Cenovus Energy Inc. | 225 6 Ave SW PO Box 766 | Calgary, AB T2P 0M5 | 403.766.2000 cenovus.com

September 25, 2020

Shay Dodds
Manager, In Situ Surface
Alberta Energy Regulator
Suite 1000, 250 – 5th Street S.W.
Calgary, AB T2P 0R4

Re: Christina Lake Thermal Project
Phase H Optimization Project
Application Under the *Oil Sands Conservation Act* and *Environmental Protection and Enhancement Act*

Dear Mr. Dodds,

Cenovus Energy Inc. (Cenovus) has prepared the enclosed application for submission to the Alberta Energy Regulator (AER) for approvals to construct and operate the Christina Lake Thermal Project (CLTP) Phase H Optimization (the Project). More specifically, Cenovus is seeking approval from the AER for the following:

- amendment to Scheme Approval No. 8591QQQ to construct and operate the Project pursuant to Section 13 of the Oil Sands Conservation Act (OSCA), and Part 2 and Part 4 of the Oil Sands Conservation Rules; and
- amendment to Approval No. 48522-01-14, under Part 2, Division 2, Section 70 of the Environmental Protection and Enhancement Act (EPEA) to construct, operate and reclaim the Project, as proposed in the application contained herein.

This single application has been developed to combine all information required under the *OSCA* and *EPEA*. Other related applications under provincial statutes will be submitted separately to the agencies having jurisdiction.

The Project will be completed within the existing CLTP central processing facilities located at Sections 16 and 17, Township 76, Range 6, W4M, approximately 20 km southeast of the community of Conklin, Alberta. The Project is proposed to:

- increase the electrical generation capacity of the CLTP by approximately 96 MW (2 – 48 MW gas turbine generators);
- provide additional steam generation facilities through the installation of two new heat recovery steam generators (HRSGs); and
- update and optimize the Phase H water handling facilities

The Project will not result in a change to the approved CLTP Phase A to H production capacity of 49,284 m^3/d (310,000 bbl/d), or the associated Project Area and Development Area boundaries.

Should you have any questions or concerns regarding the enclosed application, please contact the undersigned at (403) 766-7521, or brent.mitchell@cenovus.com.

Yours truly,

CENOVUS ENERGY INC.

Brent Mitchell
Sr. Specialist, Regulatory Applications

Enclosure

Phase H Optimization Project
Integrated Application to the Alberta Energy Regulator

September 2020

Prepared for:

Cenovus Energy Inc.

Prepared by:

Stantec Consulting Ltd.
Calgary, Alberta

Project Number: 123513310

Limitations and Sign-off

This document entitled Phase H Optimization Project Integrated Application to the Alberta Energy Regulator was prepared by Stantec Consulting Ltd. (“Stantec”) for the account of Cenovus Energy Inc. (the “Client”) to support the regulatory review process for its EPEA Approval Amendment and Scheme Approval Amendment (the “Application”) for the Christina Lake Thermal Project (the “Project”). In connection therewith, this document may be reviewed and used by the Alberta Energy Regulator participating in the review process in the normal course of its duties. Except as set forth in the previous sentence, any reliance on this document by any other party or use of it for any other purpose is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The information and conclusions in the document are based on the conditions existing at the time the document was published and does not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by the Client or others, unless expressly stated otherwise in the document. Any use which another party makes of this document is the responsibility and risk of such party. Such party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other party as a result of decisions made or actions taken based on this document.

Elaine Little

Digitally signed by Elaine Little
Date: 2020.09.16 15:24:30 -06'00'

Project Manager _____
(signature)

Elaine Little, B.Sc.

Hill, Maureen

Digitally signed by Hill, Maureen
Date: 2020.09.16 16:26:20 -06'00'

Project Director _____
(signature)

Maureen Hill, B.Sc, M.E.Des., P.Biol.

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Abbreviations

%	percent
°C	degrees Celsius
µg/m^3	micrograms per cubic metre
AAAQO	Alberta Ambient Air Quality Objective
ABMI	Alberta Biodiversity Monitoring Institute
ACO	Aboriginal Consultation Office
ACR	Alberta Chamber of Resources
AEP	Alberta Environmental Protection
AER	Alberta Energy Regulator
AQMG	Air Quality Modelling Guideline
m ASL	metres above sea level
m E	meters East
m N	meters North
AUC	Alberta Utilities Commission
bbl/d	barrels per day
BFW	Boiler Feed Water
$CaCO_3$	calcium carbonate
CAPP	Canadian Association of Petroleum Producers
Cenovus	Cenovus Energy Inc.
CFU	compact flotation unit
CLTP	Christina Lake Thermal Project
CO_2	carbon dioxide
CH_4	methane

CO_2eq	carbon dioxide equivalent
COSIA	Canada's Oil Sands Innovation Alliance
CPF	central processing facility
CWE	Cold Water Equivalent
DA	Development Area
e^3Sm^3/d	thousand standard cubic metres per day
e^3m^3/d	thousand cubic metres per day
EIA	Environmental Impact Assessment
EPEA	Alberta *Environmental Protection and Enhancement Act*
ERCB	Alberta Energy Resources Conservation Board
ESRD	Alberta Environment and Sustainable Resource Development
EUB	Alberta Energy and Utilities Board
GHG	greenhouse gas
GOR	Gas to Oil Ratio
GTG	gas turbine generator
ha	hectare
HRSG	heat recovery steam generator
IGF	induced gas flotation
K	Kelvin
kg	kilogram
km	kilometre
kPa	kilopascal
LARP	Lower Athabasca Regional Plan
m	metre
m/s	metres per second

m^3	cubic metre
m^3/d	cubic metres per day
MMBtu/h	millions of international British thermal units per hour
MSL	Mineral Surface Lease
MW	megawatt
N_2O	nitrous oxide
NO	nitric oxide
NO_2	nitrogen dioxide
NO_X	nitrogen oxides (oxides of nitrogen)
NRSU	Non-Regenerative Scavenger Unit
ORF	Oil Removal Filter Package
OSCA	Oil Sands Community Alliance
OSCA	*Oil Sands Conservation Act*
OSCR	*Oil Sands Conservation Rules*
OSDG	Oil Sands Developers Group
OSM	Oil Sands Monitoring
OTSG	Once through steam generator
PA	Project Area
PFD	Process flow diagram
ppm	parts per million
PW	Process water
PWSR	produced water to steam ratio
PVSV	Pressure vacuum safety valve
Q	quarter year
SAGD	Steam-assisted gravity drainage

Sm^3/d	standard cubic metres per day
SO_2	sulphur dioxide
SOR	Steam to Oil Ratio
t/d	tonnes per day
the Guide	Guide to Content for Energy Project Applications
the Project	Phase H Optimization Project
W4M	West of the Fourth Meridian
WBEA	Wood Buffalo Environmental Association
WLS	Warm Lime Softener
yr	year

Introduction

Cenovus Energy Inc. (Cenovus) operates a commercial scheme for the recovery of crude bitumen at the Christina Lake Thermal Project (CLTP), located at Townships 75 and 76, Ranges 4, 5 and 6, West of the Fourth Meridian (W4M). Steam-assisted gravity drainage (SAGD) technology is utilized to extract bitumen from the McMurray Formation. The facility includes the central processing facilities (CPFs), SAGD well pairs, and supporting infrastructure and pipelines. The CLTP operates under Alberta Energy Regulator (AER) *Environmental Protection and Enhancement Act* (*EPEA*) Approval No. 48522-01-14 and *Oil Sands Conservation Act* (*OSCA*) Scheme Approval No. 8591QQQ.

As described in this application, Cenovus is requesting an EPEA approval amendment and scheme approval amendment for the proposed optimization of the CLTP approved Phase H CPF, or the Phase H Optimization Project (the Project). The Phase H and Eastern Expansion Application (Scheme Application No. 1758947, EPEA Application No. 019-48522) was previously approved in December 2015. The Project is proposed to:

- increase the electrical generation capacity of the CLTP by approximately 96 MW (2 – 48 MW gas turbine generators)
- provide additional steam generation facilities through the installation of two new heat recovery steam generators (HRSGs)
- update and optimize the Phase H water handling facilities

The Project will be completed within the existing CLTP CPF disturbance area at Section 16, Township 76, Range 6, W4M. No additional land disturbance is required to complete the Project. The CLTP is located approximately 20 km southeast of the community of Conklin, Alberta. Figure 18-1 provides the CLTP project location in association with the surrounding area. After regulatory and internal corporate approvals, site construction is expected to take up to three years with operations commencing the following year. The operational lifespan of the Project is expected to be approximately 25 years.

This document is Cenovus's integrated application to the AER for an amendment to Approval No. 48522-01 (as amended) under Division 2 of Part 2 and Section 70 of the *EPEA*, and amendment to Commercial Scheme Approval No. 8591 (as amended), pursuant to Section 13 of the *OSCA*, and Part 2 and Part 4 of the Oil Sands Conservation Rules (OSCR). It has been prepared in accordance with the Guide to Content for Energy Project Applications (AER, 2014) (the Guide) and the requirements listed in subsection 3(1) of the Approvals and Registrations Procedure Regulation (Alberta Regulation 113/93). It has also been prepared in accordance with draft Directive 023: Oil Sands Project Applications (AER, 2013). A concordance table relating to the requirements outlined in draft Directive 023 is provided in the AER Directive 023 Concordance Table (Appendix A). The format for this report follows the headings in the Guide, in bold text throughout this document.

Part 3: Amendments

17.0 CONFIRM APPLICANT IDENTIFICATION

17.1 CONFIRM APPLICANT NAME

Cenovus Energy Inc. (Cenovus). AER Business Associate Code: A5D4.

17.2 MAILING ADDRESS OF REGISTERED CORPORATION

Cenovus Energy Inc.
225 – 6 Avenue SW
P.O. Box 766 Calgary, AB
T2P 0M5

17.3 MAILING ADDRESS OF PLANT

Christina Lake Thermal Project
P.O. Box 317
Lac La Biche, AB
T0A 2C0

17.4 APPLICANT CONTACTS

Name Brent Mitchell
Title Sr. Specialist, Regulatory Applications

Telephone: 403-766-7521
Facsimile: 403-766-7600
E-mail: brent.mitchell@cenovus.com

Christina Lake Thermal Project Operations

Telephone: (780) 559-8523
Facsimile: (780) 559-8401

See also: Appendix B Authorization of Application for Approval by Owner/Agent

18.0 CONFIRMATION OF PLANT IDENTIFICATION

18.1 PRIMARY ACTIVITIES AND CLASSIFICATION

The CLTP is designated as an enhanced recovery in-situ oil sands processing plant and oil production site under the *EPEA* Activities Designation Regulation (AR 276/2003), as approved under *EPEA* Approval No. 48522-01-14. In addition, the CLTP is designated as an in-situ operation under the *OSCA*, as approved through commercial Scheme Approval No. 8591QQQ. Bitumen resource for the Project is sourced from areas within the Cenovus scheme approved Project Area (PA) and Development Area (DA) boundaries. The total CLTP Phase A to H approved production capacity is 49,284 m^3/d (310,000 bbl/d), as given in Condition 4 of the scheme approval.

As part of the Phase H Optimization Project, Cenovus is proposing to install a 96 megawatt (MW) cogeneration facility and complete associated plant modifications to the approved CLTP Phase H facilities. The Project will not result in a change to the approved production capacity, surface land requirements, or PA and DA boundaries. Pursuant to Division 2 Part 2 of *EPEA*, and pursuant to Section 13 of the *OSCA*, and Part 2 and Part 4 of the *OSCR,* amendments to the CLTP *EPEA* Approval No. 48522-01-14 and to Scheme No. 8591QQQ are required for the proposed modifications.

In consideration with Section 10 of the AER Directive 023: Oil Sands Project Applications (AER, May 2013), Cenovus requests that the scheme application be processed as a Category 2 amendment, based on the following rationale:

- the proposed Project is not expected to adversely and materially impact the rights of stakeholders, including other mineral right holders
- the proposed Project is not expected to materially affect resource conservation
- the proposed Project is not expected to adversely and materially alter the socioeconomic or environmental impacts previously predicted and assessed for the CLTP

18.2 PLANT LOCATION

The CLTP is located in Townships 75 and 76, Ranges 4, 5 and 6, West of the Fourth Meridian (W4M). Within the CLTP PA, the Phase A to H CPF is located in Section 16 and 17, Township 76, Range 6, W4M. The proposed Project is located entirely within the existing/approved CLTP CPF footprint. The latitude and longitude of the CPF plant site is 55.58129 and -110.88765, respectively. The CLTP is located approximately 20 km southeast of the community of Conklin, Alberta.

18.3 REGIONAL MAP

A regional map of the area surrounding the CLTP is provided in Figure 18-1. A location overview map of the CLTP area is provided in Figure 18-2.

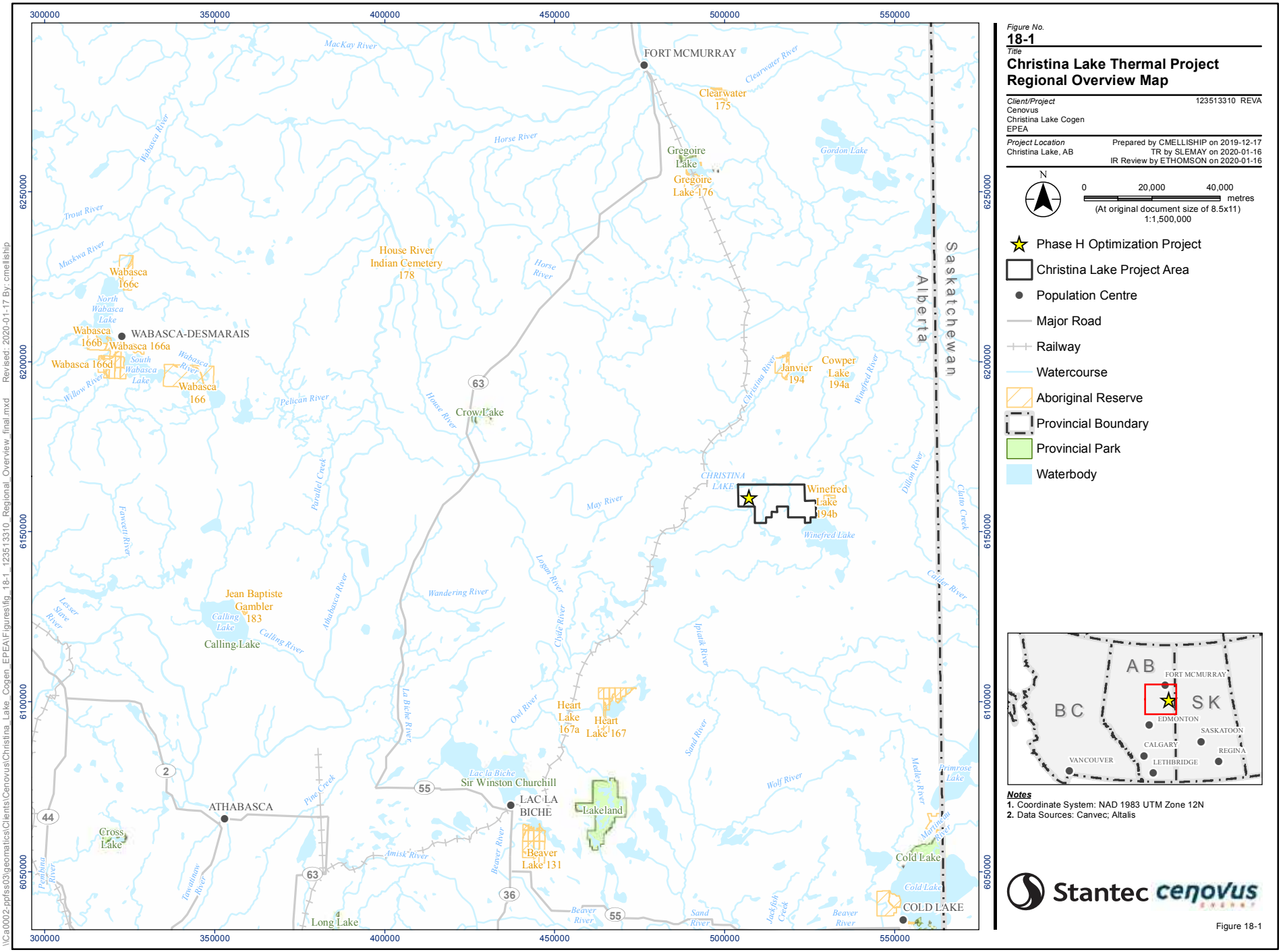

Figure No.
18-1

Title
Christina Lake Thermal Project
Regional Overview Map

Client/Project
Cenovus
Christina Lake Cogen
EPEA

123513310 REVA

Project Location
Christina Lake, AB

Prepared by CMELLISHIP on 2019-12-17
TR by SLEMAY on 2020-01-16
IR Review by ETHOMSON on 2020-01-16

Notes
1. Coordinate System: NAD 1983 UTM Zone 12N
2. Data Sources: Canvec; Altalis

