss for horned grebe.

Moose and fisher were also considered to have a moderate environmental consequence of habitat loss during operations in the Application Case. Compared to the EIA, an additional 570 ha of natural areas (i.e., all land cover types in Table 36-1 except urban and industrial disturbance) will be disturbed in the Application Case due to exploration activities in the LSA. Approximately half of these proposed and planned exploration activities will occur in habitat that is predicted to be high or moderately high suitability for moose or fisher in the Baseline Case, and may result in a high magnitude effect on habitat in the LSA for these two species during operations. However, magnitude and environmental consequence at the RSA scale, which is the ecologically relevant population scale, will remain negligible in the Application Case. The effects of proposed and planned seismic programs will not affect predicted environmental consequences at the LSA or RSA scale after reclamation.

For the Planned Development Case (PDC), if all 570 ha of additional natural areas disturbed due to Project exploration activities affected the high or moderate-high habitat suitability class for all wildlife KIRs, the environmental consequence of habitat loss could potentially increase for horned grebe (i.e., from low to moderate) and yellow rail (i.e., from moderate to high). However, the RSA is comprised of only 6% high suitability habitat for horned grebe and yellow rail (EIA, Volume 5, Section 7.3, Table 7.3-2), and less than 1% of the proposed and planned exploration activities occur in habitat predicted to be high suitability for horned grebe or yellow rail. Therefore, exploration activities are not predicted to increase environmental consequences for these two KIRs in the PDC. Habitat loss predicted in the PDC is considered conservative because it is assumed that disturbances from construction of planned projects occur simultaneously and no reclamation will occur before Project completion.

ERRATA

37. ESRD Supplemental Information Request Round 1, SIR 65, Table 65-2, Page 145.

ESRD Supplemental Information Request Round 1, SIR 69, Figures 69-1 to 69-13, Pages 161-174.

ESRD Supplemental Information Request Round 1, SIR 186, Figure 186-1, Page 414.

Monday Creek is a tributary of Sunday Creek and the confluence is just south of the Cenovus Christina Lake lease.

In Table 65-2, the column Unnamed (Monday) Creek appears to be mislabelled. All Figures in the SIR response 69 are mislabelled. In Figure 186-1, the sub-watershed is mislabelled.

a. Correct the mislabelled tables and figures.

b. Assign identifiers to the unnamed tributaries.

Response:

a. Table 65-2 from ESRD Round 1 SIR 65 has been reviewed and the relative distances have been updated, as provided in Table 37-1.

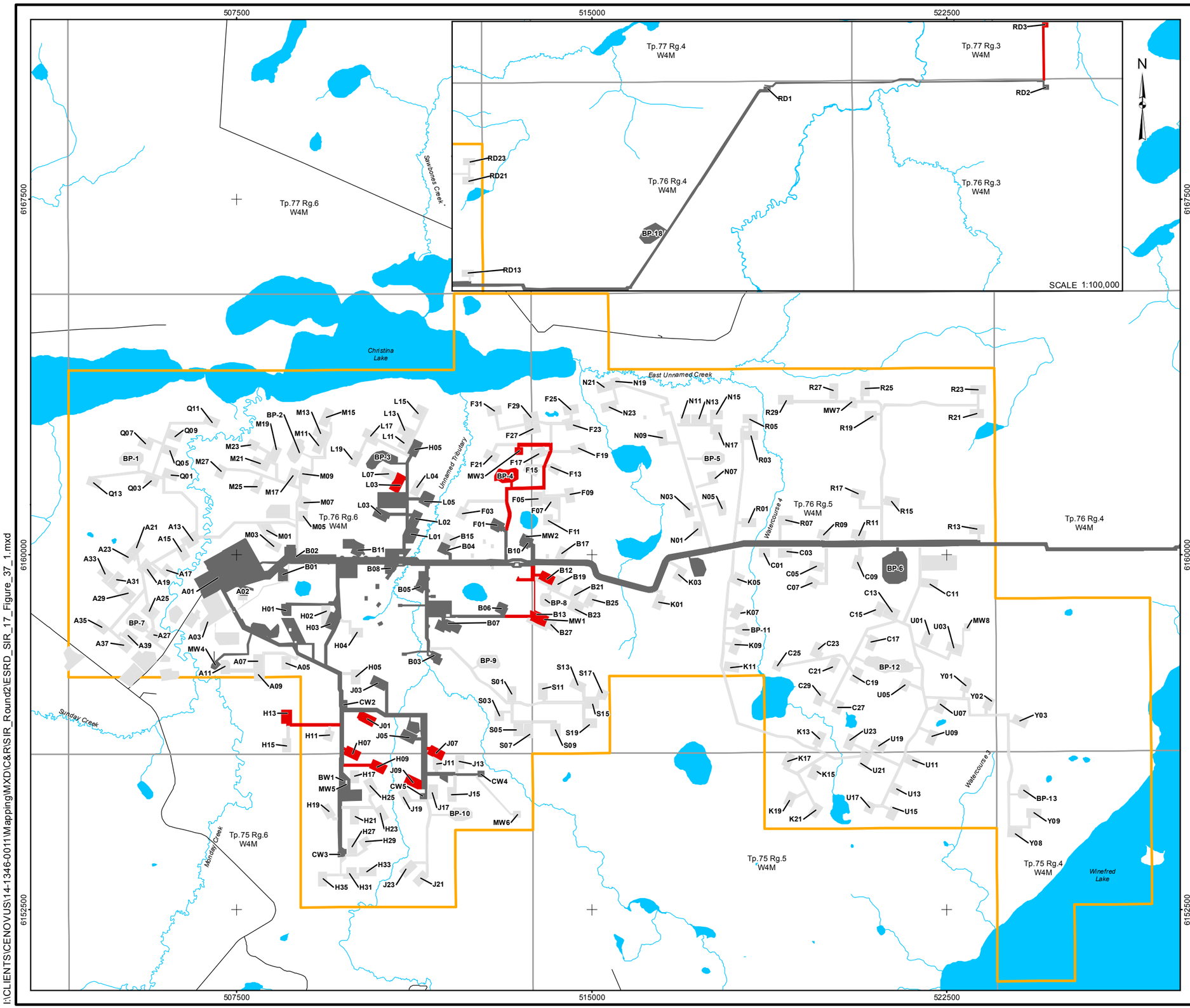
Table 37-1 Camps and Distances from Fish-Bearing Watercourses

Camp Name	Capacity (persons)	Distance from Fish-Bearing Watercourse [km]					
		Sunday Creek	Unnamed (Monday) Creek	Christina Lake	Winefred Lake	Kirby Lake	Jackfish River
Martin's Point	400	0.2	1.1	4.5	17.5	12.5	11.4
Birch Creek	400	0.6	1.9	3.7	17.2	12.8	11.4
Elk's Point	800	1.0	1.4	5.6	18.2	12.5	11.1
Sunday Creek	1,200	1.7	0.7	6.4	14.9	9.7	14.0

Figures 69-1 to 69-13 from ESRD Round 1 SIR 69 have been revised and are presented as Figures 37-1 to 37-13.

Figure 186-1 from ESRD Round 1 SIR 186 has been revised and is presented as Figure 37-14.

b. See response 37a).



LEGEND

- ROAD
- WATERCOURSE
- LEASE AREA
- WATERBODY

YEAR 2015 FOOTPRINT DEVELOPMENT

- CREATED
- EXISTING
- PLANNED

NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

3 0 3
SCALE 1:80,000 KILOMETRES

PROJECT
cenovus ENERGY
CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

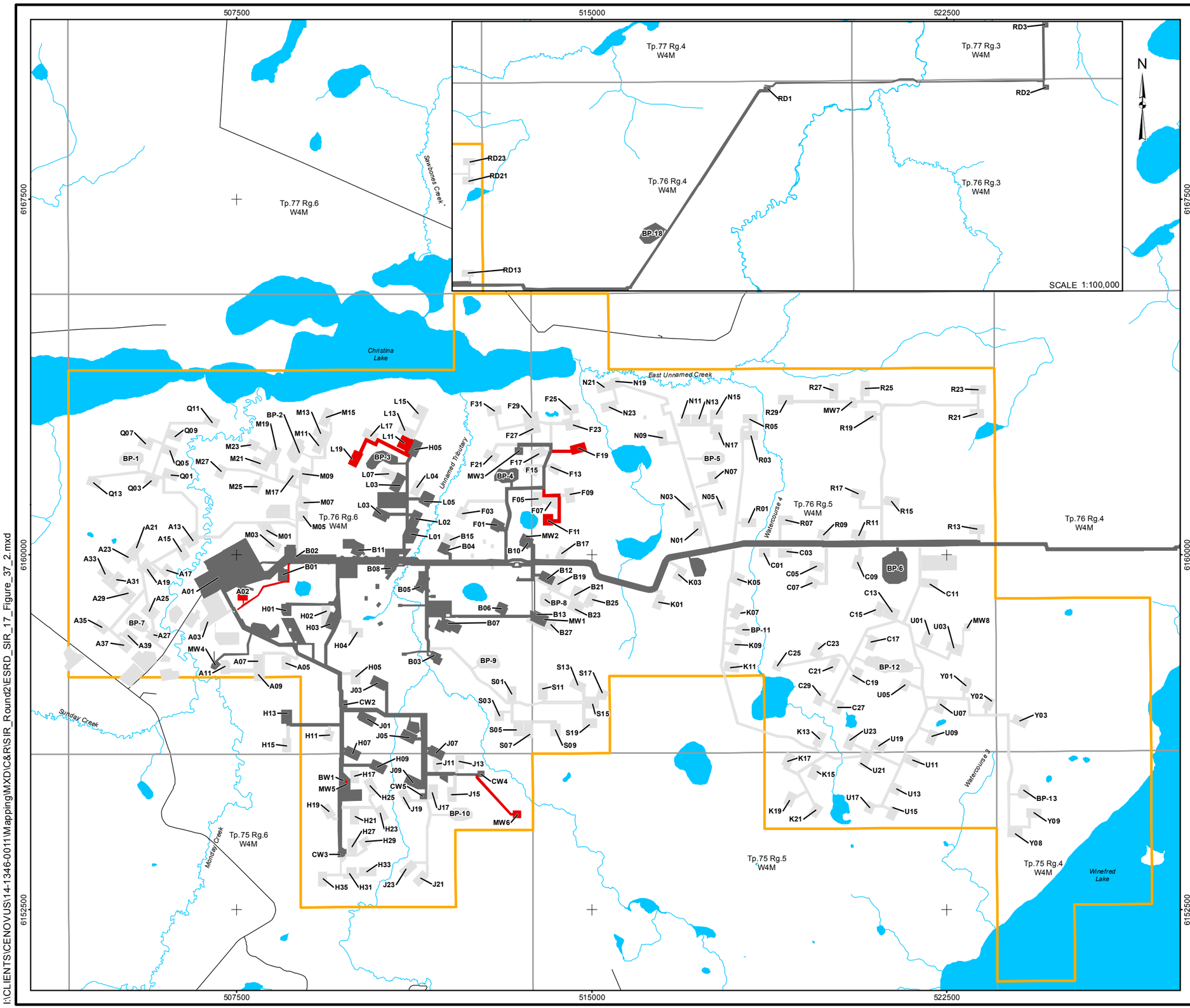
TITLE
CHRISTINA LAKE THERMAL PROJECT FOOTPRINT DEVELOPMENT FOR THE YEAR 2015

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	FD	10 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	GU	25 Nov. 2014		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 37-1

I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\C&RS\IR_Round2\ESRD_SIR_17_Figure_37_1.mxd



LEGEND

- ROAD
- WATERCOURSE
- LEASE AREA
- WATERBODY

YEAR 2016 FOOTPRINT DEVELOPMENT

- CREATED
- EXISTING
- PLANNED

NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

3 0 3
SCALE 1:80,000 KILOMETRES

PROJECT
cenovus ENERGY
CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

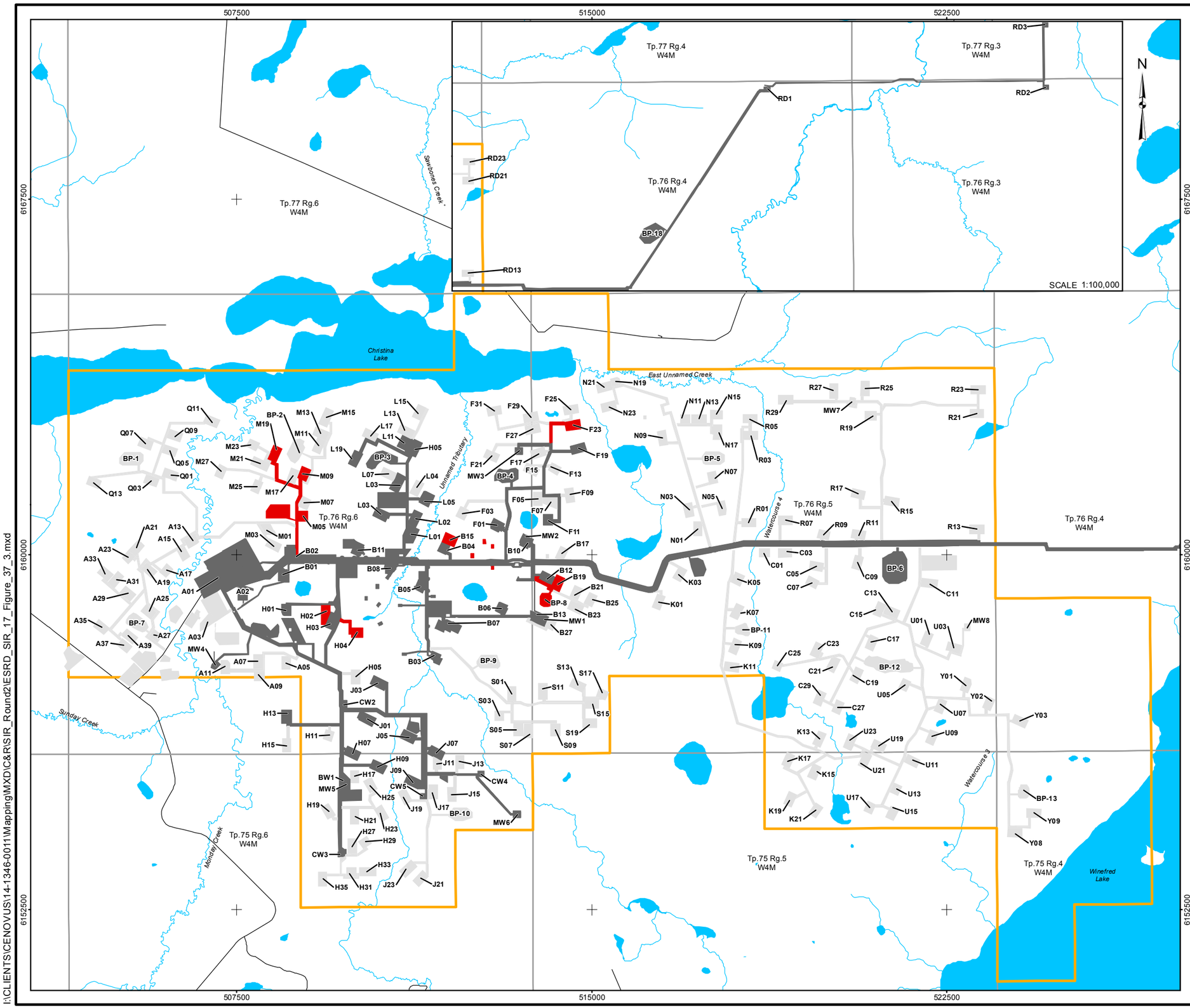
TITLE
CHRISTINA LAKE THERMAL PROJECT FOOTPRINT DEVELOPMENT FOR THE YEAR 2016

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	FD	10 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	GU	25 Nov. 2014		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 37-2

I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\C&RS\IR_Round2\ESRD_SIR_17_Figure_37_2.mxd