Stantec cenovus ENERGY

Figure 18-1

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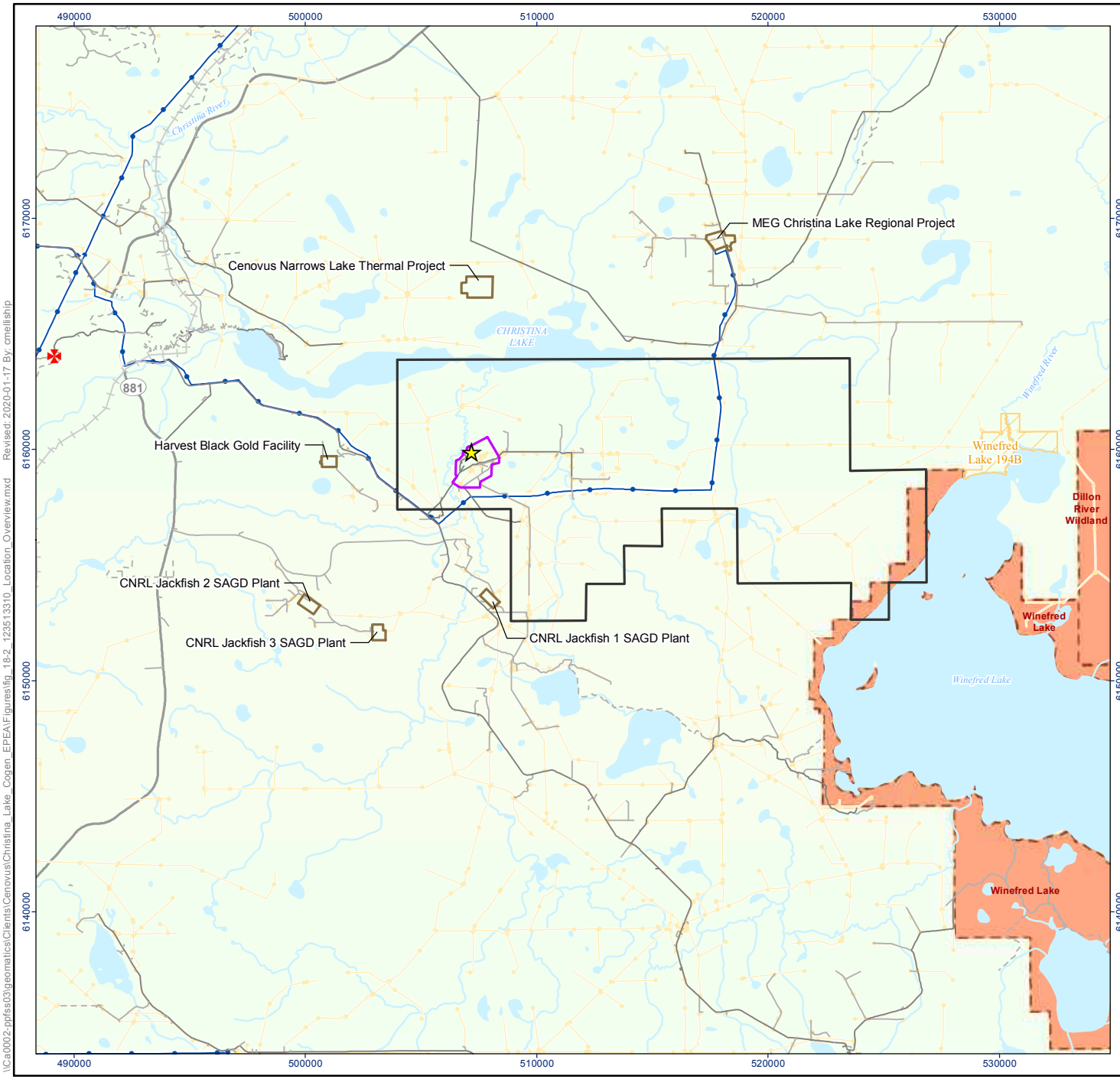


Figure No.
18-2

Title
Christina Lake Thermal Project Location Overview Map

Client/Project
Cenovus
Christina Lake Cogen
EPEA

123513310 REVA

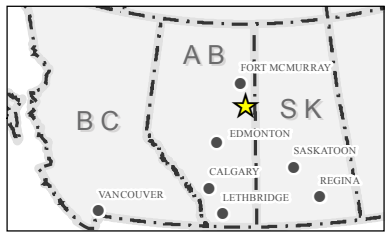
Project Location
Christina Lake, AB

Prepared by CMELLISHIP on 2020-01-14
TR by SLEMAY on 2020-01-16
IR Review by ETHOMSON on 2020-01-16

N

0 4,000 8,000 metres
(At original document size of 8.5x11)
1:250,000

- Phase H Optimization Project
- Christina Lake Project Area
- Christina Lake Central Processing Facility
- Regional Facility Fenceline
- Firebreak Tower
- Gravel Road
- Major Road
- Powerline
- Pipeline
- Railway
- Truck Trail
- Unclassified or Unimproved Road
- Watercourse
- Aboriginal Reserve
- Crown Reserve
- Green Area
- Provincial Boundary
- Waterbody



Notes
1. Coordinate System: NAD 1983 UTM Zone 12N
2. Data Sources: Canvec; Altalis

Stantec cenovus ENERGY

Figure 18-2

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18.4 PROJECT AND PLANT SIZE

The CLTP has an approved Phase A to H bitumen production capacity of 49,284 m^3/d (310,000 bbl/d), steam generation capacity of 89,696 m^3/d (CWE) and electrical generating capacity of 88 MW. Through the addition of the Project, Cenovus is proposing to add 8,767 m^3/d (Cold Water Equivalent [CWE]) of steam generation capacity and 96 MW of electrical generating capacity (see Section 21.1.1). Given the proposed Steam to Oil Ratio (SOR) for the Project, Cenovus is not anticipating an overall increase to the bitumen production capacity. The approved and proposed bitumen production, steam generation capacity, and power capacity for the CLTP are provided in Table 18-1.

Table 18-1 Christina Lake Thermal Project Central Plant Summary

	Approved Phase A-G	Approved Phase H	Proposed Phase H Optimization	Proposed Phase A-H (Total)
# of once-through steam generators (OTSGs)	24	5	0	29
# of gas turbine generator (GTG)/heat recovery steam generators (HRSGs)	2	0	2	4
Production Capacity (bbl/d)	260,000	50,000	0[(a)]	310,000
Production Capacity (m^3/d)	41,335	7,494	0[(a)]	49,284
Power Generation Capacity[(b)] (MW)	88	0	96	184

NOTES:
[(a)] The Project will not result in an overall Phase A to H production increase.
[(b)] Power capacity based on an ambient temperature of 15 C.

The Project will result in the addition and modification of the following equipment to the approved Phase H facilities:

- two new 48 MW gas turbine generators to increase the electrical generation capacity of the CLTP by approximately 96 MW
- two new 112 MW heat recovery steam generators (HRSGs) to provide additional steam generation facilities
- a compact flotation unit (CFU) to optimize the Phase H CPF water handling facilities
- additional utilities and tankage
- Sunday Creek substation modifications

The plot plan for the Phase H Optimization Project, which includes the major equipment to be added for the Project is provided in Appendix C. The Project will have a footprint of approximately 0.5 ha, and the cogeneration facility and associated plant modifications will be located entirely within the footprint of the existing Christina Lake CPF and approved Mineral Surface Lease (MSL) 002635 (see Figure 18-3).

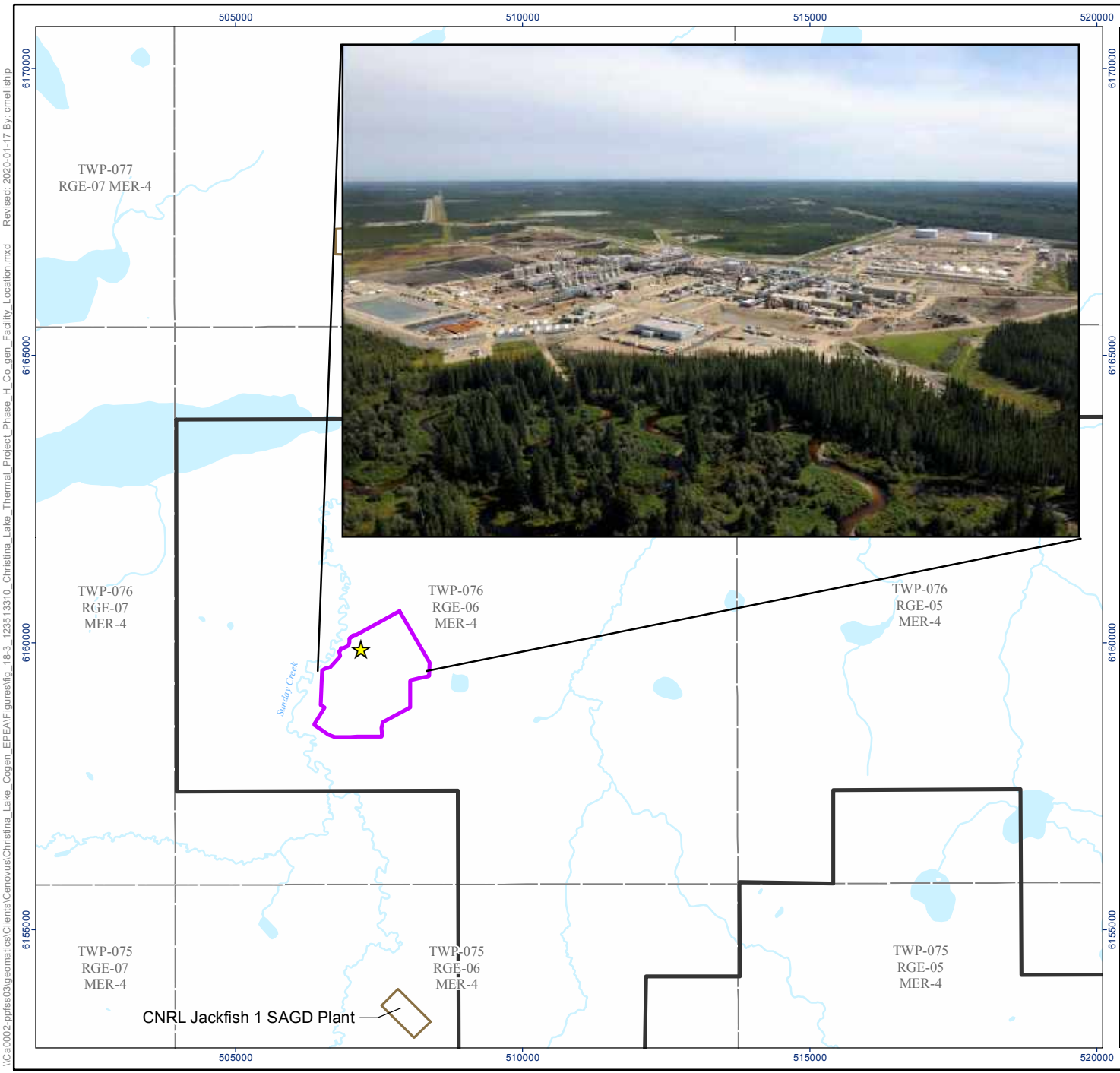


Figure No.
18-3

Title
Christina Lake Thermal Project
Phase H Co-gen Facility Location

Client/Project
Cenovus
Christina Lake Cogen
EPEA

123513310 REVA

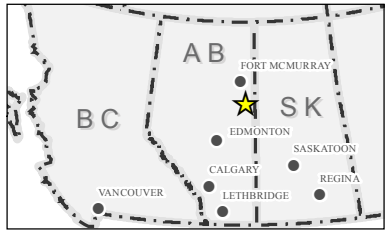
Project Location
Christina Lake, AB

Prepared by CMELLISHIP on 2020-01-14
TR by SLEMAY on 2020-01-16
IR Review by ETHOMSON on 2020-01-16

N

0 1,250 2,500 metres
(At original document size of 8.5x11)
1:100,000

- Phase H Optimization Project
- Christina Lake Project Area
- Christina Lake Central Processing Facility
- Regional Facility Fenceline
- Watercourse
- Provincial Boundary
- Township
- Waterbody



Notes
1. Coordinate System: NAD 1983 UTM Zone 12N
2. Data Sources: Canvec; Altalis
3. Image: Cenovus

Stantec cenovus ENERGY

Figure 18-3

\\Ca0002-ppfss03\geomatics\Clients\Cenovus\Christina_Lake_Cogen_EPEA\Figures\fig_18-3_123513310_Christina_Lake_Thermal_Project_Phase_H_Co_gen_Facility_Location.mxd Revised: 2020-01-17 By: cmelliship

As discussed above, the Project is proposed to optimize and expand the approved Phase H facilities. Given its location in relation to the existing and approved facilities, the Project can utilize a significant amount of the existing and approved site infrastructure, including the following:

- sales oil pipeline
- natural gas source pipeline
- site access roads and infrastructure
- work site camps and office/support buildings
- sulphur removal facilities
- steam/emulsion/produced gas pipeline corridors and well pads

The use of this existing/approved infrastructure significantly reduces the footprint requirements for the Project.

Water is required for steam generation to support SAGD production. The majority of the water used for steam generation is recycled produced water that is de-oiled and softened in the produced water treatment areas of the CPF. Brackish water is used to make up for water losses from boiler blowdown and regeneration waste streams that are sent to disposal wells. The current CLTP operation predominantly uses saline water from the Clearwater B Aquifer for steam generation water make-up, and a limited amount of fresh water from the Christina Channel (Empress Formation) for utility water purposes. The Project will primarily use make-up water from the McMurray Formation and will not require an increase to the freshwater allocations approved in the current CLTP *Water Act* licenses. Wastewater from the CLTP is injected (disposed of) into the saline Basal McMurray Aquifer.

Bitumen resource for the Project will be sourced from areas within the Cenovus scheme approved PA and DA boundaries. Well pad drainage pattern update scheme applications will be submitted separately, as required, as well pad development progresses within the approved DA. The Project will not result in a change to the scheme approved production capacity, or PA and DA boundaries.

19.0 PROJECT BACKGROUND FOR THE PROPOSED CHANGES

19.1 RELEVANT REGIONAL INITIATIVES AND PLANS

Cenovus is committed to responsible resource development. Following sustainable development principles allows Cenovus to balance environmental integrity while enhancing social and economic opportunities. This section discusses Cenovus's efforts in working with others involved in the region to achieve these goals.

19.1.1 Co-Operative Efforts

Cenovus works together with industry and communities to improve our environmental footprint while providing economic opportunity and stability. These activities include:

- regional environmental monitoring
- working co-operatively in environmental research
- stakeholder consultation

Cenovus participates in co-operative efforts to address industry issues where it determines that such endeavors are effective. Cenovus re-visits its participation in such co-operative effort on an ongoing basis. Cenovus is currently a participant in the following:

Canada's Oil Sands Innovation Alliance (COSIA) – Formed in March of 2012, COSIA consists of a consortium of Canadian oil sands producers focused on accelerating the pace of improving environmental performance in the oil sands region. The commitments put forward in the charter focus on collaboration and transparent exchange, by setting environmental performance goals and reporting publicly on progress towards those goals.

The guiding principle for COSIA is that all members will have greater success by collaborating on environmental innovation than by their own individual efforts. Four environmental priority areas that will allow COSIA to achieve these objectives are tailings, water, land, and greenhouse gases. Cenovus's President and Chief Executive Officer stated:

> *"As a company with a deep-rooted respect for the environment, and a culture that fosters new ideas and new approaches in all aspects of our business, we are excited to be a charter member of COSIA."*

Oil Sands Monitoring (OSM) Program – The OSM Program mandate is to implement an ambient environmental monitoring program for the oil sands that integrates air, water, land and biodiversity. The program strives to improve the characterization of the state of the environment and enhance understanding of the cumulative effects of oil sands development in the oil sands area. Cenovus currently provides logistical support, technical information and funding, contributing to the $50 million industry allocation as specified in the funding formula for the OSM Program.

Wood Buffalo Environmental Association (WBEA) - WBEA monitors the environment of the Regional Municipality of Wood Buffalo in northeastern Alberta. WBEA is committed to reporting accurate and timely high-quality data from its air, terrestrial and human exposure monitoring programs to ensure regional stakeholders have the information needed to make informed environmental decisions. Cenovus is a funding industry member of WBEA.

Oil Sands Community Alliance (OSCA) – This organization was formerly called the Oil Sands Developers Group (OSDG). The OSCA is a Canadian Association of Petroleum Producers (CAPP) directed program funded through industry members that works with various other organizations to address socio-economic issues of oil sands developments. Cenovus participates as a member of OSCA.

Alberta Chamber of Resources (ACR) – Cenovus is a financial supporter and an active participant in the ACR, as well as participating in its Integrated Landscape Management program. As stated by ACR, (ACR 2010):

> *"The Integrated Landscape Management program represents the first large scale Canadian effort to proactively address the cumulative impacts of resource-based land use."*

Alberta Biodiversity Monitoring Institute (ABMI) – Cenovus is a financial supporter and an active participant in the ABMI. This organization is establishing a province-wide biodiversity monitoring program. As stated by ABMI (ABMI 2010):

> *"The Alberta Biodiversity Monitoring Institute (ABMI) conducts world-class monitoring of the changing state of Alberta's species, habitats and ecosystems. The goal of the ABMI is to support natural resource decision-making by providing relevant, timely, and credible scientific knowledge on the state of provincial biodiversity."*

19.1.2 Lower Athabasca Regional Plan

The Lower Athabasca Regional Plan (LARP) sets out several objectives for long term land-use planning. It touches on management and conservation for topics such as air quality, ecosystem function and biodiversity, groundwater and surface water quality and tailings management framework (GOA 2012).

Development of the oil sands is in keeping with the principles of the LARP which states "The economic potential of the oil sands is optimized" as one of its Regional Outcomes (GOA 2012). Cenovus is actively engaged in ensuring consistency with the LARP as it relates to CLTP development.

19.2 RELATED HEARING RESULTS AND DECISIONS

The original joint application and Environmental Impact Assessment (EIA) for the CLTP was submitted to the Alberta Energy and Utilities Board (EUB) and Alberta Environmental Protection (AEP) in March 1998. In 2000, the Order in Council was issued, and the scheme and *EPEA* application was approved by the EUB and AEP for the production of 70,000 bbl/d (11,200 m^3/d) of bitumen over three phases of development (Phases I, II and III), each with a separate CPF site. Subsequent to this, Cenovus amended the original application to the current Phase A/B development and then further amended the application to incorporate Phases C and D, giving a Phase A to D cumulative bitumen production capacity of 98,800 bbl/d (15,700 m^3/d).

The CLTP Phase E, F and G joint application and EIA was filed on October 2, 2009 to the Alberta Energy Resources Conservation Board (ERCB) and Alberta Environment and Sustainable Resource Development (ESRD). This application included three additional 40,000 bbl/d (6,360 m^3/d) phases, bringing the cumulative production capacity to 218,800 bbl/d (34,789 m^3/d). This joint application and *EPEA* amendment were approved by the ERCB in April 2011 and ESRD in July 2011. Subsequent to this, Cenovus submitted the Phase CDE Debottleneck and Phase F/G Amendment to further optimize the CLTP Phase A to G facilities and increase the total cumulative bitumen production rate to 260,000 bbl/d (41,335 m^3/d).

In March 2013, Cenovus filed the CLTP Phase H and Eastern Expansion joint application and EIA (the Phase H Application), which proposed to expand the existing and approved CLTP Phase A to G facilities to increase bitumen production by 50,000 bbl/d (7,949 m^3/d), bringing the total production capacity to 310,000 bbl/d (49,284 m^3/d). The Phase H and Eastern Expansion joint application was approved in December 2015 (EPEA Approval No. 48522-01-06; and Scheme Approval No. 8591QQ). Cenovus completed construction of Phase G in 2019 and the current Phase A to G CPF has a production capacity of approximately 260,000 bbl/d (41,335 m^3/d).

The CLTP phased development history and associated regulatory approval dates are provided in Table 19-1.