LEGEND

- ROAD
- WATERCOURSE
- LEASE AREA
- WATERBODY

YEAR 2017 FOOTPRINT DEVELOPMENT

- CREATED
- EXISTING
- PLANNED

NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

3 0 3
SCALE 1:80,000 KILOMETRES

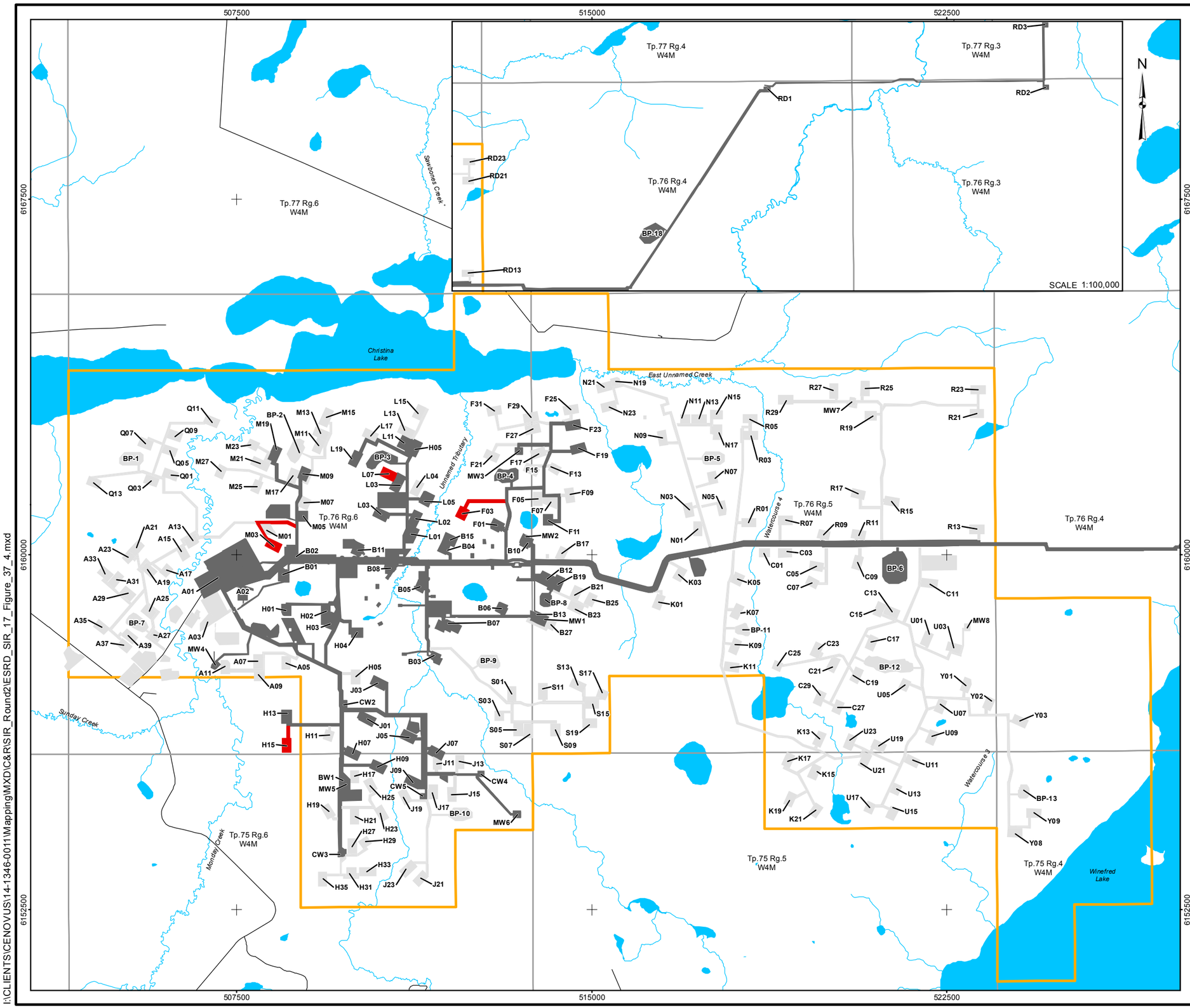
PROJECT
cenovus ENERGY
CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

TITLE
CHRISTINA LAKE THERMAL PROJECT FOOTPRINT DEVELOPMENT FOR THE YEAR 2017

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	FD	10 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	GU	25 Nov. 2014		
CHECK	RL	15 Jan. 2015	FIGURE: 37-3	
REVIEW	SNS	15 Jan. 2015		

I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\C&RSIR_Round2\ESRD_SIR_17_Figure_37_3.mxd



LEGEND

- ROAD
- WATERCOURSE
- LEASE AREA
- WATERBODY

YEAR 2018 FOOTPRINT DEVELOPMENT

- CREATED
- EXISTING
- PLANNED

NOTES

1. UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

3 0 3
SCALE 1:80,000 KILOMETRES

PROJECT
cenovus ENERGY
CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

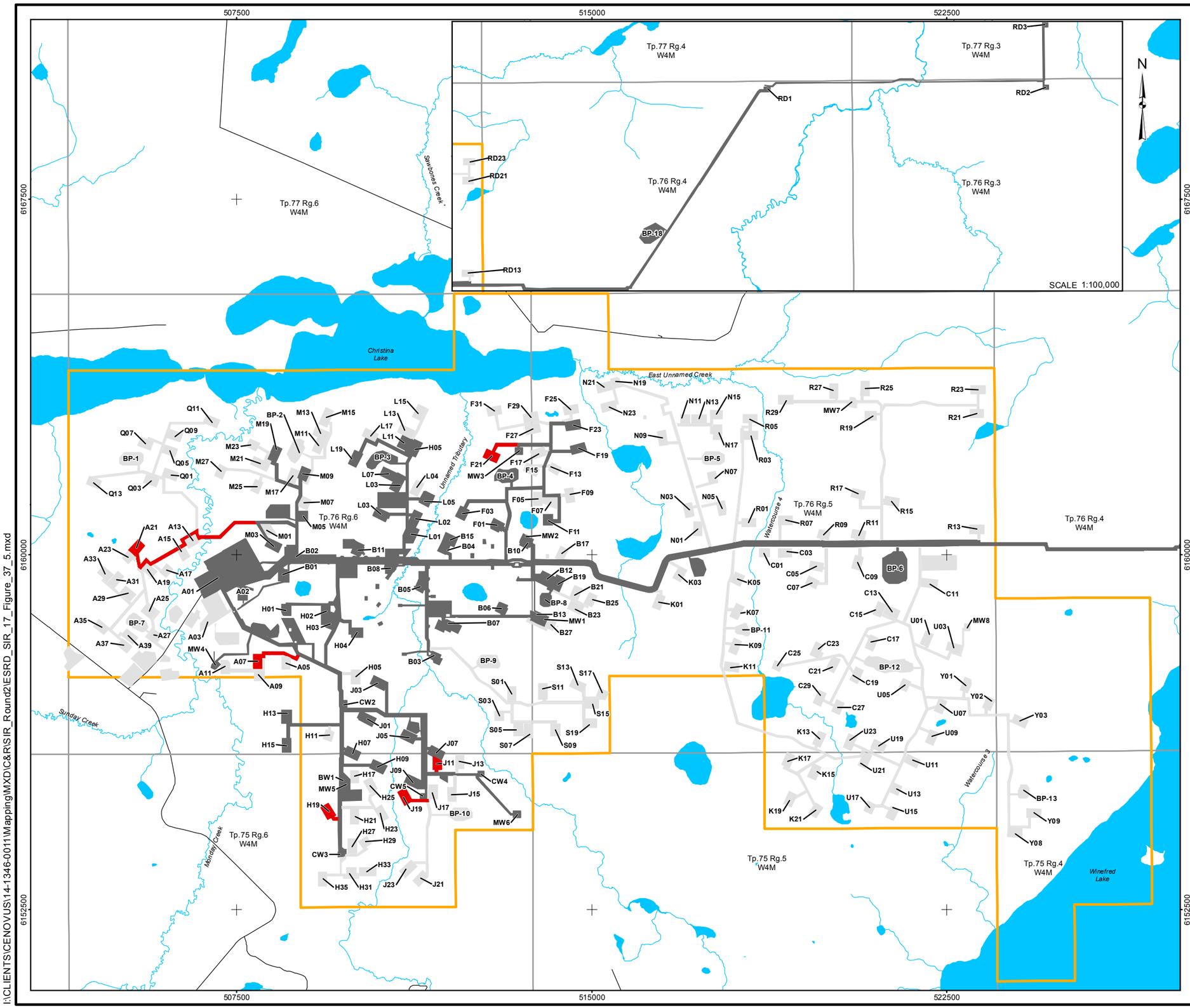
TITLE
CHRISTINA LAKE THERMAL PROJECT FOOTPRINT DEVELOPMENT FOR THE YEAR 2018

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	FD	10 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	GU	25 Nov. 2014		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 37-4

I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\C&RS\IR_Round2\ESRD_SIR_17_Figure_37_4.mxd