Table 19-1 Christina Lake Thermal Project Phased Expansion Approval Chronology

Phase	Application Description	Approved Cumulative Capacity	Scheme Approval	EPEA Approval
Phase I, II, III	Initial Project Application - three phase development	11,200 m^3/d	8591 (April 2000)	48522-00-00 (August 2000)
A	First Commercial Phase of CLTP	1,590 m^3/d (10,000 bbl/d)	8591C (March 2005)	48522-00-00 (August 2000)
B	Phase B Amendment	2,989 m^3/d (18,800 bbl/d)	8591E (December 2005)	48522-00-07 (December 2005)
C/D	Phase C/D plant expansion	15,709 m^3/d (98,800 bbl/d)	8591I (July 2008)	48522-00-09 (July 2008)

Table 19-1 Christina Lake Thermal Project Phased Expansion Approval Chronology

Phase	Application Description	Approved Cumulative Capacity	Scheme Approval	EPEA Approval
E/F/G	Phase E/F/G plant expansion	34,789 m^3/d (218,800 bbl/d)	8591Q (April 2011)	48522-00-12 (July 2011)
F/G Amendment	Phase F/G plant optimization	37,969 m^3/d (238,800 bbl/d)	8591Y (December 2012)	48522-01-03 (December 2012)
C/D/E Amendment	Phase C/D/E plant optimization	41,335 m^3/d (260,000 bbl/d)	8591DD (September 2013)	48522-01-04 (January 2014)
H	Phase H plant expansion	49,284 m^3/d (310,000 bbl/d)	8591QQ (December 2015)	48522-01-06 (December 2015)

A hearing was conducted as part of the original CLTP application (Application No. 1023589) in 1999. Issues reviewed during the hearing included need for the project, public consultation, socioeconomic issues, bitumen recovery process, land use, environmental issues and cumulative effects of oil sands development. EUB Decision 2000-7 was issued in February 2000 regarding the hearing conducted. No additional regulatory hearings have occurred related to the CLTP.

19.3 ENVIRONMENTAL IMPACT ASSESSMENT ACCEPTANCE DATE

As discussed in Section 19.2, Cenovus (and its predecessor companies) completed three EIAs for the CLTP. The EIA acceptance dates for these applications are provided below:

- Original Application and EIA submitted in March 1998 – EIA accepted 1999
- Phase EFG Application and EIA (Encana FCCL, 2009) – EIA accepted 2011
- Phase H Application and EIA (Cenovus FCCL, 2013) – EIA accepted 2015

To determine if the Project required an EIA, Cenovus provided a Project Summary Table and Project Map to the AER on October 3, 2019. Following review of the provided documentation, the AER determined on October 21, 2019 that an EIA was not required for the Project (see Appendix D).

19.4 RELATED AUTHORIZATIONS

Other related applications or guidelines under provincial and federal statutes may be pertinent to the Project. Any supplemental applications required for the development of the Project will be submitted separately to agencies having jurisdiction. Potential pertinent approvals or guidelines may include but are not necessarily limited to the following:

- Provincial:
  - *Historical Resources Ac*t, for clearance to construct surface facilities
  - MSL002635, *Public Lands Act*, for surface rights

  - Directive 017: Measurement Requirements for Upstream Oil and Gas Operations (AER 2018)
  - Directive 042: Measurement, Accounting and Reporting Plan (MARP) Requirement for Thermal Bitumen Schemes (AER 2006)
  - Directive 055: Storage Requirements for the Upstream Petroleum Industry (AER 2001)
  - Directive 056: Energy Development Applications and Schedules (AER 2019a)
  - Directive 081: Water Disposal Limits and Reporting Requirements for Thermal In Situ Oil Sands Schemes (AER 2019b)
  - *Municipal Government Act*, Part 17 for development permits
  - Application to Alberta Utilities Commission (AUC) under Rule 007 (AUC 2019) and Rule 012 (AUC 2013) of the *Hydro and Electric Energy Act*.
- Federal:
  - The Project as proposed is not expected to require Federal approval (see Appendix D).

19.5 FINANCIAL SECURITY

No changes to financial security are required due to the Project.

19.6 PROJECT TIMELINE AND MILESTONES

After regulatory and internal corporate approvals, site construction is expected to take up to three years with operations commencing the following year. The operational lifespan of the Project is expected to be approximately 25 years.

19.7 PUBLIC CONSULTATION AND STAKEHOLDER ENGAGEMENT

Cenovus submitted a pre-consultation assessment request to the Government of Alberta Aboriginal Consultation Office (ACO) for the Project on May 24, 2019. Given that the Project Is located wholly within MSL002635, does not require additional surface disturbance, and will meet current emission standards and the Alberta Ambient Air Quality Objectives (AAAQOs), the ACO adequacy assessment determined that consultation is not required for the Project (FNC 201903720). Cenovus maintains ongoing community and local engagement with its stakeholders. No stakeholder engagement activities outside of the regulatory approval amendment process are currently planned for the Project; however, stakeholder engagement will continue as required. To date, no environmental concerns have been identified. Cenovus will continue to work with stakeholders to address concerns raised through the application process and public notice of application.

20.0 UPDATE APPLICABLE ELEMENTS OF THE CURRENT SETTING AND ITS ENVIRONMENTAL CONDITION

20.1 SCOPE OF UPDATES

The Project will result in changes to air quality in the vicinity of the Project and will require approximately 0.5 ha of land within the existing CLTP CPF footprint. The Project includes a change to saline groundwater withdrawal and disposal plans.

The land to be used is currently brownfield (i.e., within the active facility footprint), located to the south of the existing storm water pond and north of the de-oiling buildings, tanks and facilities. The Project's predicted air emission contributions have been calculated in support of this application (see Section 21.18).

The Project will not adversely alter the socioeconomic impacts previously assessed and approved for the CLTP.

20.2 CURRENT SETTING AND ENVIRONMENTAL CONDITIONS

The proposed changes due to the Project have the potential to affect environmental aspects related to air quality as further described below. Cenovus also updated the regional hydrogeology model as provided in Appendix E to assess changes to saline water use and subsequent disposal volumes into the McMurray Formation. Cenovus is not proposing to increase its approved freshwater allocation for the Project

20.2.1 Existing Conditions

Development of the Project will not require additional or new disturbance of the natural environment and will be entirely within the existing development of the CLTP. The area that has been identified for the Project (see Figure 18-3) is currently stripped of vegetation and soils and does not have any natural waterbodies; therefore, no environmental effects on vegetation, soil, wildlife, hydrology, fish and fish habitat will occur.

20.2.2 Ambient Air Quality

Topography within a 22 km by 22 km study area was assessed for the air quality assessment, provided in Appendix F. The Project is situated at a base elevation of approximately 565 m above sea level (ASL). Terrain elevations decrease to the northwest towards Christina Lake. Terrain generally rises gently to the southwest. The maximum elevation within the study area is 690 m.

As per the Air Quality Modelling Guideline (AQMG), representative regional ambient background concentrations were determined for the study area (Appendix F). Wood Buffalo Environmental Association (WBEA) Conklin station monitoring data were selected to provide background sulphur dioxide

(SO_2), nitrogen dioxide (NO_2) and nitrogen oxides (NO_X) concentrations for the area because the station is located approximately 13 km west-northwest of the Project site, and is the closest continuous monitoring station in the local area outside the Project boundary. Ambient data for SO_2, NO_2 and NO_X for the most recent year (2018) were analyzed using the AQMG (ESRD 2013) methodology to calculate background concentrations. Background concentrations are presented in Table 20-1.

Table 20-1 Estimated Ambient Background Concentrations

Substance	Averaging Period	Background Concentration [a] (µg/m³)	AAAQO[b] (µg/m³)	Comparison of Background to AAAQO (%)
SO_2	One-hour	2.62	450	0.6
	24-hour	2.62	125	2
	30-day	0.65	30	2
	Annual	0.35	20	2
NO_X	One-hour	12.2	-	
	Annual	3.89	-	
NO_2	One-hour	10.0	300	4
	Annual	3.31	45	9

NOTES:

[a] Background concentration was calculated as per Section 4.2 of the Air Quality Modelling Guideline (ESRD 2013). The hourly average background concentration is the 90th percentile value calculated from the complete data set. For averaging periods greater than one-hour, the maximum calculated value, for each averaging period, was based on a reduced hourly data set with the hourly values above the 90th percentile value removed.

[b] Concentrations given (µg/m³) at 25°C and 101.325 kPa. See Table 2-2 in Appendix F.

20.3 CHANGES TO ENVIRONMENTAL ASPECTS DUE TO REGIONAL INITIATIVES AND PLANS

Cenovus works together with industry and communities to improve its environmental footprint while providing economic opportunity and stability. These activities include:

- regional environmental monitoring
- working co-operatively in environmental research
- stakeholder consultation

Cenovus participates in co-operative efforts to address industry issues where it determines that such endeavors are effective. Cenovus re-visits its participation in such co-operative effort on an ongoing basis. More information on Cenovus's approaches to regional initiatives is located in Section 19.1.1.

The CLTP has established environmental management frameworks for air and surface water quality that include environmental limits, and abide by the conditions in EPEA Approval 48522-01-14, as amended.

20.4 CHANGES TO PLANT OBLIGATIONS

Not applicable. There are no changes proposed for CLTP obligations as a result of the Project. All monitoring and other requirements will be completed in accordance with the CLTP *EPEA* and Scheme approvals.

21.0 PROPOSED CHANGES TO DESIGN AND OPERATION

21.1 PROPOSED CHANGES TO PLANT PROCESSES

The Phase H facilities were originally proposed in, and approved as part of, the March 2013 CLTP Phase H and Eastern Expansion joint application and EIA (the Phase H Application). Phase H included the addition of five OTSGs, with a total of 29 OTSGs and 2 GTG/HRSGs for the Phase A to H CPFs. The Phase H and Eastern Expansion application was approved in December 2015 (the Phase H Approval).

As described in this application, Cenovus is proposing to optimize the previously approved CLTP Phase H project through the addition and modification of the following surface facilities:

- Addition of two 48 MW GTGs
- Addition of two 112 MW HRSGs
- Addition of a CFU within the produced water de-oiling system

The proposed cogeneration facility will supply additional electrical power generating capacity to further balance on-site power needs, import power requirements and provide additional efficient steam generation capacity for use in the SAGD operations. In addition, the incorporation of a CFU will optimize the produced water de-oiling system and replace the previously planned induced gas flotation (IGF) unit. The proposed changes will not increase the approved CLTP Phase A to H approved bitumen production capacity of 310,000 bbl/d (49,284 m^3/d).

The following sections further discuss the additions and modifications proposed for the approved Phase H facilities that were previously described in the Phase H and Eastern Expansion Application (Scheme Application No. 1758947). For ease of review, the Facilities section follows the same format as the original Phase H application document. If the sections are unchanged due to this amendment, the sections are denoted as “No changes required to this section”. The material balances, block flow diagrams, and energy balances associated with this section are provided in Appendix G, process flow diagrams are provided in Appendix H, and the equipment list and plot plan have been provided in Appendix C. An assessment of environmental noise as a result of the additions and modifications discussed in the following sections has been included as Appendix I.

21.1.1 Central Processing Facility Overview

The currently approved CLTP Phase H facilities are proposed to be expanded to increase steam generation capacity and sustain oil production. The updated steam and bitumen capacities for all phases of the CPF are summarized in Table 21-1.

Table 21-1 Injection Steam Capacity and Bitumen Production Capacity

Phase	Status	Dry Steam Capacity	Bitumen Production Capacity	
		m^3/d Cold Water Equivalent (CWE) [a]	(bbl/d)	(m^3/d)[a]
Phases A and B	Operating	5,347[b]	18,800	2,989[b]
Phase C	Operating	11,392[b]	40,000	6,359[b]
Phase D	Operating	11,392[b]	40,000	6,359[b]
Phase E	Operating	11,392[b]	40,200	6,359[b]
Phase F	Operating	14,612[b]	40,200	6,391[b]
Phase G	Operating	14,610[b]	40,000	6,391[b]
Phases A to G (Sub-total)	**See Above**	**68,745**	**219,200**	**34,850**
CDE 2nd Stage OTSGs	Operating	6,695[b]	21,200	3,371
Phases A to G, includes CDE 2nd Stage OTSGs (Sub-total)	**See Above**	**75,440**	**240,400**	**38,221**
Phase H	Approved	17,178[b]	46,100	7,329[b]
Phase H Amendment (the Project)	Proposed	8,767[b]	23,500	3,736[b]
Phases A to H, includes CDE 2nd Stage OTSGs and the Project (Total)	See Above	102,135	**310,000**	**49,286**

NOTES:
[a] Totals may not add due to rounding.
[b] Refer to Block Flow Diagram CL1-42-BFD-00-143-03.

A summary of the Project equipment and the associated subsections in which equipment is referenced is provided in Table 21-2. Equipment lists are also provided in Appendix C.

21.1.1.1 Steam Generation

Two HRSGs will be installed to increase the Phase H steam capacity. The placement of these HRSGs is within the CPF plot plan as shown in Appendix C. The CPF will have a fixed maximum steam rate based on the number of steam generators available, while the bitumen production rate will depend on the SOR achieved. The average forecast SOR for Phases A to H is 2.0.

The dry steam rates for Phases C through H has been upgraded to 82% based on CPF performance to date. As per previous amendments, emission modelling for all steam generators is based on the burner limitations.

Overall CPF block flow diagrams for a produced water to steam ratio (PWSR) of 1.0, an overall energy balance, development profile with the Directive 081 water usage formulas, and a simplified water balance are included in Appendix G.

Table 21-2 Central Processing Facility Equipment for the Project

Equipment Description	Equipment Identification Number	Sub-Section Reference	Associated Process Flow Diagrams[(a)]
Produced Water/Glycol Exchangers	E-4650F, E-4450F, E-4550F	21.1.3.1 (Production Processing)	CL1H-42-PFD-04-0140-001 CL1H-42-PFD-04-0150-001 CL1H-42-PFD-04-0160-001
Glycol Air Coolers	AC-7351A-J	21.1.4.3 (CPF Glycol System)	CL1H-42-PFD-07-0142-002
Produced Water Transfer Pumps	P-0510A-C	21.1.5.2 (Produced Water Deoiling System)	CL1H-42-PFD-01-0151-001
Produced Water Surge Tank	T-0515	21.1.5.2 (Produced Water Deoiling System)	CL11H-42-PFD-01-0151-001 CL1H-42-PFD-01-0161-001 CL1H-42-PFD-01-0161-002
CFU Feed Pumps	P-0520A-C		
CFU Package	PK-0525		
Oil Removal Filter Packages (ORFs)	PK-0540D		
Deoiled Water Pumps	P-0558D		
Oil Recycle Tanks	T-0545B		
Deoiling Flocculant Polymer Injection Package	PK-0779, T-0778		
HRSGs	B-5600/5650	21.1.1.1 (Steam Generation)	CL1H-42-PFD-02-0140-001 CL1H-42-PFD-02-0161-001 CL1H-42-PFD-02-0161-002 CL1H-42-PFD-02-0161-004 CL1H-42-PFD-02-0161-005
HP Natural Gas Filters/Separators	F-5495A/B		
HP Natural Gas Heater	EH-5494		
Gas Turbines	GT-5500/5550		
Steam Separators	V-5700		
BFW / Blowdown Exchangers	E-5705		
Blowdown/Glycol Exchanger	E-5710		
2nd Stage BFW Charge Pumps	P-2880		
Boiler Feed Water (BFW) Booster Pumps	P-3010H		
BFW Charge Pumps	P-3015H		
Vapour Recovery Unit (VRU) Compressor Package	PK-7670	21.1.9 (Vapour Recovery System)	CL1H-42-PFD-07-0140-002

NOTE:
(a) Associated process flow diagrams provided in Appendix H.

21.1.1.2 Make-Up Water Treatment

The Project has made no change to the scope of this system since the original Phase H application, although the anticipated make-up water requirements have changed as a result of the Project.

21.1.1.3 Water Re-use and Disposal

The Project has made no change to the scope of the water re-use and disposal water systems since the original Phase H application; however, the anticipated wastewater disposal volumes have changed as a result of the Project.

Five OTSGs are proposed for Phase H, as described in the original application, with one designated for 2nd stage operation. Two HRSGs added for the Project allow the 2nd stage OTSG to operate at rated capacity. Refer to Figure 21-1 for a sketch of the proposed steam generation configuration.

Development profiles indicating anticipated production and water usage are included in Appendix G. In these models it is assumed that all steam generators will operate at 82% steam quality. The PWSR equal to 1.0 cases yield the maximum make-up water requirements. The predicted high PWSR cases yield the maximum blowdown disposal requirements.

21.1.1.4 Produced Gas Treatment

The Project has made no change to the scope of this system since the original Phase H application.

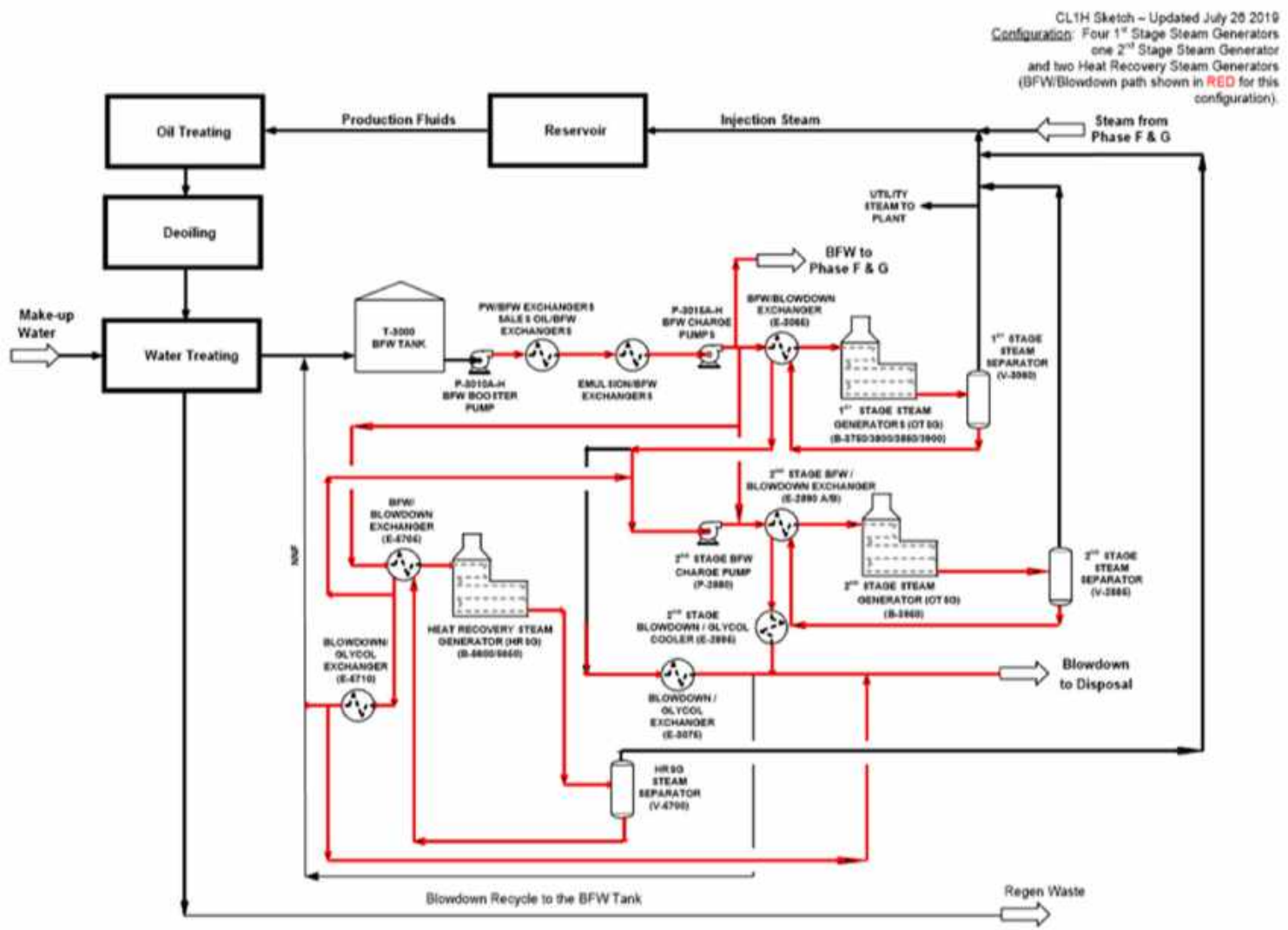


Figure 21-1 Phase H Sketch: Four 1st Stage OTSGs, One 2nd Stage OTSG, Two HRSGs

21.1.1.5 Bitumen Production Treatment

Heat and material balances for the Project are included in Appendix G.

21.1.2 Flow Rates

The anticipated cumulative flow rates for the expanded CPF are listed in Table 21-3.

Table 21-3 CPF Cumulative Flow Rates

Parameter	Units	Phases A to H
Saturated steam from steam generators	m^3/d CWE	102,135 [(a)]
Saturated steam to injection wells	m^3/d CWE	101,015 [(a)]
Oil from production wells	Sm^3/d	49,283 [(a)]
Produced water from wells	m^3/d CWE	101,015 [(a)]
Produced gas from wells (dry basis)	e^3Sm^3/d	908.8 [(a)] 1,792.0 (Sensitivity) [(e)]
Coinjection/Blowdown Produced Gas	e^3Sm^3/d	366.7 [(a)] 1,304.8 (Sensitivity) [(e)]
Fresh water consumption	Sm^3/d	229 [(a)] 5,000 (Upset) [(d)]
Brackish make-up water consumption	Sm^3/d	11,166 [(a)] 23,650 (Upset)[(b)]
Steam blowdown to disposal	Sm^3/d	9,803 [(a)] 22,247 (Upset)[(b)]
Regeneration/neutralization waste to disposal[(c)]	Sm^3/d	1,029 [(a)] 1,119 (Upset)[(b)]

NOTES:

(a) Refer to the Block Flow Diagrams and Simplified Water Balances in Appendix G.

(b) Upset conditions indicated are based on a blowdown recycle rate of 0% and a PWSR of 1.0. For simplicity, it is assumed that all OTSGs operate at a steam quality of 82% in the upset case. Note that the Block Flow Diagrams and Simplified Water Balances (Appendix G) assume an 82% steam quality for all the OTSGs, except the Phase CDE 2nd Stage OTSGs, which use a steam quality of 75%.

(c) Regen waste quantities are based on assumed water quality. Design assumes 20 ppm total hardness as $CaCO_3$ for the produced water, 140 ppm as $CaCO_3$ for the Clearwater B (Phases A to E) and 352 ppm as $CaCO_3$ for the Basal McMurray (Phases F to H). Operating capacities for the Strong Acid Cation (SAC) and Weak Acid Cation (WAC) resins are based on vendor recommendations. Blowdown recycle and total dissolved solids influence sodium interference and reduce the operating capacity of SAC resin. This may contribute to more frequent regenerations and result in increased regeneration waste. Use of higher hardness water will similarly require more frequent regeneration and result in increased regeneration waste. Regen waste quantities are also including the Phase A-E Brackish Water Regen Waste.

(d) Fresh water consumption will normally be minimized. Fresh water rates up to the permanent non-saline license (5,600 Sm^3/d) may be used to blend with high hardness brackish water.

(e) Sensitivity condition based on timing of well pad co-injection and blowdown and recycle ratio of co-injection/blowdown injected gas. Produced gas from wells (dry basis) is reported including co-injection/blowdown produced gas.

21.1.2.1 Bitumen Rates

Bitumen production rates are presented in Table 21-4.

Table 21-4 Bitumen Production Capacity

Phase(s)	Bitumen Production Capacity[(a)]	
	(bbl/d)	(m^3/d)
A to E	138,800	22,067
CDE 2nd Stage OTSGs	21,200	3,371
F and G	80,400	12,783
H	46,100	7,329
H Amendment (the Project)	23,500	3,736
A to H	**310,000**	**49,286**

NOTE:
(a) Totals may not add due to rounding.

21.1.2.2 Water Rates

Development profiles indicating anticipated production and water usage are included in Appendix G. Based on the development profile, CLTP is anticipating compliance with Directive 081 disposal limits during all years included in the development profile (2024 – 2054).

For the three cases provided in this section, it is assumed that all steam generators will operate at 82% steam quality. This assumption was made to simplify the model and may be slightly different than the block flow diagram numbers provided in Appendix G, which use 82% steam quality for Phases A to H, and 75% for the CDE 2nd Stage OTSGs.

The ideal blowdown recycle case is based on a PWSR equal to 1.0 (Table 21-5).

The maximum make-up water requirement is based on a PWSR equal to 1.0 with 0% blowdown recycle (Table 21-6).

The maximum disposal requirement is based on a PWSR equal to 1.23 (Table 21-7). This is the highest daily PWSR predicted from reservoir forecasts.

Under normal operating conditions, the make-up water and disposal rates may increase due to the addition of the two HRSGs; however, the maximum make-up water and disposal rates are forecasted to range between the values listed in Tables 21-6 and 21-7.

Table 21-5 Water Balance Summary, Ideal Blowdown Recycle Case

Phase(s)	PWSR	Steam Quality (%)	Blowdown Recycle (%)	Brackish Make-up (t/d)	Water Treating Regen Loss (t/d)	WLS Sludge Water (t/d)	Blowdown Disposal (t/d)
A to E	1.00	82	50	5,029	555	29	4,317
A to E, plus CDE 2nd Stage OTSG's	1.00	82	75	5,138	588	34	4,390
F and G	1.00	82	50	4,995	270	37	3,594
H	1.00	82	50	2,497	160	18	3,209
A-H	**1.00**	**82**	**57**	**12,630**	**1,029**	**89**	**11,193**

Table 21-6 Water Balance Summary, Maximum Make-Up Water Case

Phase(s)	PWSR	Steam Quality (%)	Blowdown Recycle (%)	Brackish Make-up (t/d)	Water Treating Regen Loss (t/d)	WLS Sludge Water (t/d)	Blowdown Disposal (t/d)
A to E	1.00	82	0	9,281	438	34	8,705
A to E, plus CDE 2nd Stage OTSG's	1.00	82	0	10,857	512	40	10,179
F and G	1.00	82	0	6,900	324	25	6,436
H	1.00	82	0	6,032	283	22	5,632
A-H	**1.00**	**82**	**0**	**23,650**	**1,118**	**87**	**22,247**

Table 21-7 Water Balance Summary, Maximum Disposal Case

Phase(s)	PWSR	Steam Quality (%)	Blowdown Recycle (%)	Brackish Make-up (t/d)	Water Treating Regen Loss (t/d)	WLS Sludge Water (t/d)	Blowdown Disposal (t/d)	Produced Water Disposal (t/d)
A to E	1.23	82	0	2,733	444	36	8,705	2,898
A to E, plus CDE 2nd Stage OTSG's	1.23	82	0	2,850	515	42	10,179	2,606
F and G	1.23	82	0	0	308	25	6,436	0
H	1.23	82	0	0	270	22	5,632	0
A-H	**1.23**	**82**	**0**	**2,850**	**1,090**	**89**	**22,247**	**1,888**

21.1.2.3 Produced Water Rates

The produced water flow rates are presented in Table 21-8.

Table 21-8 Produced Water Rates

Phase(s)	Produced Water Rates (Sm^3/d)
A to E	39,524
CDE 2nd Stage OTSGs	6,695
F and G	29,224
H	25,572
A to H	**101,015**

These design values are based on a PWSR equal to 1.0 and an updated SOR of approximately 2.0. Higher water rates may occur as a result of a PWSR greater than one, or optimization of steam rates.

21.1.2.4 Produced Gas Rates

The most recent forecasts for the Christina Lake facility show a continuing upward trend in produced gas rates and Gas to Oil Ratio (GOR), peaking in Q1 2022 before declining through to Q1 2027.

Increases in produced gas rates are tied to the timing of well pad co-injection and blowdown programs that are forecasted for the Project. Co-injection and blowdown are crucial strategies for Christina Lake reservoir and SOR management.

At the planned first oil date for the Project, forecast data shows a GOR of 11 and 23 Sm^3 of dry produced gas per m^3 of bitumen on the Phase FG trunk, and full field, respectively. The estimated GOR includes produced gas from the reservoir, as well as recycled gas from the co-injection and blowdown operations.

Forecast produced gas flow rates are provided in Table 21-9.

Table 21-9 Produced Gas Rates

Phase(s)	Produced Gas Rates Design Case[(a)] (e^3Sm^3/d)	Produced Gas Rates Sensitivity Case[(b)] (e^3Sm^3/d)
A to E	406.9	802.4
CDE 2nd Stage OTSGs	62.1	122.5
F and G	293.2	578.1
H	146.6	289.0
A to H	**908.8**	**1,792.0**

NOTES:
(a) Design case is based on a GOR of 18
(b) Sensitivity case is based on a GOR of 36

21.1.2.5 Lift Gas Rates

The CLTP no longer utilizes gas lift for SAGD production.

21.1.3 Central Processing Facility Production Description

21.1.3.1 Production Processing

The Project has made limited change to the scope of this system since the Phase H application. Changes include the addition of several produced water/glycol heater exchangers.

Reference process flow diagrams are found in Appendix H:

- CL1H-42-PFD-04-0140-001
- CL1H-42-PFD-04-0141-001
- CL1H-42-PFD-04-0142-001
- CL1H-42-PFD-04-0150-001
- CL1H-42-PFD-04-0152-001
- CL1H-42-PFD-04-0160-001
- CL1H-42-PFD-04-0162-001

New production processing equipment required for the Project is listed in Table 21-10.

Table 21-10 Project Production Processing Equipment

Equipment Description	Equipment Identification Number
Produced Water/Glycol Exchangers	E-4450F E-4550F E-4650A-F

21.1.3.2 Desanding System

No changes required to this section.

21.1.4 Heat Recovery Integration

Other than Boiler Feed Water Heating equipment, the Project has made no change to the scope of this system since the Phase H application.

Reference process flow diagrams (PFDs) are found in Appendix H:

- CL1H-42-PFD-02-0140-001
- CL1H-42-PFD-02-0161-001
- CL1H-42-PFD-02-0161-002

- CL1H-42-PFD-02-0161-005
- CL1H-42-PFD-04-0160-001
- CL1H-42-PFD-05-0140-001
- CL1H-42-PFD-06-0140-001

21.1.4.1 Boiler Feed Water Heating

The Project has provided additional BFW booster and charge pumps, and BFW/Blowdown Exchanger as listed in Section 21.1.8 below.

Reference PFDs are found in Appendix H:

- CL1H-42-PFD-02-0140-01
- CL1H-42-PFD-02-0161-001
- CL1H-42-PFD-02-0161-002
- CL1H-42-PFD-02-0161-005

21.1.4.2 Sales Oil/Diluent Heat Exchange

No changes required to this section.

21.1.4.3 Glycol System

The Project has made limited change to the scope of this system since the Phase H application. Changes include several glycol air coolers to increase cooling capacity.

Reference PFDs are found in Appendix H:

- CL1H-42-PFD-07-0142-001
- CL1H-42-PFD-07-0142-002

New glycol system equipment required for the Project is listed in Table 21-11.

Table 21-11 Project Glycol System Equipment

Equipment Description	Equipment Identification Number
Glycol Air Coolers	AC-7351A-J

21.1.5 Make-up Water and Produced Water Treatment

21.1.5.1 Make-up Water Treatment

There are no changes required to this system as a result of the Project.

21.1.5.2 Produced Water Treatment

The Project proposes the implementation of a CFU to replace the IGF equipment proposed in the Phase H application. Changes to the produced water de-oiling system are further discussed below.

Reference PFDs for Phase H are found in Appendix H:

- CL1H-42-PFD-01-0161-001
- CL1H-42-PFD-01-0161-002
- CL1H-42-PFD-01-0162-001
- CL1H-42-PFD-01-0163-001
- CL1H-42-PFD-01-0164-001
- CL1H-42-PFD-01-0166-001
- CL1H-42-PFD-01-0166-002

Producing Water De-Oiling

In the Project, the de-oiling train consists of a process water (PW) Surge Tank, CFU, and Oil Removal Filter (ORF). The PW Surge Tank gathers produced water from Phases F, G, and H. Produced water is pumped to the CFU which is designed for 99% bulk oil removal. From the CFU, produced water is routed to a set of ORFs for final oil removal.

The ORFs, which are hydromation filters common to the heavy oil industry, capture residual traces of dispersed oil from the produced water. Hydromation filters can remove about 90% of finely dispersed oil droplets from a produced water stream. The filter feed stream is expected to contain between 10 to 20 ppm of finely dispersed oil. The de-oiled water from the filters will normally contain less than 2 ppm residual oil and is acceptable for the Warm Lime Softeners (WLSs).

Produced water from the ORFs is routed to the De-oiled Water Tank. The tank provides surge capacity and reserve water to accommodate minor upsets and normal flow fluctuations.

Skim oil from the PW Surge Tank is routed to an Oil Recycle Tank where water is separated from the oil. Separated oil is recovered to the free water knock-out drum via the off-spec oil header. Separated water is recycled back to the PW Surge Tank.

New produced water de-oiling system equipment required for the Project is listed in Table 21-12.

Table 21-12 Project Produced Water De-oiling System Equipment

Equipment Description	Equipment Identification Number
PW Surge Tank	T-0515
CFU Feed Pumps	P-0520A/B/C
CFU Package	PK-0525
Skim Vessels	V-0522A/B/C

Table 21-12 Project Produced Water De-oiling System Equipment

Equipment Description	Equipment Identification Number
Compact Flotation Units (CFU)	V-0525A/B/C
Reject Vessel	V-0527
Oil Removal Filter Packages (ORFs)	PK-0540D
De-oiled Water Pumps	P-0558D
Oil Recycle Tanks	T-0545B
Oil Recycle Pumps	P-0548A/B
Water Recycle Pumps	P-0550A/B
De-oiling Polymer Injection Package	PK-0779, T-0778

Water Softening System

No changes required to this system as a result of the Project.

21.1.5.3 Boiler Blowdown Recycle

No changes required to this section.

21.1.5.4 Water Disposal – Blowdown and Regeneration Waste

No changes required to this section.

21.1.5.5 Produced Water Disposal

No changes required to this section.

21.1.6 Utilities

With the exception of electricity/cogeneration, the Project will not significantly change any of the other Phase H utilities equipment.

21.1.6.1 Cogeneration

The Project includes two 48 MW GTGs for electricity and steam cogeneration. Electricity from the cogeneration units in Phases F and H (as well as the grid for back-up) will be used to supply power to the CPF, including Phase H. The existing Sunday Creek substation with a possible bus expansion will accommodate the Phase H Cogeneration feeds.

Reference energy balances are found in Appendix G.

Reference PFDs for utilities are found in Appendix H:

- CL1H-42-PFD-07-0141-001

- CL1H-42-PFD-07-0142-001
- CL1H-42-PFD-07-0142-002
- CL1H-42-PFD-07-0143-001
- CL1H-42-PFD-07-0144-001
- CL1H-42-PFD-07-0145-001
- CL1H-42-PFD-07-0145-003
- CL1H-42-PFD-07-0147-001
- CL1H-42-PFD-07-0148-001

21.1.7 Fluid Storage

The Project has made limited change to the scope of this system since the original Phase H application. Changes include the addition of two diluent/glycol exchangers.

Reference PFDs are found in Appendix H:

- CL1H-42-PFD-06-0140-001
- CL1H-42-PFD-06-0141-001
- CL1H-42-PFD-06-0141-002

New Diluent System equipment required for the Project is listed is in Table 21-13.

Table 21-13 Project Diluent System Equipment

Equipment Description	Equipment Identification Number
Diluent/Glycol Exchangers	E-4065C1/C2

21.1.8 Steam Generation

The Project is proposing to increase steam generation capacity through the addition of two 112 MW HRSGs. The Project will also include additional boiler feedwater/blowdown/glycol heat exchange to increase heat integration.

Reference PFDs for the steam generation system are found in Appendix H:

- CL1H-42-PFD-02-0140-001
- CL1H-42-PFD-02-0161-001
- CL1H-42-PFD-02-0161-002
- CL1H-42-PFD-02-0161-004
- CL1H-42-PFD-02-0162-005

New steam generation equipment required for the Project is listed in Table 21-14.

Table 21-14 Project Steam Generation Equipment

Equipment Description	Equipment Identification Number
HRSGs	B-5600/5650
Gas Turbines	GT-5500/5550
HP Natural Gas Filters/Separators	F-5495A/B
HP Natural Gas Heater	EH-5494
Steam Separators	V-5700
BFW / Blowdown Exchangers	E-5705
Blowdown/Glycol Exchangers	E-5710
BFW Booster Pumps	P-3010H
BFW Charge Pumps	P-3015H

21.1.9 Vapour Recovery System

The Project has made limited change to the scope of this system since the Phase H application. Changes include the addition of a PW Surge Tank and Oil Recycle Tank.

Reference PFDs for the vapour recovery system are found in Appendix H:

- CL1H-42-PFD-07-0140-001
- CL1H-42-PFD-07-0140-002

New waste gas sources tied into vapour recovery equipment are detailed in Table 21-15.

Table 21-15 Project Equipment with Vapour Recovery

Equipment Description	Equipment Identification Number
PW Surge Tank	T-0515
Oil Recycle Tank	T-0545B

21.1.10 Sulphur Removal Facility

The produced gas handling facilities at the Phase A-E and F-H CPFs include dedicated Non-Regenerative Scavenger Unit (NRSU) trains that utilize a triazine-based chemical to remove sulphur from the produced gas streams. The current Phase A-E and F-H NRSU design configuration is provided in Figure 21-2, below.

The NRSU design is based on a GOR of 11 Sm^3 gas per m^3 of bitumen and a Sulphur to Bitumen Ratio of 0.2 kg S per m^3 of bitumen.