LEGEND

- ROAD
- WATERCOURSE
- LEASE AREA
- WATERBODY

YEAR 2019 FOOTPRINT DEVELOPMENT

- CREATED
- EXISTING
- PLANNED

NOTES

1. UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

3 0 3
SCALE 1:80,000 KILOMETRES

PROJECT
cenovus ENERGY
CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

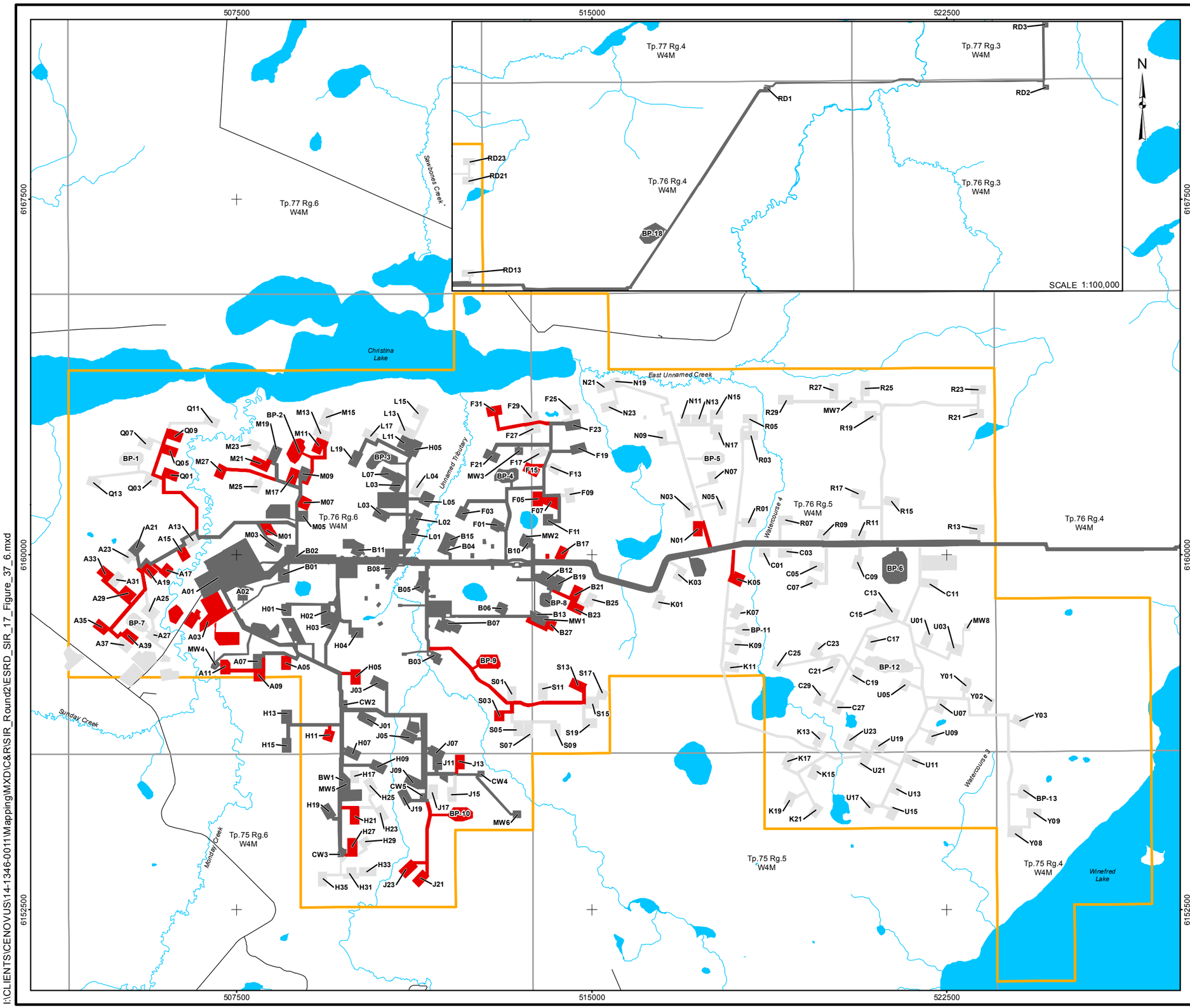
TITLE
CHRISTINA LAKE THERMAL PROJECT FOOTPRINT DEVELOPMENT FOR THE YEAR 2019

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	FD	10 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	GU	25 Nov. 2014		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 37-5

I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\C&RS\IR_Round2\ESRD_SIR_17_Figure_37_5.mxd



LEGEND

- ROAD
- WATERCOURSE
- LEASE AREA
- WATERBODY

YEAR 2020-2024 FOOTPRINT DEVELOPMENT

- CREATED
- EXISTING
- PLANNED

NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

3 0 3
SCALE 1:80,000 KILOMETRES

PROJECT
cenovus ENERGY
CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

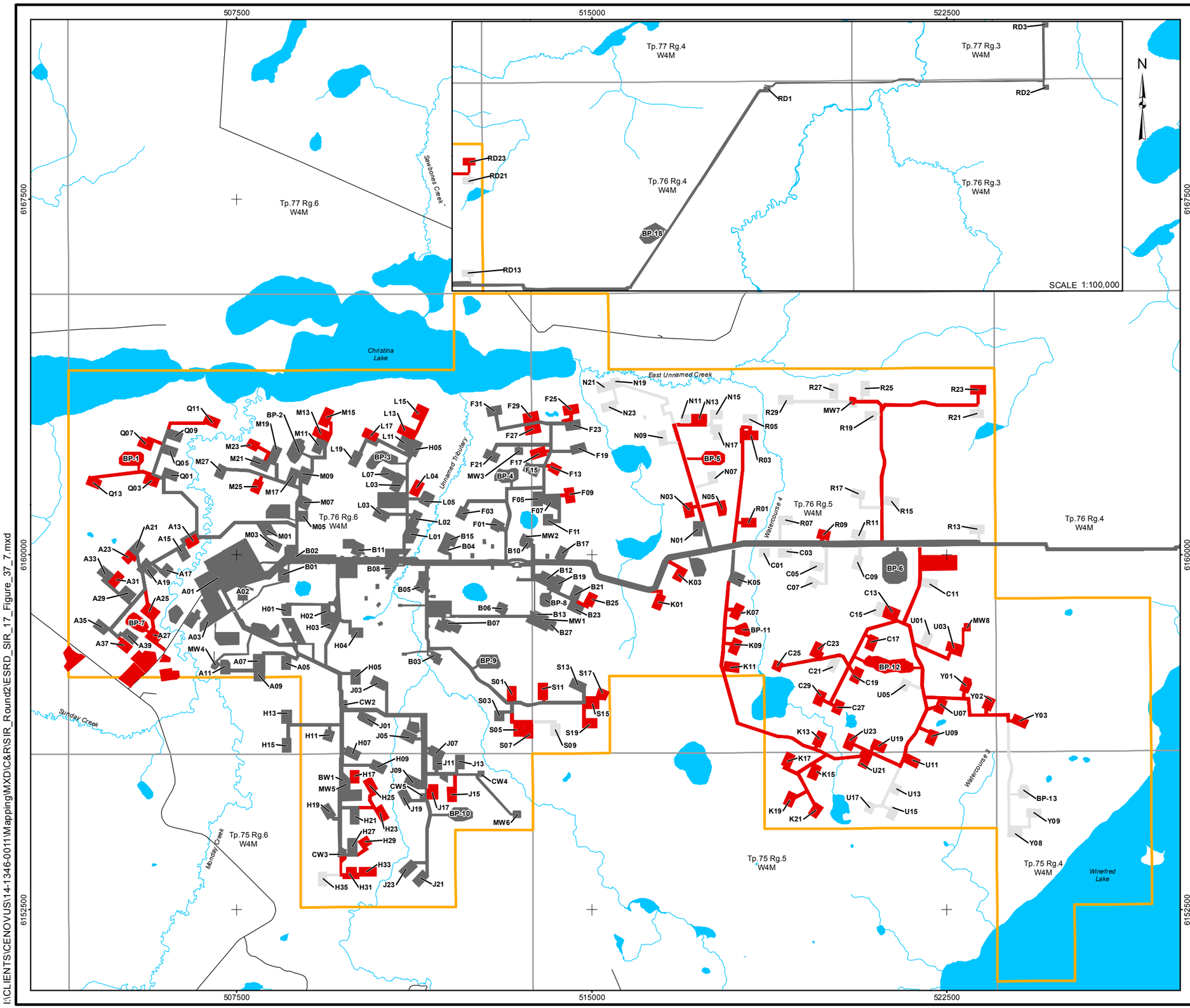
TITLE
CHRISTINA LAKE THERMAL PROJECT FOOTPRINT DEVELOPMENT FOR THE YEAR 2020 - 2024