As given in Section 21.1.2.4, the forecast GOR for the CLTP ranges from 18 to 36 and is significantly higher than the design GOR for the Phase A-E and F-H NRSU trains. Based on the forecast GOR, Cenovus anticipates a produced gas rate of up to 1,792 e^3m^3/d, and due to hydraulic limitations, a partial

bypass of the NRSUs is required. Given this, Cenovus proposes to maintain the current SO_2 limit of 7.0 t/d issued under *EPEA* Approval No. 48522-01-14 for the Project. An ambient air quality assessment has been completed for the proposed emission limit and the modeled ground level SO_2 concentrations are predicted to be within the Alberta Ambient Air Quality Objectives (see Appendix F).

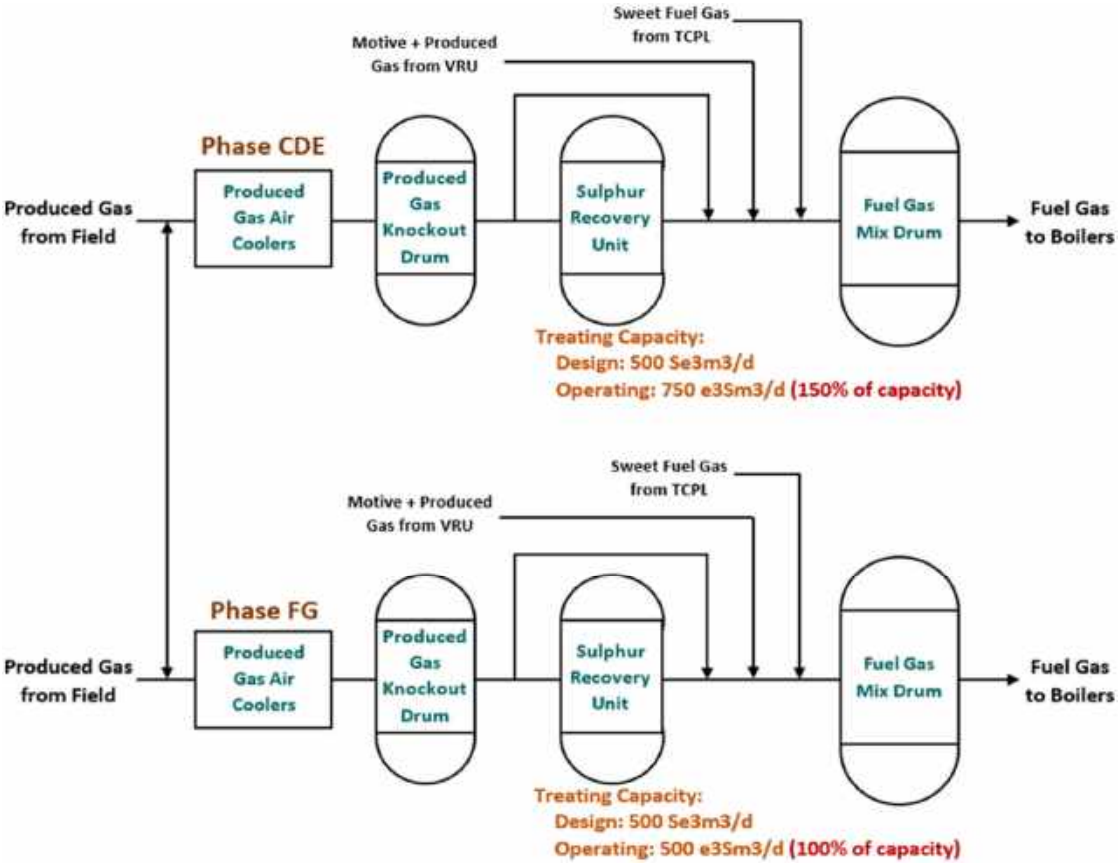


Figure 21-2 CLTP NRSU Design Configuration

21.1.11 Flare System

No changes required to this section.

21.1.12 Blend and Diluent Storage Terminal

No changes required to this section.

21.1.13 Offsites Process Description

No changes required to this section.

21.1.14 Roads and Infrastructure

No changes required to this section.

21.1.15 Design Standards

The Project will apply the same design standards as the original Phase H application.

21.2 PROPOSED CHANGES TO GENERATED SUBSTANCES

Refer to Section 21.15 to 21.18 for details on emission streams to air resulting from the combustion of fuel gas.

The Project's waste streams will be integrated into the existing CLTP waste management system. The Project will generate solid and liquid waste streams associated with the cooling system's heat medium (coolant), lubrication oil and filters, wash water, and domestic waste from operations. Under normal operating conditions the cooling system's heat medium is fully contained within the system. Demineralized wash water will be used to clean the gas-turbine during maintenance operations.

21.3 EFFICIENCY OPTIMIZATION, SUBSTANCE RELEASE REDUCTION, AND WASTE MINIMIZATION

The concept of total recycle of produced water will be maintained in Phase H, except for the 2nd stage blowdown which cannot be recycled. Make-up water is currently drawn from the Basal McMurray source wells. Christina Lake facilities are designed to recycle between 0 and 75% of the steam generator blowdown, excluding the 2nd stage steam generator blowdown. Recycling blowdown acts to reduce water requirements for make-up and minimize water consumption and disposal rates. The make-up water treatment system is designed to satisfy the water make-up requirements assuming no boiler blowdown recycle. Blowdown recycle will be maximized; however, short-term upsets in blowdown recycle may occur intermittently during plant upsets or start-up scenarios.

21.4 FOOTPRINT MINIMIZATION

The Project will be located entirely within the existing footprint of the CLTP CPF, thereby not requiring development of any previously undisturbed land. Water and wastewater systems will be integrated into the existing facilities and the general operations of the CLTP.

21.5 SCALED DIAGRAMS OF THE PLANT

Scale diagrams of the Project (plot plans) are provided in Appendix C.

21.6 PROPOSED CHANGES TO MATERIAL STORAGES

A list of new tanks to be installed for the Project are provided in Table 21-16.

Table 21-16 Storage Tanks

Tank Status	Tank ID	Description of Tank	Location	Contents	Capacity (m^3)	Placement	Material of Primary Container	Corrosion Control	Secondary Containment	Method of Leak Detection	Maximum True Vapour Pressure	Type of Vents	Fugitive Emissions Controls
Proposed	T-0515	Produced Water Surge Tank	Outside	Produced Water		Above Grade	Carbon Steel	Devchem 256	Liner and Berm	API 650 Annex 1	95 kPaa @90C	PVSV	Vapour Control Unit
Proposed	T-0545B	Oil Recycle Tank	Outside	Produced Water/Oil	590	Above Grade	Carbon Steel	Enviroline 405HTR/ Devchem 256	Liner and Berm	API 650 Annex 1	95 kPaa @90C	PVSV	Vapour Control Unit

21.7 PROPOSED CHANGES TO COLLECTION AND STORAGE PERFORMANCE MONITORING

There are no proposed changes to collection or storage performance monitoring. All new required tanks will meet Secondary Containment guidelines and be included in existing regular maintenance activities at the CLTP. All chemicals stored in the new tanks are considered non-hazardous.

21.8 PROPOSED CHANGES TO TREATMENT AND CONTROL SYSTEMS

Not applicable. The Project does not require changes to the existing treatment and control systems. The Project will be integrated into the existing CLTP CPF wastewater treatment and release control systems. The project does result in an increase to anticipated disposal water volumes, and an updated hydrogeological assessment for the Project is included as Appendix E.

21.9 PROPOSED CHANGES TO SUITABILITY AND CAPACITY OF WASTEWATER TREATMENT AND RELEASE CONTROL

Not applicable. The Project will be integrated into the existing CLTP CPF wastewater treatment and release control systems.

21.10 SCALED DIAGRAM OF PROPOSED CHANGES TO TREATMENT FACILITIES AND DISPOSAL LOCATIONS

Not applicable. There are no changes to the CLTP CPF treatment and disposal locations.

21.11 PROPOSED CHANGES TO MONITORING FOR PERFORMANCE EVALUATION

Not applicable. There are no changes to the CLTP CPF performance monitoring and evaluation

21.12 CHANGES IN LOCATION AND TO RELEASE OF TREATED WASTEWATER

Not applicable. There are no proposed changes to the location and release of treated wastewater. The Project does result in an increase to anticipated disposal water volumes, and an updated hydrogeological assessment for the Project is included as Appendix E.

21.13 PROPOSED CHANGES TO AMBIENT MONITORING FOR WASTEWATER RELEASE

Not applicable. No changes are proposed to the monitoring and reporting programs that are conducted as per *EPEA* Approval 48522-01-14 (as amended).

21.14 PROPOSED CHANGES TO WASTEWATER RELEASE AND DISPOSAL DETAILS

Not applicable. There are no proposed changes to the release and disposal of treated wastewater.

21.15 PROPOSED CHANGES TO SUBSTANCES RELEASED TO AIR

The primary substances of interest associated with the Project are SO_2 and NO_X. Oxides of nitrogen are produced in most combustion processes and are almost entirely made up of nitric oxide (NO) and NO_2. Together they are often referred to as NO_X.

21.16 PROPOSED CHANGES TO NATURE OF AIR EMISSIONS

The emission rates and substances released to the air for the new cogeneration units are provided in Table 21-17 in Section 21.18. An air quality assessment, including the specifications and emission data for the new cogeneration units and the approved CLTP emission sources, is provided in Appendix F.

The addition of the two cogeneration units are anticipated to increase the CLTP NOx emissions by 11%. The total SO_2 emissions from the CLTP remain the same at 7 t/d after the addition of the cogeneration units (see Appendix F).

21.17 AIR EMISSIONS MINIMIZATIONS

An air quality assessment, including the specifications and emission data for the two new cogeneration units is provided in Appendix F. The Project is predicted to decrease the maximum concentrations within the air quality study area in the range of 0 to 3% (see Section 21.22). The predicted decrease is due to updated NO_X and SO_2 emission rates after the Project addition.

21.18 AIR EMISSION DETAILS

Approved air emission sources at the CLTP includes 29 steam generators, 6 glycol heaters, 4 flash treaters, and 2 cogeneration units. The Project consists of two proposed cogeneration units that burn natural gas in the turbines and mixed fuel gas in the HRSGs.

An air quality assessment, including the specifications and emission data for the two new cogeneration units is provided in Appendix F. The emission rates for the two new cogeneration units are presented in Table 21-30 below. A simplified plot plan with emission source stack locations is provided as Figure 21-3. The emission rates for the 41 approved sources are provided in Table 4-2 of the Appendix F.

Table 21-17 Stack and Emission Parameters Associated with the Two New Cogeneration Units at the CLTP

Source identification No.		**GT-5500 Turbine**	**GT-5500 HRSG Boiler**	**GT-5550 Turbine**	**GT-5550 HRSG Boiler**
Unit Name / Description		**Cogeneration Unit [a]**		**Cogeneration Unit [a]**	
Temporal Variation		Continuous	Continuous	Continuous	Continuous
Capacity - Heat Input (HHV)	MW	135	81.3	135	81.3
	MMBtu/h	461	277	461	277
Efficiency (HHV)	%	73.7		73.7	
Fuel Type	-	Sweet fuel gas (natural gas)	Mixed fuel gas	Sweet fuel gas (natural gas)	Mixed fuel gas
Fuel Consumption	10^3 Sm^3/d [b]	287	179	287	179
Stack Location					
UTM NAD 83	m E	507181		507197	
UTM NAD 83	m N	6159898		6159870	
Base Elevation of Stack	m ASL	564		564	
Stack Dimensions					
Height Above Base Elevation	m	32		32	
Inside Tip Diameter	m	3.34		3.34	
Exhaust Parameters					
Exit Velocity	m/s	22.7		22.7	
Exit Temperature	C	204		204	
	K	474		474	
Emission Rate					
NO_X [c]	t/d	0.961		0.961	
SO_2	t/d	0.167		0.167	

NOTES:

[a] The power output of the turbine of each cogeneration unit is 47.5 MW.

[b] Sm^3/d: referenced to 15 C and 101.325 kPa.

[c] NOx emission rates are calculated based on ECCC 2017 Guideline (ECCC 2017) (see Appendix F).

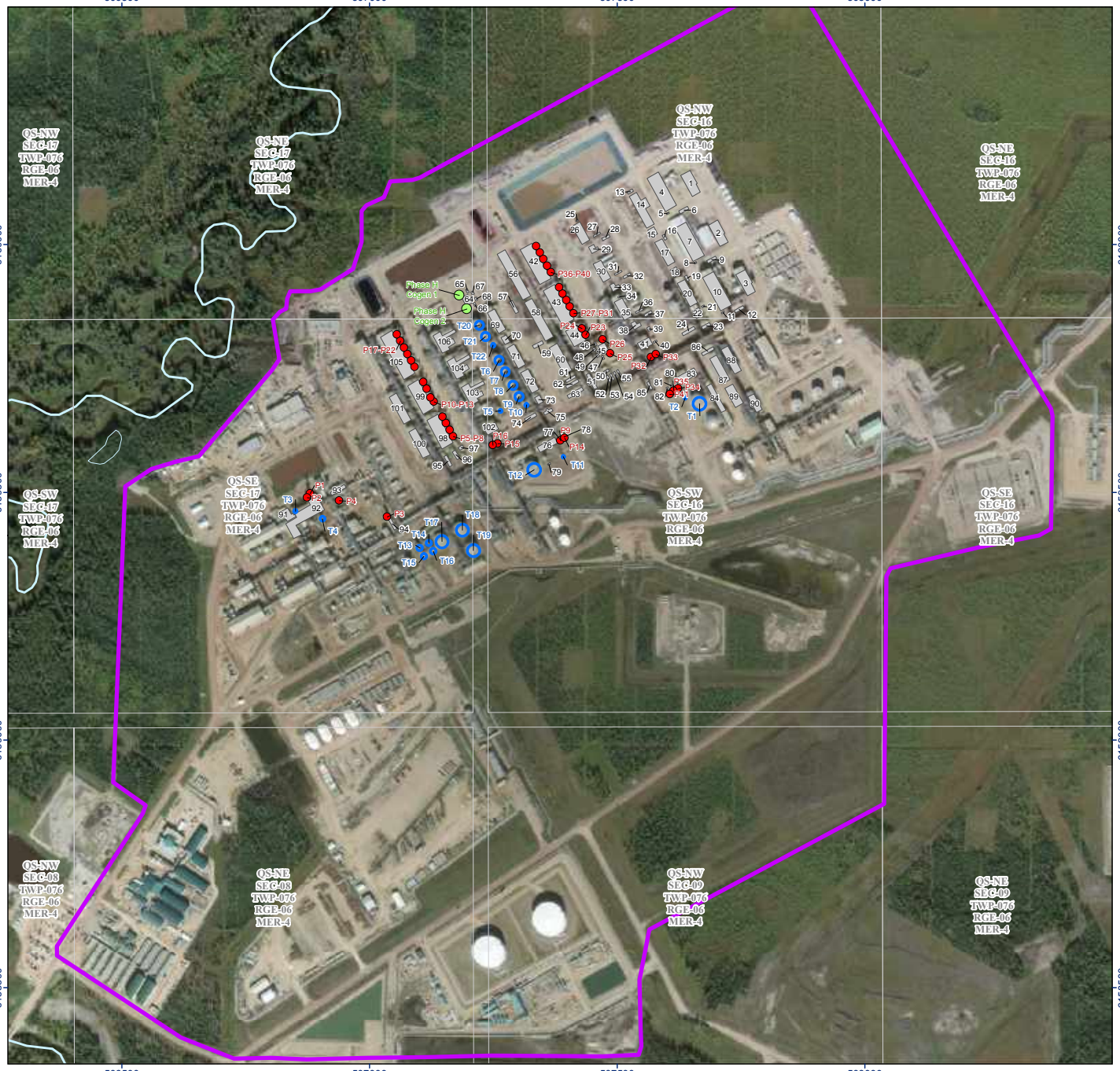


Figure No.
21-3
Title
Simplified Plot Plan

Client/Project
Cenovus
Christina Lake Cogen
EPEA

123513310 REVA

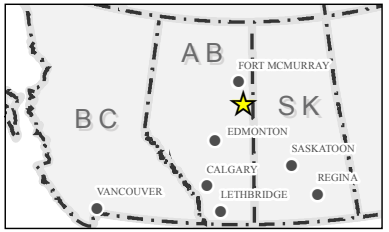
Project Location
Christina Lake, AB

Prepared by CMELLISHIP on 2019-12-18
TR by SLEMAY on 2020-01-16
IR Review by ETHOMSON on 2020-01-16

N

0 150 300 metres
(At original document size of 8.5x11)
1:12,000

- New Stack - Phase H Optimization Project
- Stack
- Building
- Christina Lake Central Processing Facility
- Tank
- Watercourse
- Quarter Section
- Waterbody



Notes
1. Coordinate System: NAD 1983 UTM Zone 12N
2. Data Sources: Canvec; Altalis
3. Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Stantec cenovus ENERGY

Figure 21.3

\\Ca0002-ppfss03\geomatics\Clients\Cenovus\Christina Lake Cogen EPEA\Figures\fig 21-3 123513310 Simplified Plot Plan.mxd Revised: 2020-01-20 By: cmellishi

21.18.1 Greenhouse Gas Emissions

Cenovus's corporate strategy for greenhouse gas (GHG) management is to reduce GHG emissions intensity from its operating facilities. The corporate goal is to reduce per-barrel GHG emissions by 30 percent by the end of 2030, and to achieve net-zero emissions by 2050.

GHG emissions for the Project have been calculated and are presented in Table 21-18.The Project does not offset any emissions from previously approved OTSGs at the CLTP; however, the additional power that will be produced by the Project does offset GHGs from the Alberta Power generation pool, as CLTP will require less power from the grid as a result of the Project. No offsets have been factored into the GHG estimate as presented.

Table 21-18 GHG Emissions for the Project

Parameters	Units	Cogeneration Unit GT-5500/GT-5550		Cogeneration Unit GT-5500/GT-5550	
		Turbine	HRSG	Turbine	HRSG
CO_2 Emission	tonnes/yr	211,828	131,926	211,828	131,926
CH_4 Emission	tonnes/yr	3.88	2.42	3.88	2.42
N_2O Emission	tonnes/yr	3.46	2.16	3.46	2.16
CO_2eq	tonnes/yr	212,957	132,629	212,957	132,629

21.19 PROPOSED CHANGES TO FLARE PIT DETAILS

Not applicable. The Project's components do not require flare pits.

21.20 PROPOSED CHANGES TO FUGITIVE EMISSIONS

Not applicable. Fugitive emissions associated with the Project are expected to be consistent with those assessed in the Phase H and Eastern Expansion Application.

21.21 PROPOSED CHANGES TO NON-POINT EMISSION SOURCES

Not applicable. There are no non-point emission sources associated with the Project.