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	FD	10 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	GU	25 Nov. 2014		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 37-6

I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\C&RS\IR_Round2\ESRD_SIR_17_Figure_37_6.mxd



LEGEND

- ROAD
- WATERCOURSE
- LEASE AREA
- WATERBODY

YEAR 2025-2029 FOOTPRINT DEVELOPMENT

- CREATED
- EXISTING
- PLANNED

NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

3 0 3
SCALE 1:80,000 KILOMETRES

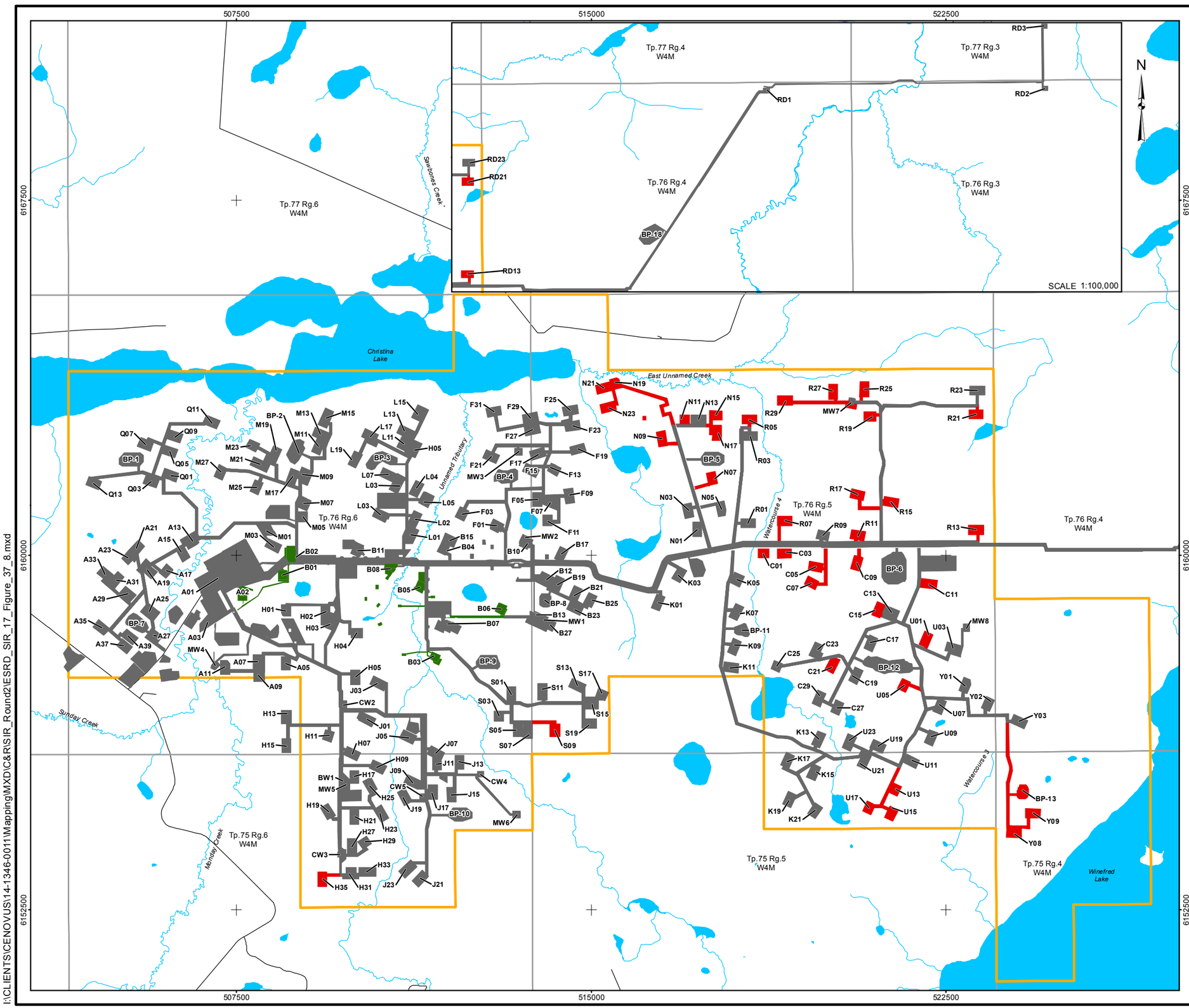
PROJECT
cenovus ENERGY
CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

TITLE
CHRISTINA LAKE THERMAL PROJECT FOOTPRINT DEVELOPMENT FOR THE YEAR 2025 - 2029

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	FD	10 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	GU	25 Nov. 2014		
CHECK	RL	15 Jan. 2015	FIGURE: 37-7	
REVIEW	SNS	15 Jan. 2015		

I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\C&RSIR_Round2\ESRD_SIR_17_Figure_37_7.mxd



LEGEND

- ROAD
- WATERCOURSE
- LEASE AREA
- WATERBODY

YEAR 2030-2034 FOOTPRINT DEVELOPMENT

- CREATED
- EXISTING
- RECLAIMED

NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

3 0 3
SCALE 1:80,000 KILOMETRES

PROJECT
cenovus ENERGY
CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

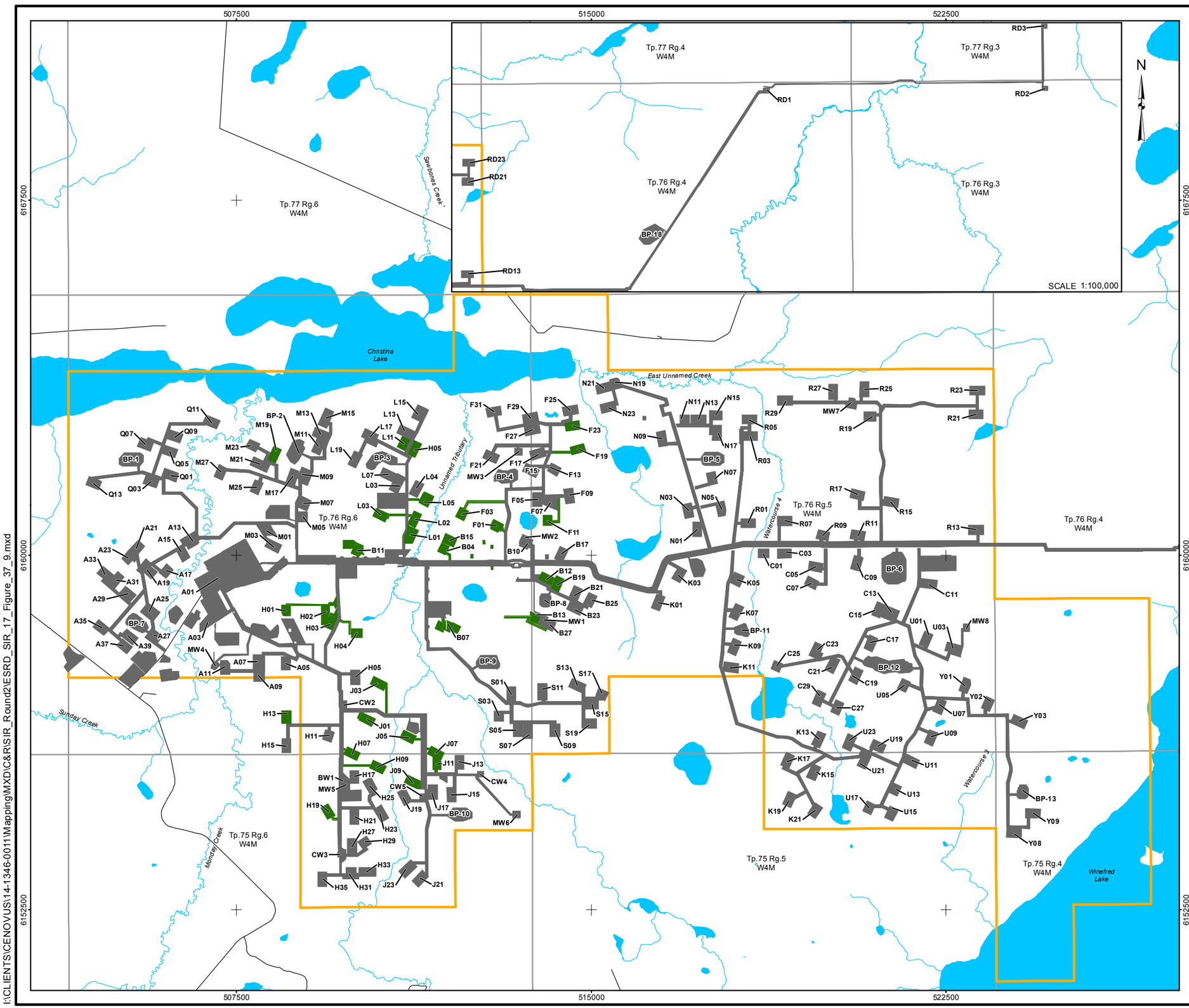
TITLE
CHRISTINA LAKE THERMAL PROJECT FOOTPRINT DEVELOPMENT FOR THE YEAR 2030 - 2034