21.22 DISPERSION MODELLING OF TREATMENT AND CONTROL SYSTEMS

Potential effects on ambient air quality were evaluated using the CALPUFF dispersion model in accordance with the AEP Air Quality Model Guideline, and are presented in Appendix F. Dispersion modelling for the Application Case includes emissions from the existing regional emission sources, in combination with the CLTP existing and approved emission sources and the two proposed cogeneration

units. The maximum predicted concentrations, are summarized in Table 21-19, including the background concentrations.

The maximum predicted 1-hour, 24-hour, 30-day and annual average ground-level SO_2 concentrations associated with the Application Case are 299, 113, 14.5, and 8.17 µg/m^3, respectively. These values include ambient background and are less than the corresponding AAAQO.

Using the Ozone Limiting Method (OLM), The maximum predicted 1-hour and annual average ground-level NO_2 concentrations associated with the Application Case are 128 and 13.9 µg/m^3, respectively. These values include ambient background and are also less than the corresponding AAAQO.

Compared to the Base Case, the Project is predicted to decrease the maximum concentrations within the study area in the range of 0 to 3% (see Appendix F). The predicted decrease is due to updated NO_X and SO_2 emission rates after the Project addition. The addition of the two cogeneration units is predicted to have a minimal impact on ambient air quality.

Table 21-19 Maximum Predicted Ground-level Concentrations (µg/m^3) Associated with the Application Case

Substance	Averaging Period	Maximum Predicted Ground-Level Concentrations (µg/m^3)	Ambient Background Concentration (µg/m^3)	Maximum Predicted Concentration Including Background (µg/m^3)	AAAQO (µg/m^3)	Comparison of Predictions to AAAQO (%)
SO_2	1-hour [b]	297	2.62	299	450	66
	24-hour	110	2.62	113	125	90
	30-day	13.8	0.65	14.5	30	48
	Annual	7.82	0.35	8.17	20	41
NO_2 [a]	1-hour [b]	118	10.0	128	300	43
	Annual	10.6	3.31	13.9	45	31

NOTES:
[a] NO_x was converted to NO_2 using the Ozone Limiting Method (OLM).
[b] 9th highest predictions (ESRD 2013).

21.23 PLANT AIR EMISSION DIAGRAM

See Figure 21-3 for the simplified plot plan showing the stack locations of all the CLTP emission sources.

21.24 PROPOSED CHANGES TO MONITORING FOR PERFORMANCE EVALUATION OF TREATMENT AND CONTROL SECTIONS

Not applicable. There are no proposed changes to the monitoring or performance evaluations for the CLTP.

21.25 PROPOSED CHANGES TO LOCATION AND MONITORING OF AMBIENT AIR QUALITY

CLTP currently conducts ambient air quality monitoring as per the requirements of *EPEA* Approval 48522-01-14, as amended. There are no proposed changes to ambient air quality monitoring as a result of the Project.

21.26 AIR EMISSIONS RELEASE AND DISPOSAL METHODS

Air emissions for the Project are presented in Section 21.18 and Appendix F.

21.27 PROPOSED CHANGES TO EXISTING OPERATIONAL AND MANAGEMENT SYSTEMS

Not applicable. There are no proposed changes to existing operational and management systems as the Project will be an addition to the current processes at the CLTP CPF.

21.28 EVALUATION OF NEW OPERATIONAL AND MANAGEMENT SYSTEMS

Not applicable. There are no proposed changes to existing operational and management systems as the Project will be an addition to the current processes at the CLTP CPF.

22.0 AMENDED OR FINAL RECLAMATION PLAN

The Project is located within the existing CLTP CPF disturbance area. There are no changes to the reclamation plan completed for the CLTP as a result of the Project. However, as required by the existing *EPEA* approval, within six months of the CLTP ceasing operation, Cenovus will prepare and submit a Decommissioning and Land Reclamation Plan to the AER.

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23.1 LITERATURE CITED

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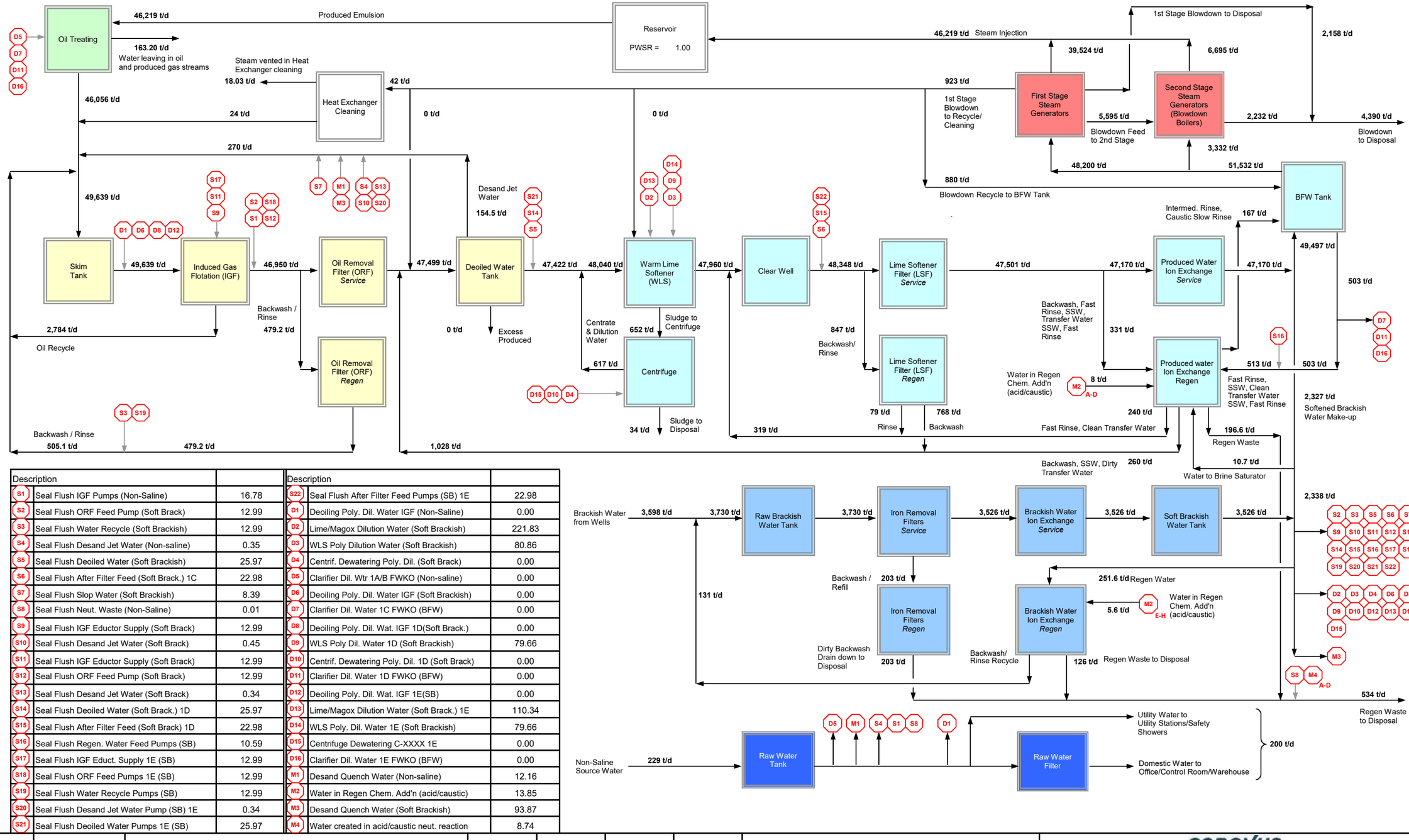
APPENDIX G

Heat and Material Balance, Energy Balance, Water Balance



	Description			Description	
S1	Seal Flush IGF Pumps (Non-Saline)	16.78	S22	Seal Flush After Filter Feed Pumps (SB) 1E	22.98
S2	Seal Flush ORF Feed Pump (Soft Brack)	12.99	D1	Deoiling Poly. Dil. Water IGF (Non-Saline)	0.00
S3	Seal Flush Water Recycle (Soft Brackish)	12.99	D2	Lime/Magox Dilution Water (Soft Brackish)	221.83
S4	Seal Flush Desand Jet Water (Non-saline)	0.35	D3	WLS Poly Dilution Water (Soft Brackish)	80.86
S5	Seal Flush Deoiled Water (Soft Brackish)	25.97	D4	Centrif. Dewatering Poly. Dil. (Soft Brack)	0.00
S6	Seal Flush After Filter Feed (Soft Brack.) 1C	22.98	D5	Clarifier Dil. Wtr 1A/B FWKO (Non-saline)	0.00
S7	Seal Flush Slop Water (Soft Brackish)	8.39	D6	Deoiling Poly. Dil. Water IGF (Soft Brackish)	0.00
S8	Seal Flush Neut. Waste (Non-Saline)	0.01	D7	Clarifier Dil. Water 1C FWKO (BFW)	0.00
S9	Seal Flush IGF Eductor Supply (Soft Brack)	12.99	D8	Deoiling Poly. Dil. Wat. IGF 1D(Soft Brack.)	0.00
S10	Seal Flush Desand Jet Water (Soft Brack)	0.45	D9	WLS Poly Dil. Water 1D (Soft Brackish)	79.66
S11	Seal Flush IGF Eductor Supply (Soft Brack)	12.99	D10	Centrif. Dewatering Poly. Dil. 1D (Soft Brack)	0.00
S12	Seal Flush ORF Feed Pump (Soft Brack)	12.99	D11	Clarifier Dil. Water 1D FWKO (BFW)	0.00
S13	Seal Flush Desand Jet Water (Soft Brack)	0.34	D12	Deoiling Poly. Dil. Wat. IGF 1E(SB)	0.00
S14	Seal Flush Deoiled Water (Soft Brack.) 1D	25.97	D13	Lime/Magox Dilution Water (Soft Brack.) 1E	110.34
S15	Seal Flush After Filter Feed (Soft Brack) 1D	22.98	D14	WLS Poly. Dil. Water 1E (Soft Brackish)	79.66
S16	Seal Flush Regen. Water Feed Pumps (SB)	10.59	D15	Centrifuge Dewatering C-XXXX 1E	0.00
S17	Seal Flush IGF Educt. Supply 1E (SB)	12.99	D16	Clarifier Dil. Water 1E FWKO (BFW)	0.00
S18	Seal Flush ORF Feed Pumps 1E (SB)	12.99	M1	Desand Quench Water (Non-saline)	12.16
S19	Seal Flush Water Recycle Pumps (SB)	12.99	M2	Water in Regen Chem. Add'n (acid/caustic)	13.85
S20	Seal Flush Desand Jet Water Pump (SB) 1E	0.34	M3	Desand Quench Water (Soft Brackish)	93.87
S21	Seal Flush Deoiled Water Pumps 1E (SB)	25.97	M4	Water created in acid/caustic neut. reaction	8.74

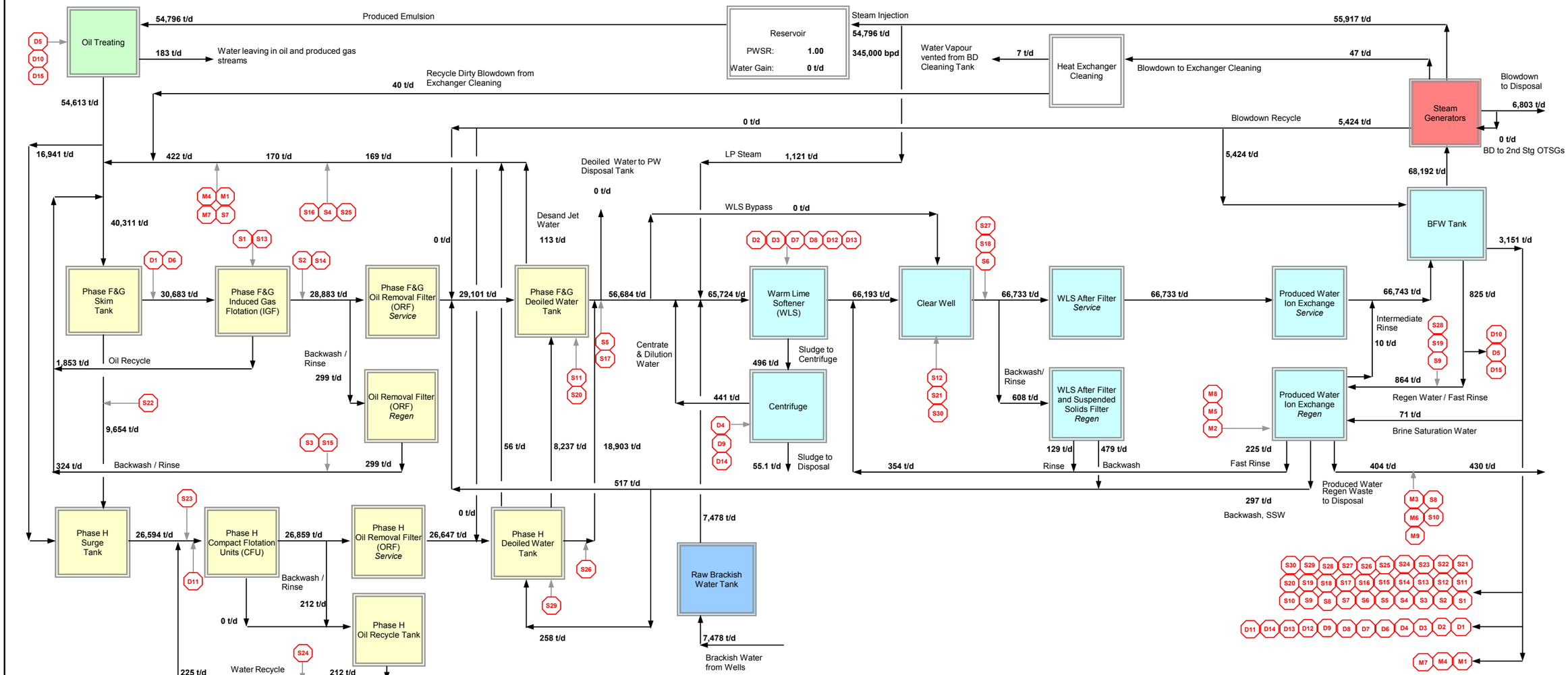
REV	DATE	DESCRIPTION	BY	CHKD	APPD	APPD
B	29-Nov-2019	Re-Issued for Regulatory Approval	SRP			
A	20-Aug-2012	Issued for Regulatory Approval	CJG	MDE		

Cenovus FCCL Partnership

TITLE

CHRISTINA LAKE COMMERCIAL PLANT
Overall Water Plant Block Diagram Phase 1A-E Debottleneck
Phase 1A-E Debottleneck

PROJECT	PROJ. NO	DOCUMENT NUMBER	REV
Christina Lake Phase 1A-E	-	CL1-42-WTR-00-300-01	B



1H	1G	1F	Description	Rate, tonne/d
	S13	S1	Seal Flush IGF Eductor Supply (Process W)	25.97
	S14	S2	Seal Flush ORF Feed Pump (Process W)	25.97
S24	S15	S3	Seal Flush Water Recycle (Process W)	38.96
S25	S16	S4	Seal Flush Desand Jet Water (Process W)	1.36
S26	S17	S5	Seal Flush Deoiled Water (Process W)	90.91
S27	S18	S6	Seal Flush After Filter Feed (Process W)	68.93
		S7	Seal Flush Slop Water (Process W)	8.39
		S8	Seal Flush PW Disposal (Process W)	12.99
S28	S19	S9	Seal Flush Brine Pump (Process W)	38.96

1H	1G	1F	Description	Rate, tonne/d
	D6	D1	Deoiling Poly. Dil. Water IGF (Process W)	0.00
D12	D7	D2	Lime/Magox Dilution Water (Process W)	545.55
D13	D8	D3	Flocculant Poly Dilution Water (Process W)	65.73
D14	D9	D4	Centrif. Dewatering Poly. Dil. (Process W)	0.00
D15	D10	D5	Clarifier Dil. Water 1F FWKO (BFW)	0.00
M7	M4	M1	Desand Quench Water (Process W)	243.18
M8	M5	M2	Water in PW Chem. Add'n (acid/caustic)	1.06
M9	M6	M3	Water in Waste Add'n (acid/caustic)	0.00
		S10	Seal Flush Regen Waste Water P (PW)	12.99

1H	1G	1F	Description	Rate, tonne/d
S29	S20	S11	Sample Coolers -Deoling Area (Process W)	755.22
S30	S21	S12	Sample Coolers -WT Area (Process W)	1078.89
S22			Seal Flush PW Transfer Pump (Process W)	25.97
S22			Seal Flush CFU Feed Pump (Process W)	12.99
D11			CFU Flocculant Poly Dilution Water (Process W)	26.83

Water Reporting		
	Result	Max/Limit
Fresh Make-Up	0.0%	10%
Brackish Make-Up	11.8%	25.0%
PW Use	88.2%	75.0%

REV	DATE	DESCRIPTION	BY	CHKD	APPD	APPD
A	10/Jul/2019	Issued for Regulatory Application	BJZ	RVG	KUL	

CONSULTANT LOGO

Vista Projects

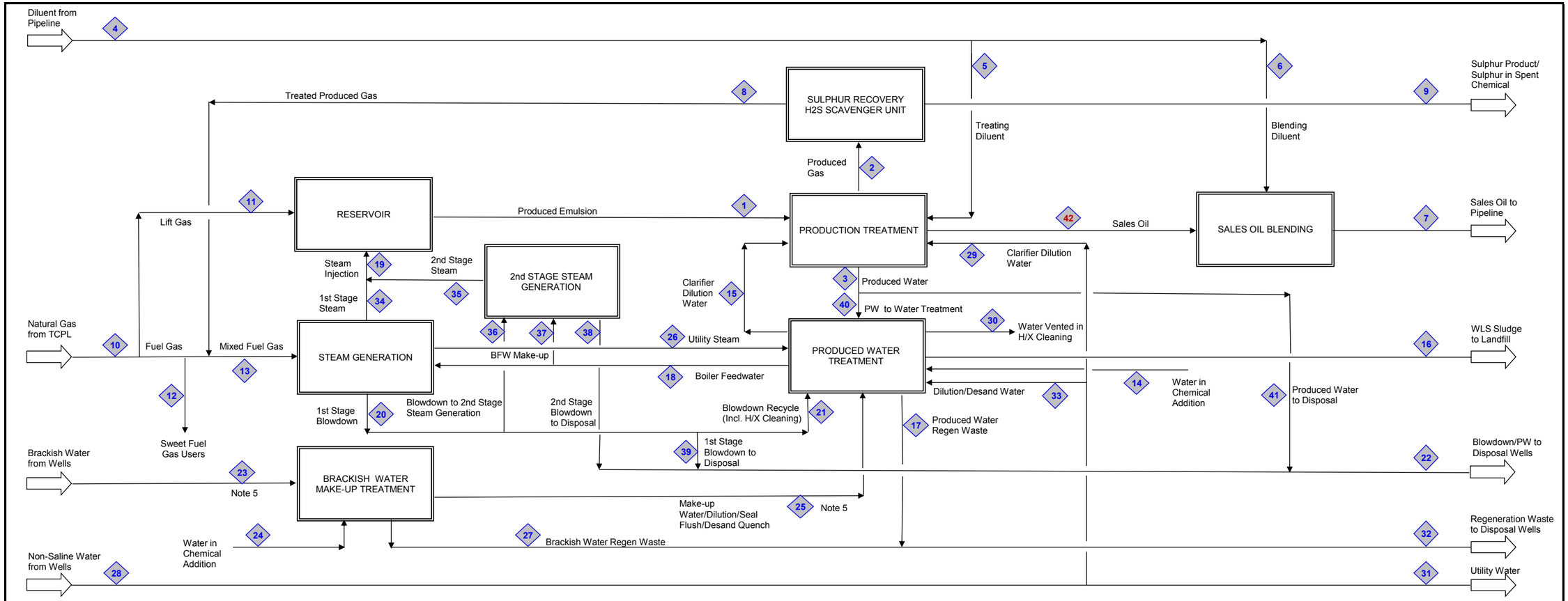
cenovus ENERGY

Cenovus FCCL Partnership

TITLE

CHRISTINA LAKE COMMERCIAL PLANT
Overall Water Plant Block Diagram Phase 1F and Phase 1G and Phase 1H
PWSR = 1.0, 100% BFW Feed, 50% of BD Recycle