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	FD	10 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	GU	25 Nov. 2014		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 37-8

I:\CLIENTS\CENOVUS\14-1346-0011\MappingMXD\C&R\SIR_Round2\ESRD_SIR_17_Figure_37_8.mxd



LEGEND

- ROAD
- WATERCOURSE
- LEASE AREA
- WATERBODY

YEAR 2035-2039 FOOTPRINT DEVELOPMENT

- EXISTING
- RECLAIMED

NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

3 0 3
SCALE 1:80,000 KILOMETRES

PROJECT
cenovus ENERGY
CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

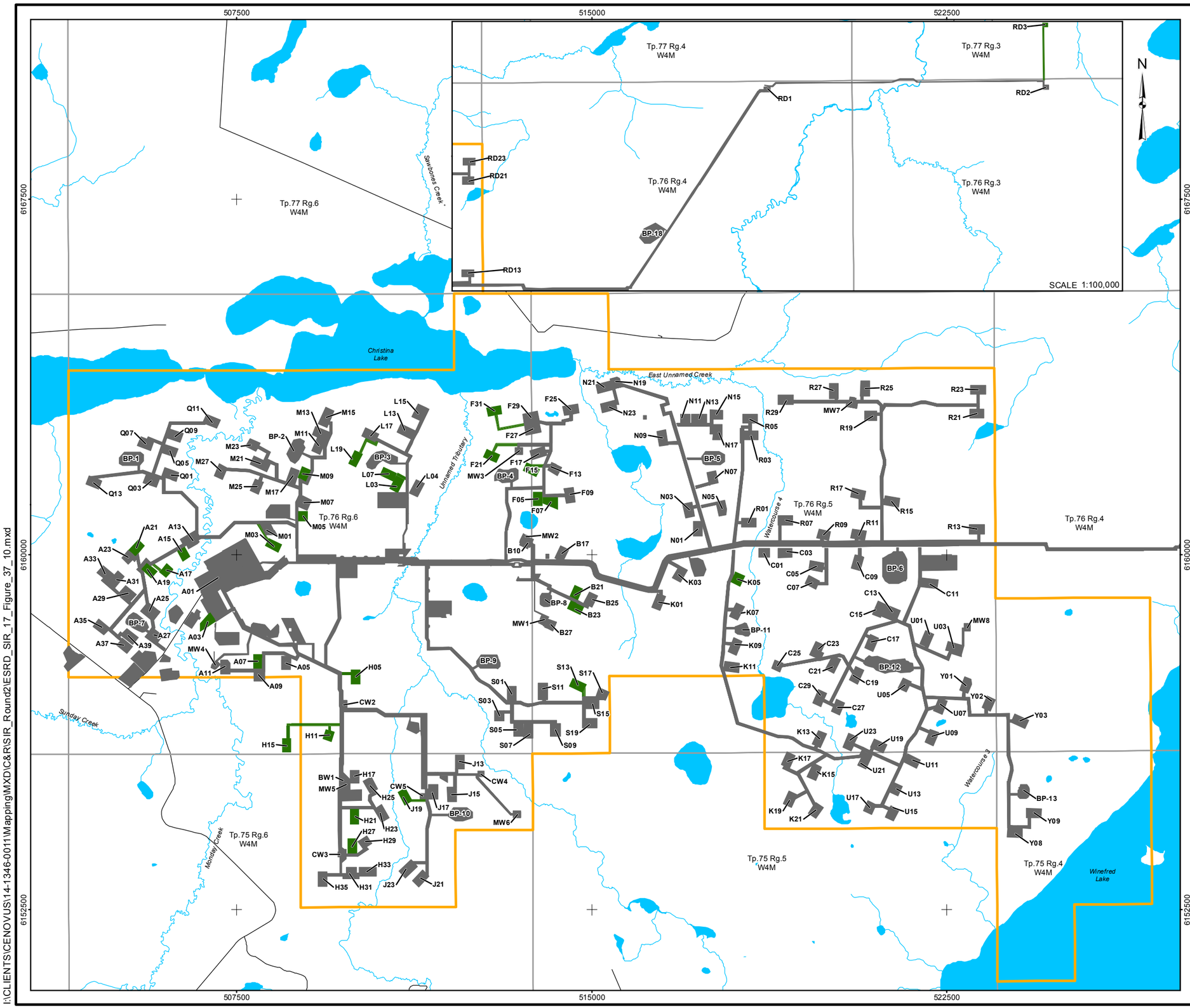
TITLE
CHRISTINA LAKE THERMAL PROJECT FOOTPRINT DEVELOPMENT FOR THE YEAR 2035 - 2039

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	FD	10 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	GU	25 Nov. 2014		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 37-9

I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\C&R\SIR_Round2\ESRD_SIR_17_Figure_37_9.mxd



I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\C&RS\IR_Round2\ESRD_SIR_17_Figure_37_10.mxd

PROJECT

cenovus ENERGY

CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

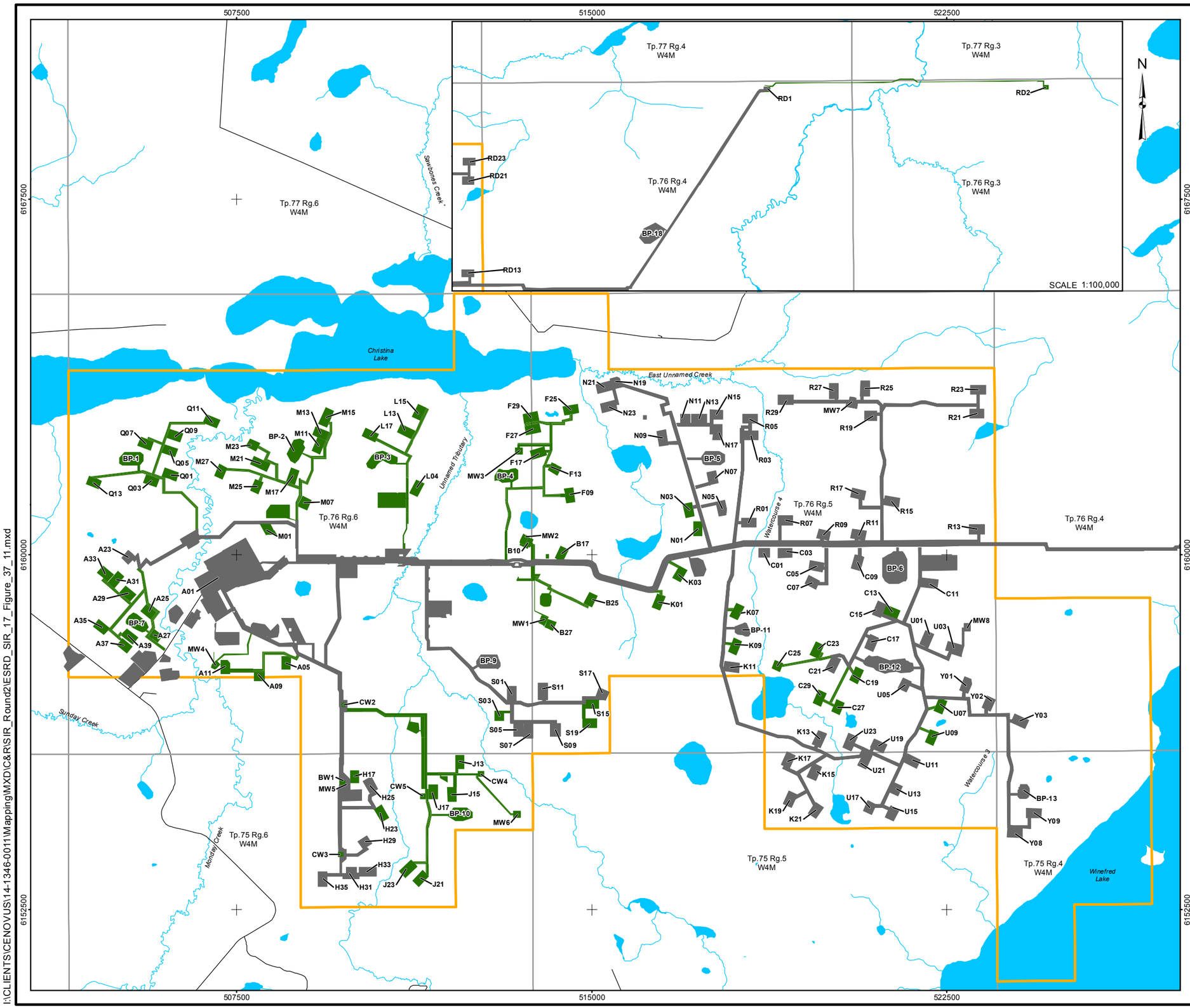
TITLE

CHRISTINA LAKE THERMAL PROJECT FOOTPRINT DEVELOPMENT FOR THE YEAR 2040 - 2044

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	FD	10 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	GU	25 Nov. 2014		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 37-10



LEGEND

- ROAD
- WATERCOURSE
- LEASE AREA
- WATERBODY

YEAR 2045-2049 FOOTPRINT DEVELOPMENT

- EXISTING
- RECLAIMED

NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

3 0 3

SCALE 1:80,000 KILOMETRES

PROJECT

cenovus ENERGY

CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

TITLE

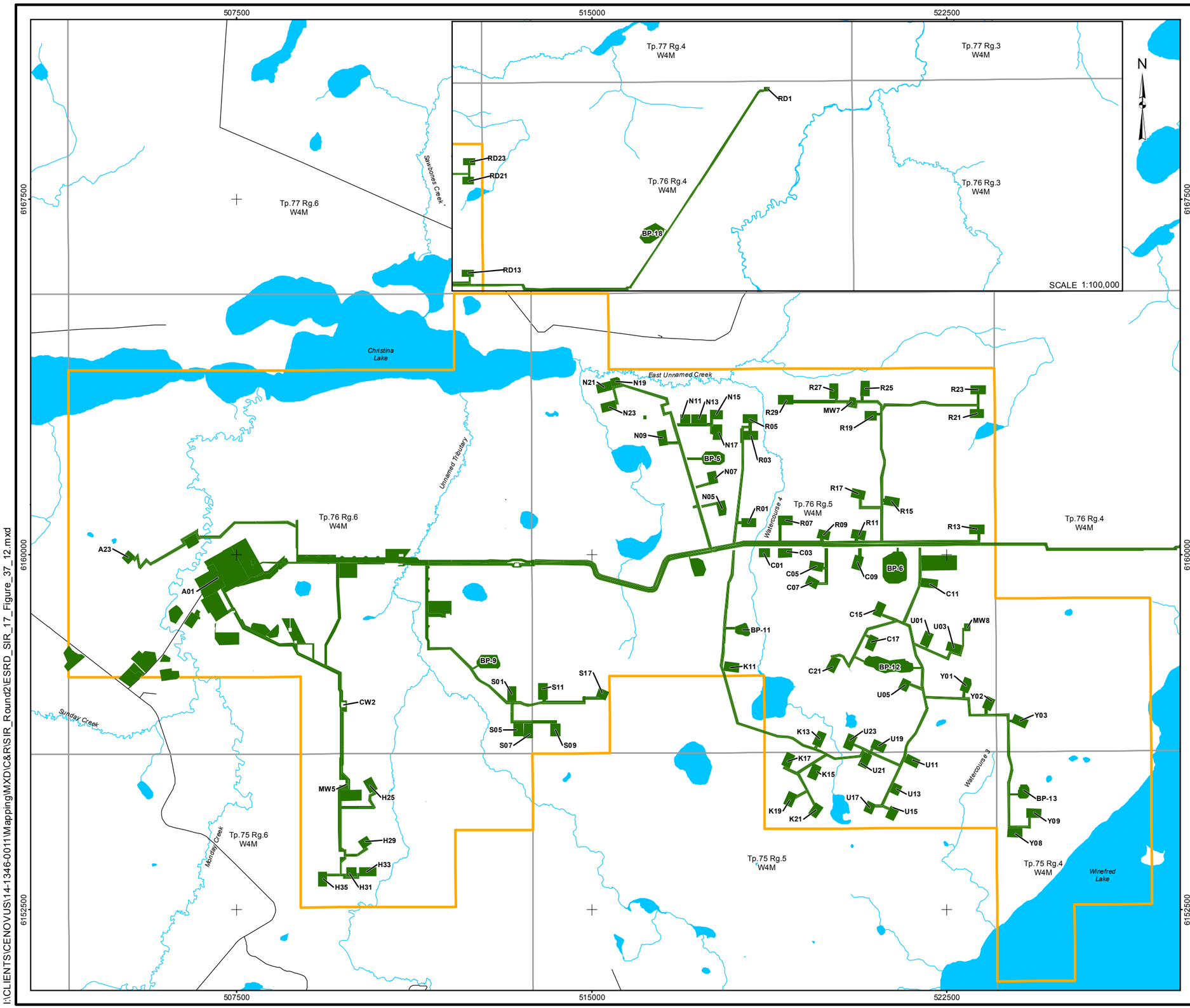
CHRISTINA LAKE THERMAL PROJECT FOOTPRINT DEVELOPMENT FOR THE YEAR 2045 - 2049

Golder Associates

PROJECT		14-1346-0011	FILE No.		
DESIGN	FD	10 Feb. 2014	SCALE AS SHOWN	REV.	0
GIS	GU	25 Nov. 2014			
CHECK	RL	15 Jan. 2015			
REVIEW	SNS	15 Jan. 2015			

FIGURE: 37-11

I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\C&RS\IR_Round2\ESRD_SIR_17_Figure_37_11.mxd



LEGEND

- ROAD
- WATERCOURSE
- LEASE AREA
- WATERBODY

YEAR 2050-2056 FOOTPRINT DEVELOPMENT

- RECLAIMED

NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

3 0 3
SCALE 1:80,000 KILOMETRES

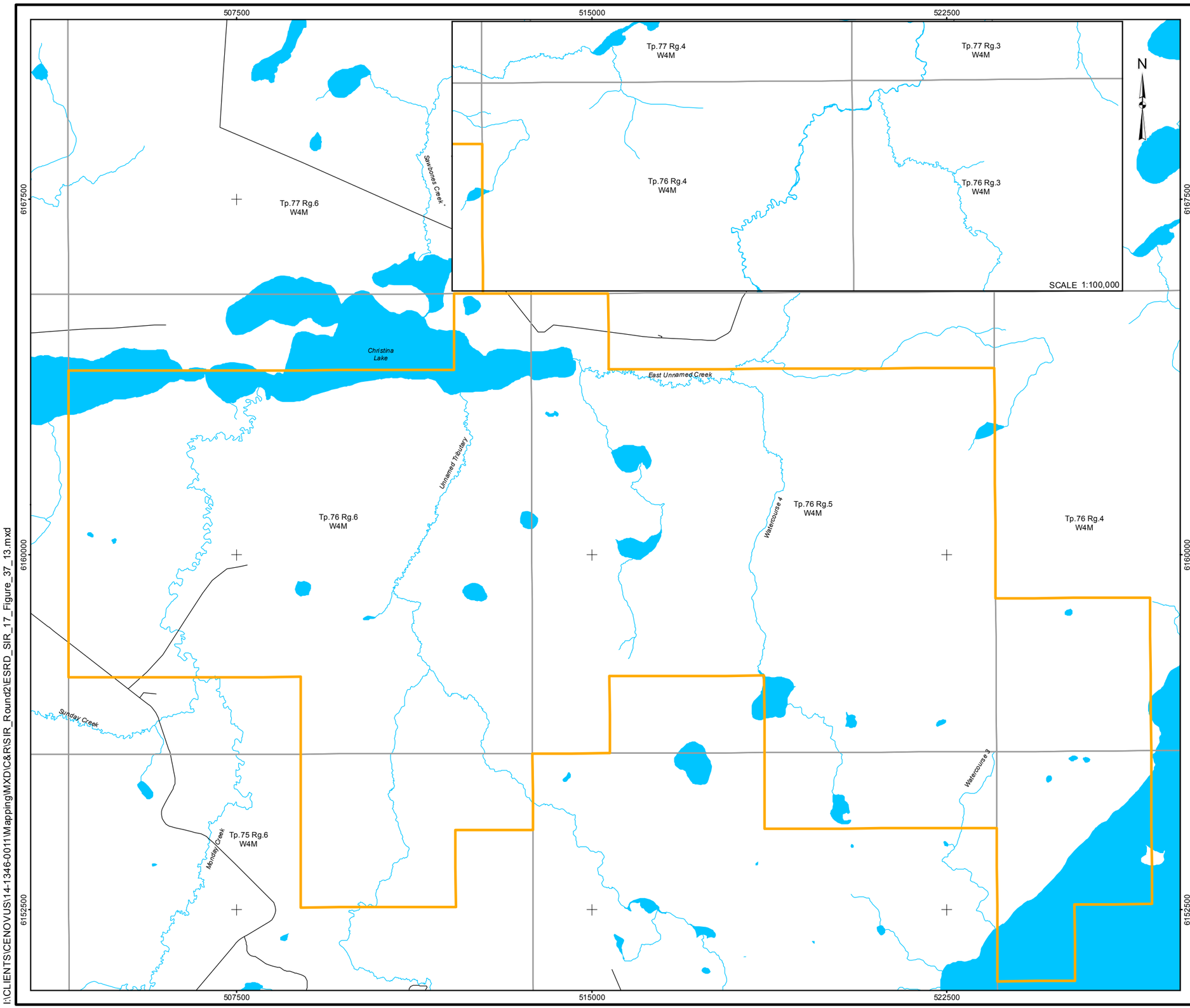
PROJECT
cenovus ENERGY
CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