PROJECT	PROJ. NO	DOCUMENT NUMBER	REV
Christina Lake Phase 1H	CL1H	CL1-42-WTR-00-400-01-REG	A



	1 Produced Emulsion	2 Produced Gas	3 Produced Water(1)	4 Diluent from Pipeline	5 Treating Diluent	6 Blending Diluent	7 Sales Blend	8 Treated Prod Gas	9 Sulphur Product(2)	10 TCPL Gas	11 Lift Gas	12 Sweet Fuel Gas Users	13 Mixed Fuel Gas	14 Water in PW Chem Addition	15 Clarifier Dilution Water	16 WLS Sludge	17 Prod Wtr Regen Waste	18 Boiler Feed Water	19 Injection Steam(4)	20 1st Stage Blowdown	21 Blowdown Recycle (Incl. H/X Cleaning)	22 Blowdown to Disposal Wells	23 Raw Brackish Water	24 Water in BW Chem Addition	25 Make-up Water	26 Utility Steam	27 Brackish Water Regen Waste	28 Non-Saline Water	29 Clarifier Dilution Water	30 Water Vented in H/X Cleaning	31 Non-Saline Domestic	32 Regen Waste to Disposal Wells
Prod Gas, Sm³/d	908,842	892,426	-	-	-	-	-	885,817	-	7,137,097	366,729	1,574,871	6,081,314	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diluent, Sm³/d	-	-	-	48,724	24,149	24,575	48,724	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bitumen, Sm³/d	49,283	-	-	-	-	-	49,283	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water, Sm³/d	99,569	-	99,688	-	-	-	341	-	-	-	-	-	-	8.8	398	85	608	118,027	99,569	23,648	7,533	9,803	11,166	10.8	10,756	1,121	421	292	63	18	200	1,029
Sulphur, kg/d(3)	12,334	9,960	-	-	-	-	-	996	8,964	-	-	-	996	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

1) About 341Sm³/d of water leaves the system in the sales oil stream.
2) Sulphur recovery based on operation of H_2S Scavenger Unit at 90% recovery.
3) Sulphur in produced gas 9,960 kg/d, in bitumen 887 kg/d, in water 1,487 kg/d.
4) Flow indicated is Cold Water Equivalent (CWE).
5) The minimum make-up brackish water for CL1A-E is 2700 t/d based on total critical demand for soft brackish water.

	42 Pre-Blend Sales Oil	41 Produced Water to Disposal	40 PW to Water Treatment	39 1st Stage BD to Disposal	38 2nd Stage BD to Disposal	37 BFW Make-up to 2nd Stg.	36 BD to 2nd Stg. Steam Gen.	35 2nd Stage Steam	34 1st Stage Steam	33 Dilution/ Desand Water
Prod Gas, Sm³/d	-	-	-	-	-	-	-	-	-	-
Diluent, Sm³/d	24,149	-	-	-	-	-	-	-	-	-
Bitumen, Sm³/d	49,283	-	-	-	-	-	-	-	-	-
Water, Sm³/d	341	0	99,688	7,571	2,232	383	8,544	6,695	92,874	29
Sulphur, kg/d	-	-	-	-	-	-	-	-	-	-

DRAWING NUMBER	REFERENCE DRAWING

STAMPS

REV NO	REVISION	DATE	DRN	CKD	CKD	DES	LDE	PE
A	Issued for Regulatory Approval	31 July 2012	MX	APC				
B	Issued for Regulatory Approval	7 Sept 2012	MX	APC				
C	Issued for Regulatory Approval	2 Oct 2012	MX	APC				
D	Issued for Regulatory Approval	9 July 2019	ICS	BJZ			KUL	

DESIGNED BY
DRAWN BY
CHECKED BY
LEAD ENG
PROJ ENG
WORK PKG

CONSULTANT LOGO: Vista Projects

CADD FILE NAME

PROJECT NO: CL1H

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
BLOCK FLOW DIAGRAM
PHASES 1A-H & CLCDE-BB
PWSR=1 OSA

DRAWING: CL1-42-BFD-00-143-03

REVISION: D

S:\ACTIVE PROJECTS\Cenovus\2195\06. Process\06.3 Calcs\Area 00\CL1H-42-CAL-00-007 Block Flow Diagram Update (Regulatory)\Working\CL1H-42-CAL-00-007 rA Native

Facility Overall Energy Balance			
Energy in		**Energy out**	
Produced Gas + Purchased Gas	278,581 GJ/d	Bitumen Energy	2,108,701 GJ/d
Electrical	8,973 GJ/d	Energy Diluent in Product	1,895,545 GJ/d
Bitumen Energy	2,108,701 GJ/d	Energy From Turbines	16,416 GJ/d
Diluent Feed Energy	1,914,692 GJ/d		
Total	4,310,947 GJ/d	**Total**	4,020,662 GJ/d

Facility Overall Energy Efficiency (Total Energy OUT / Total Energy IN)*100 (Note1)	
Energy Efficiency	**93.3 %**

Note:

(1) Energy Efficiency = (Total Energy OUT / Total Energy IN)*100

(Total Energy in Dilbit Product Out + Energy from Turbines) / Total Energy in Feed and Purchased Offlease

[(Energy of Diluent + Bitumen Product + Energy from Turbines) / (Energy of Diluent + Bitumen Feed + Produced Gas + Purchased Natural Gas + Electrical)]*100

Where

Diluent Product = Diluent Feed - losses to fuel gas system etc.

Bitumen Product = Bitumen Feed (no losses)

CL1H-42-CAL-00-007

DRAWING NUMBER	REFERENCE DRAWING	STAMPS

REV NO	REVISION	DATE	DRN	CKD	CKD	DES	LDE	PE
6	Issued for Regulatory Approval(CL1H)	19.06.27	ICS	BJZ		ICS	KUL	
2	Issued for Regulatory Approval(CLBB)	12.07.25	MX	APC		MX		
3	Issued for Regulatory Approval(CL1H)	12.07.26	MX	APC		MX		
4	Issued for Regulatory Approval(CLCDE-BB)	12.09.27	MX	APC		MX		
5	Issued for Regulatory Approval(CL1H)	12.10.2	MX	APC		MX		

DESIGNED BY | DRAWN BY | CHECKED BY | LEAD ENG | PROJ ENG | WORK PKG

CONSULTANT LOGO: Vista Projects

CADD FILE NAME

PROJECT NO: CL1H

cenovus ENERGY

TITLE: CHRISTINA LAKE COMMERCIAL PLANT
ENERGY BALANCE
PHASE 1A-H + CLCDE-BB

DRAWING: CL1-42-BFD-00-241-01

REVISION: 6

APPENDIX H

Process Flow Diagrams

CHRISTINA LAKE COMMERCIAL PLANT
PHASE 1H EXPANSION
ALL AREAS
PROJECT #2195
PROCESS FLOW DIAGRAMS
FOR REGULATORY APPLICATION AMENDMENT

Note: Red clouds denote major equipment changes on Phase H since the previous regulatory application.

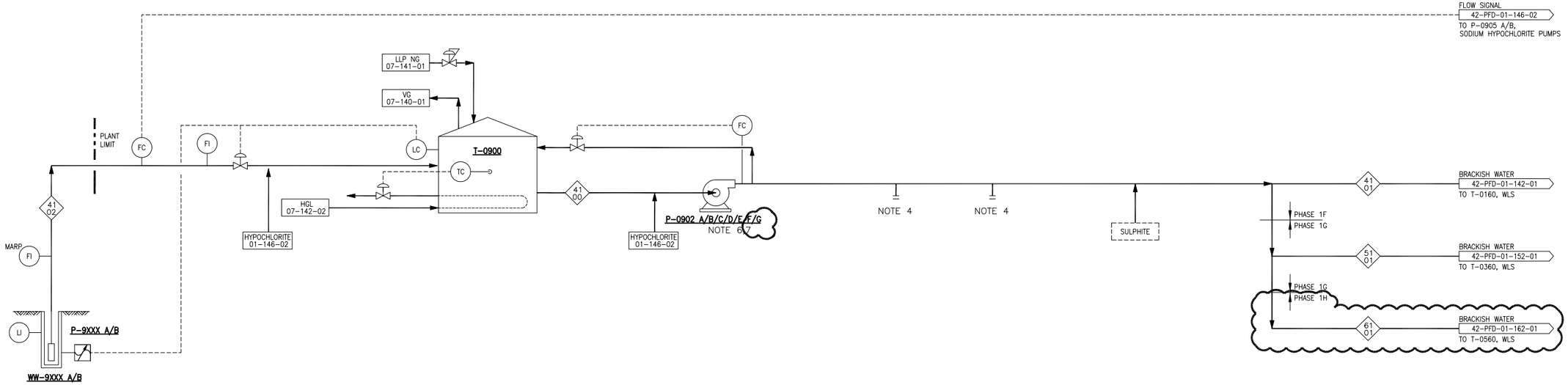
CL1-42-PFD-01-0140-001_3.A.0

WW-9XXX A/B
BRACKISH WATER WELLS

P-9XXX A/B
BRACKISH WATER WELL PUMPS
RATED FLOW: XXX Am³/h

T-0900
BRACKISH WATER STORAGE TANK
NOMINAL CAPACITY: 1378 m³

P-0902 A/B/C/D/E/F/G
BRACKISH WATER BOOSTER PUMPS
RATED FLOW: 110 Am³/h
NOTE 3,6,7



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY CL1-.
3. TWO PUMPS OPERATING DURING NORMAL SERVICE WITH THREE PUMPS OPERATING DURING BACKWASH WHEN PWSR=0.95 WITH 0% BD RECYCLE
4. FUTURE TIE-IN POINTS FOR IRON REMOVAL FILTERS.
5. DELETED.
6. P-0902D/E ARE INSTALLED AS PART OF PHASE 1G.
7. P-0902F/G ARE INSTALLED AS PART OF PHASE 1H

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GARRETT

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION – REISSUED FOR REGULATORY APPROVAL	2012/07/25	AW	APC	LY	KUL	BZS
3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	RWC	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
BRACKISH WATER SYSTEM
PHASE 1F/1G/1H

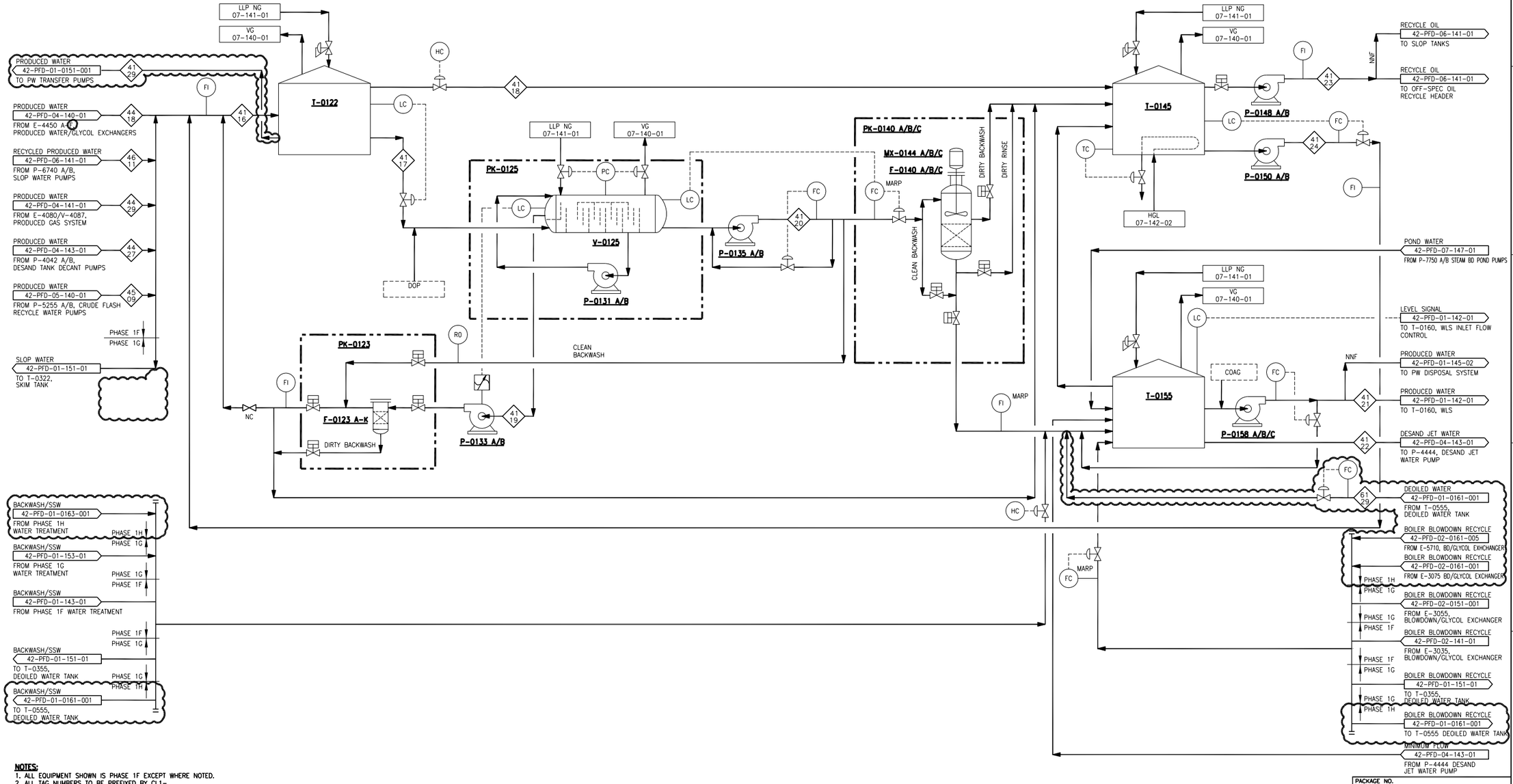
DRAWING NO.
CL1-42-PFD-01-0140-001

REVISION NO.
3.A.0

CL1-42-PFD-01-0141-001_4.A.1

T-0122 SKIM TANK	F-0123 A-K IGF OIL FILTERS	PK-0123 IGF OIL FILTER PACKAGE	P-0133 A/B IGF OIL PUMPS	V-0125 IGF VESSEL	PK-0125 IGF PACKAGE	P-0131 A/B IGF EDUCTOR SUPPLY PUMPS	P-0135 A/B ORF FEED PUMPS	PK-0140 A/B/C ORF PACKAGES	F-0140 A/B/C OIL REMOVAL FILTERS	MX-0144 A/B/C ORF AGITATORS	T-0145 OIL RECYCLE TANK	P-0148 A/B OIL RECYCLE PUMPS	P-0150 A/B WATER RECYCLE PUMPS
NOMINAL CAPACITY: 3468 m3	SIZE: 101 mm ID X 230 mm S/S		RATED FLOW: 40 Am3/h	SIZE: 3048 mm DIA X 16764 mm S/S		RATED FLOW: 265 Am3/h	RATED FLOW: 798 Am3/h		SIZE: 3658 mm DIA X 984 mm S/S		NOMINAL CAPACITY: 590 m3	RATED FLOW: 75 Am3/h	RATED FLOW: 216 Am3/h

T-0155 DEOILED WATER TANK	P-0158 A/B/C DEOILED WATER PUMPS
NOMINAL CAPACITY: 3229 m3	RATED FLOW: 442 Am3/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY CL1-.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GARRETT 55621

PERMIT TO PRACTICE VISTA PROJECTS LIMITED
Signature
Date Jun 12, 2019
PERMIT NUMBER: P 4559
The Association of Professional Engineers and Geoscientists of Alberta

2019-06-11

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	DL	RVG	LY	RVG	FY
4.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	KSO	RVG	ZGA	KUL	JEG
4.A.1	PHASE 1H EXPANSION – REISSUED FOR DESIGN	2019/06/11	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO: Vista Projects