TITLE
CHRISTINA LAKE THERMAL PROJECT FOOTPRINT DEVELOPMENT FOR THE YEAR 2050 - 2056

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	FD	10 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	GU	25 Nov. 2014		
CHECK	RL	15 Jan. 2015	FIGURE: 37-12	
REVIEW	SNS	15 Jan. 2015		

I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\C&RSIR_Round2\ESRD_SIR_17_Figure_37_12.mxd



LEGEND

- ROAD
- WATERCOURSE
- LEASE AREA
- WATERBODY

NOTES

*UNNAMED WATERCOURSE LOCALLY KNOWN AS SAWBONES CREEK

REFERENCE

ALBERTA DIGITAL BASE DATA OBTAINED FROM ALTALIS LTD. © GOVERNMENT OF ALBERTA 2004-2012 (ALL RIGHTS RESERVED), AND FROM IHS ENERGY INC.
DATUM: NAD 83 PROJECTION: UTM ZONE 12

3 0 3
SCALE 1:80,000 KILOMETRES

PROJECT
cenovus ENERGY
CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION

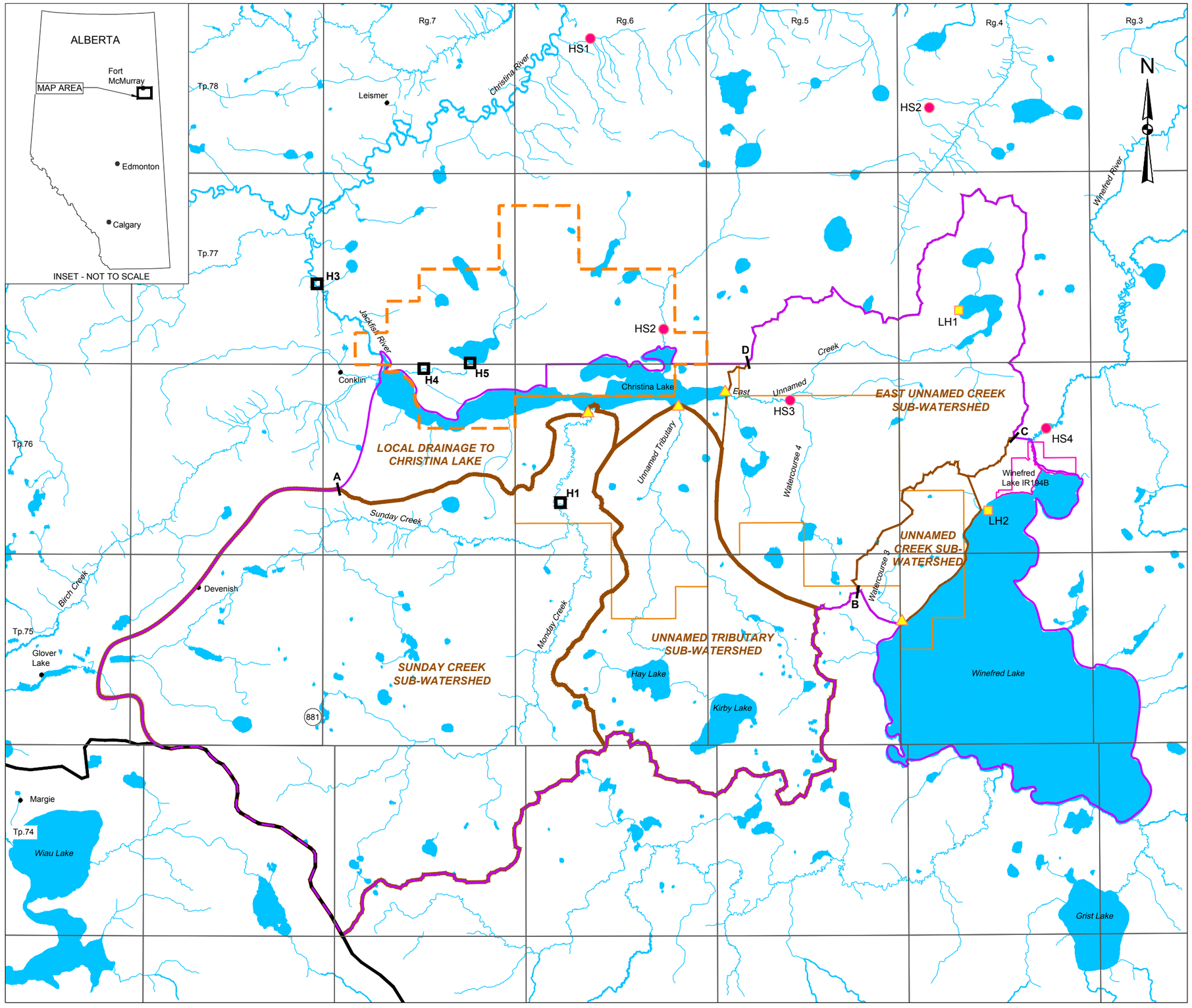
TITLE
CHRISTINA LAKE THERMAL PROJECT FOOTPRINT DEVELOPMENT FOR THE YEAR 2057

Golder Associates

PROJECT		14-1346-0011	FILE No.	
DESIGN	FD	10 Feb. 2014	SCALE AS SHOWN	REV. 0
GIS	GU	25 Nov. 2014		
CHECK	RL	15 Jan. 2015		
REVIEW	SNS	15 Jan. 2015		

FIGURE: 37-13

I:\CLIENTS\CENOVUS\14-1346-0011\Mapping\MXD\C&RS\IR_Round2\ESRD_SIR_17_Figure_37_13.mxd



LEGEND

- ASSESSMENT NODE NEAR THE MOUTH OF LOCAL WATERSHED
- BOUNDARY SEGMENT LIMIT
- COMMUNITY
- MEG FLOW MONITORING SITE
- MEG LAKE LEVEL MONITORING SITE
- NARROWS LAKE AND CHRISTINA LAKE PHASE 1E/F/G MONITORING STATION
- RAILWAY
- ROAD
- WATERCOURSE
- CLTP LEASE AREA
- INDIAN RESERVE
- LOCAL STUDY AREA
- LOCAL SUB-WATERSHED
- NARROWS LAKE LEASE BOUNDARY
- REGIONAL STUDY AREA
- WATERBODY

REFERENCE

ALBERTA NTDB DIGITAL DATA OBTAINED FROM GEOMATICS CANADA, AUGUST 2001.
SASKATCHEWAN NTDB DATA OBTAINED FROM ISC, AUGUST 2001.
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 12

0 4 8 12
SCALE KILOMETRES

PROJECT
cenovus ENERGY
CHRISTINA LAKE THERMAL PROJECT
PHASE H AND EASTERN EXPANSION
SIR REPORT

TITLE
LOCAL STUDY AREA AND SUB-WATERSHEDS WITHIN THE LOCAL STUDY AREA

Golder Associates

PROJECT No.	14.1346.0011.5300		FILE No.	14134600115300B002
DESIGN	RL	2014-11-25	SCALE	AS SHOWN
CADD	BSW	2014-11-25		
CHECK	RL	2015-01-15		FIGURE: 37-14
REVIEW	SNS	2015-01-15		