REVISION DESCRIPTION: REISSUED FOR DESIGN

PROJECT NO.: CL1H

LSD: S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE: 2019/06/11

SCALE:

cenovus ENERGY

TITLE

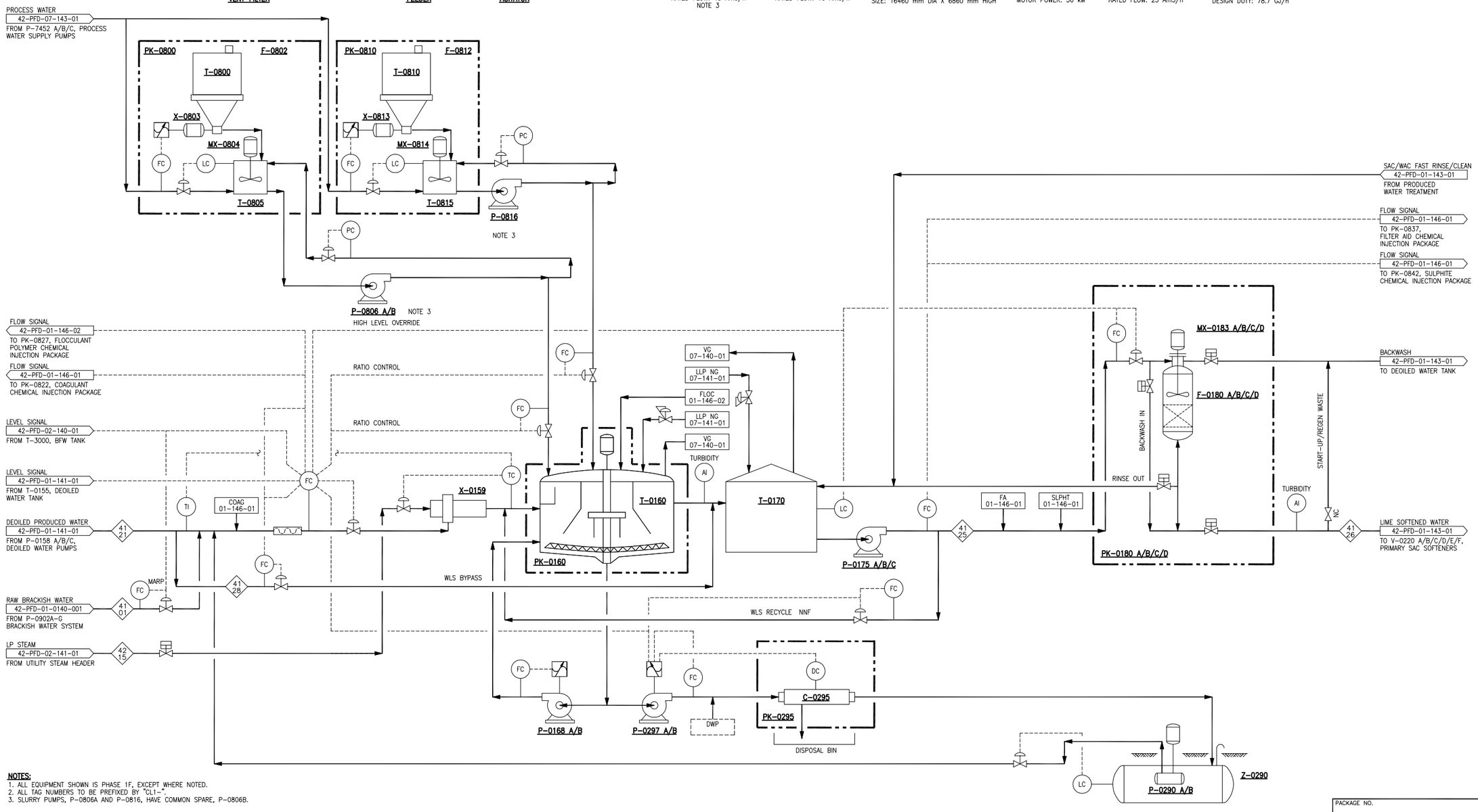
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
PRODUCED WATER DEOILING SYSTEM
PHASE 1F/1G/1H

DRAWING NO.: CL1-42-PFD-01-0141-001

REVISION NO.: 4.A.1

CL1-42-PFD-01-0142-001_3.A.0

PK-0800 LIME STORAGE AND FEED PACKAGE	PK-0810 MAGOX STORAGE AND FEED PACKAGE	F-0802 LIME STORAGE SILO VENT FILTER	T-0800 LIME STORAGE SILO	X-0803 LIME VOLUMETRIC FEEDER	MX-0804 LIME SLURRY TANK AGITATOR	T-0805 LIME SLURRY TANK	P-0806 A/B LIME SLURRY PUMPS RATED FLOW: 45 Am3/h NOTE 3	P-0168 A/B SLUDGE RECYCLE PUMPS RATED FLOW: 84 Am3/h	PK-0160 WARM LIME SOFTENER PACKAGE	PK-0295 SLUDGE CENTRIFUGE PACKAGE	T-0170 CLEAR WELL NOMINAL CAPACITY: 481 m3	P-0175 A/B/C AFTER-FILTER FEED PUMPS RATED FLOW: 450 Am3/h	Z-0290 CENTRATE SUMP	PK-0180 A-D WLS AFTER-FILTER PACKAGE	MX-0183 A/B/C/D WLS AFTER-FILTER AGITATORS	F-0180 A/B/C/D WLS AFTER-FILTERS SIZE: 3658 mm DIA X 984 mm S/S
F-0812 MAGOX STORAGE SILO VENT FILTER	T-0810 MAGOX STORAGE SILO	X-0813 MAGOX VOLUMETRIC FEEDER	MX-0814 MAGOX SLURRY TANK AGITATOR	T-0815 MAGOX SLURRY TANK	P-0816 MAGOX SLURRY PUMP RATED FLOW: 45 Am3/h NOTE 3	P-0297 A/B SLUDGE BLOWDOWN PUMPS RATED FLOW: 10 Am3/h	T-0160 WARM LIME SOFTENER SIZE: 16460 mm DIA X 6860 mm HIGH	C-0295 SLUDGE CENTRIFUGE MOTOR POWER: 56 kW	P-0290 A/B CENTRATE PUMPS RATED FLOW: 25 Am3/h	X-0159 DIRECT STEAM INJECTION HEATER DESIGN DUTY: 78.7 GJ/h					



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. SLURRY PUMPS, P-0806A AND P-0816, HAVE COMMON SPARE, P-0806B.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GARRETT

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	GP	RVG	LY	RVG	FY
3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO: Vista Projects

REVISION DESCRIPTION: ISSUED FOR DESIGN

PROJECT NO.: CL1H

LSD: S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE: 2019/04/05

SCALE: NONE

cenovus ENERGY

TITLE

CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
WARM LIME SOFTENER SYSTEM
PHASE 1F

DRAWING NO.: CL1-42-PFD-01-0142-001

REVISION NO.: 3.A.0

CL1-42-PFD-01-0143-001_3.A.0

PK-0200
PK-0205
PK-0210
SUSPENDED SOLIDS FILTERS PACKAGE

F-0200 A-M
F-0205 A-M
F-0210 A-M
SUSPENDED SOLIDS FILTERS
SIZE: 273 mm I.D. X 610 mm S/FOF

V-0220 A/B/C/D/E/F
PRIMARY SAC SOFTENERS
SIZE: 3048 mm I.D. X 3810 mm S/S

V-0230 A/B/C/D
POLISHER WAC SOFTENERS
SIZE: 3048 mm I.D. X 3810 mm S/S

P-0257 A/B
BRINE PUMPS
RATED FLOW: 20 Am3/h

T-0255
PRODUCED WATER BRINE SATURATOR
NOMINAL CAPACITY: 160 m3

BACKWASH
42-PFD-01-142-01
FROM F-0180 A/B/C/D, WLS AFTER FILTERS

SUBSURFACE WASH/ BACKWASH
42-PFD-01-141-01
TO DEOILED WATER TANKS

LIME SOFTENED WATER
42-PFD-01-142-01
FROM F-0180 A/B/C/D, WLS AFTER FILTERS

NC
FC
SERVICE INLET
DIRTY SSW/ BACKWASH OUT
SPENT CAUSTIC
FAST RINSE IN
BRINE IN
SSW IN
BACKWASH IN
RO
41 26
41 27
F-0200 A-M
F-0205 A-M
F-0210 A-M
PK-0200
PK-0205
PK-0210
V-0220 A/B/C/D/E/F

FLOW SIGNAL
42-PFD-01-146-02
TO PK-0836, BRINE SULPHITE CHEMICAL INJECTION PACKAGE

T-0255
LC
P-0257 A/B
SLPHT 01-146-02

CAUSTIC ONLY
FAST RINSE IN
ACID/CAUSTIC IN
SSW IN
V-0230 A/B/C/D
BACKWASH IN
SPENT ACID /CAUSTIC
FAST RINSE OUT
SPENT BRINE
FAST RINSE OUT

REGENERATION WATER
42-PFD-01-144-01
FROM REGEN WATER PUMPS

SOFT PRODUCED WATER
42-PFD-02-140-01
TO T-3000, BFW TANK

ACID/CAUSTIC DISPLACEMENT
42-PFD-01-144-01
FROM P-0274 A/B, CAUSTIC REGENERATION PUMPS P-0264 A/B, ACID REGENERATION PUMPS

REGEN WASTE
42-PFD-01-144-01
TO T-0280, NEUTRALIZATION TANK

SAC/WAC FAST RINSE/CLEAN
42-PFD-01-142-01
TO T-0170, CLEAR WELL

REGEN WASTE
42-PFD-01-145-01
TO T-0845 A/B, REGENERATION WASTE WATER TANKS

REGENERATION WATER
42-PFD-01-144-01
FROM REGEN WATER PUMPS

NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY CL1-.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD GARRETT ALBERTA

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	GP	RVG	LY	RVG	FY
3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

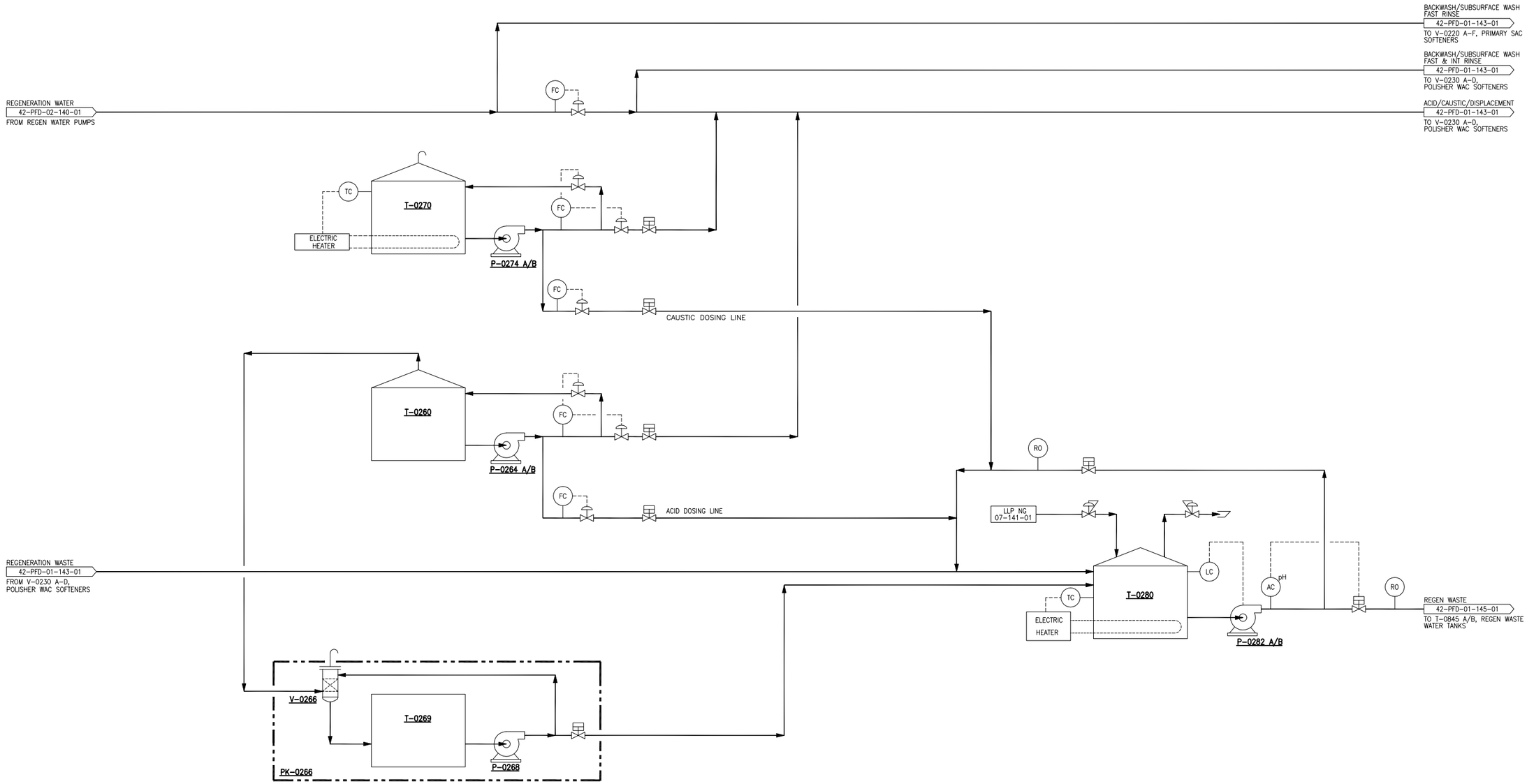
TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
WATER TREATMENT (ION EXCHANGE) SYSTEM
PHASE 1F

DRAWING NO.
CL1-42-PFD-01-0143-001

REVISION NO.
3.A.0

CL1-42-PFD-01-0144-001_3.A.0

PK-0266 ACID FUME SCRUBBER PACKAGE	V-0266 ACID FUME SCRUBBER SIZE: 610 mm I.D. x 2312 mm F/F	T-0269 SCRUBBER WATER RECIRCULATION TANK NOMINAL CAPACITY: 1.09 m3	T-0260 ACID STORAGE TANK NOMINAL CAPACITY: 323 m3	T-0270 CAUSTIC STORAGE TANK NOMINAL CAPACITY: 323 m3	P-0268 SCRUBBER WATER RECIRCULATION PUMP RATED FLOW: 5.7 Am3/h	P-0264 A/B ACID REGENERATION PUMPS RATED FLOW: 14.0 Am3/h	P-0274 A/B CAUSTIC REGENERATION PUMPS RATED FLOW: 16.3 Am3/h	T-0280 NEUTRALIZATION TANK NOMINAL CAPACITY: 323 m3	P-0282 A/B NEUTRALIZED WASTE PUMPS RATED FLOW: 62.5 Am3/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY CL1-.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD GARRETT ALBERTA

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	GP	RVG	LY	RVG	FY
3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO: Vista Projects

REVISION DESCRIPTION: ISSUED FOR DESIGN

PROJECT NO.: CL1H

LSD: S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE: 2019/04/05

SCALE: NONE

cenovus ENERGY

TITLE: CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
ACID/CAUSTIC/NEUTRALIZATION SYSTEM
PHASE 1F

DRAWING NO.: CL1-42-PFD-01-0144-001

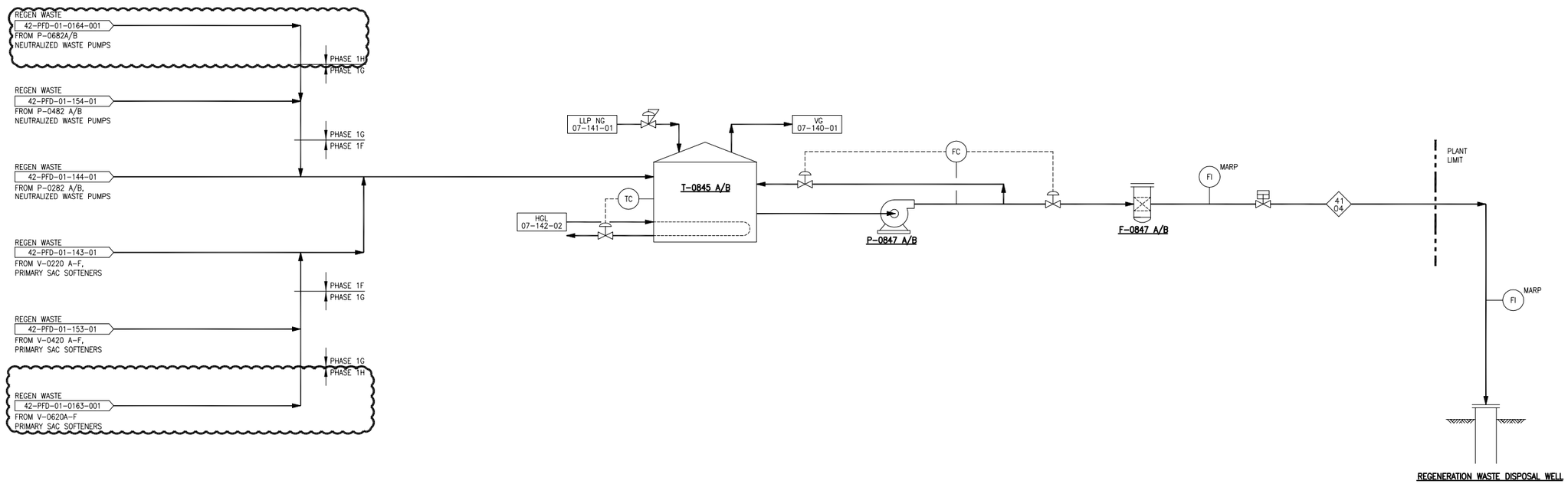
REVISION NO.: 3.A.0

CL1-42-PFD-01-0145-01_3A.0

T-0845 A/B
REGENERATION WASTE WATER TANKS
NOMINAL CAPACITY: 418 m3

P-0847 A/B
REGENERATION WASTE WATER PUMPS
RATED FLOW: 36.5 Am3/h

F-0847 A/B
REGENERATION WASTE WATER FILTERS
SIZE: 762 mm O.D. X 1016 mm S/S



NOTES:
1. EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY CL1-.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED

APEGA PERMIT No.
P 04559

The Association of Professional Engineers, and Geoscientists of Alberta

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0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
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2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	GP	RVG	LY	RVG	FY
3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO

Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
REGENERATION WASTE DISPOSAL SYSTEM
PHASE 1F/1G/1H

DRAWING NO.
CL1-42-PFD-01-0145-001

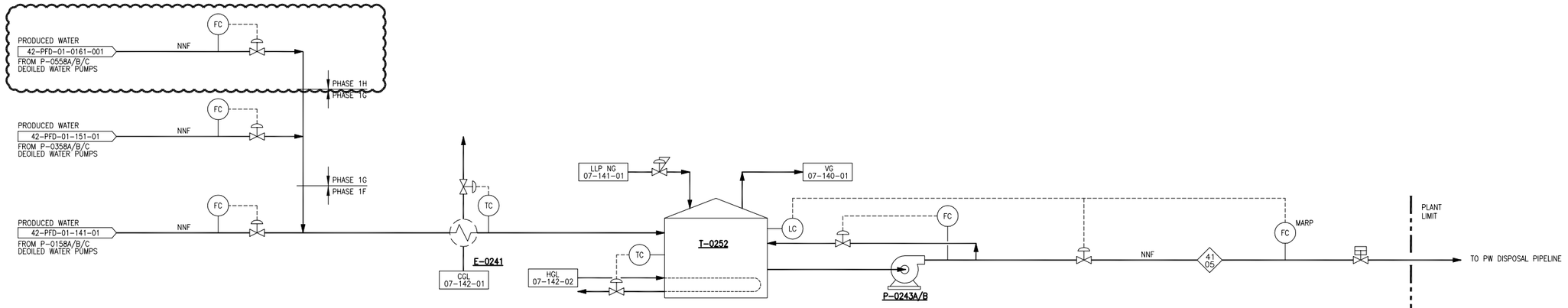
REVISION NO.
3.A.0

CL1-42-PFD-01-0145-002_2.A.0

E-0241
PRODUCED WATER DISPOSAL COOLER
RATED DUTY: 26.2 GJ/h

T-0252
PRODUCED WATER DISPOSAL TANK
NOMINAL CAPACITY: 418 m3

P-0243A/B
PRODUCED WATER DISPOSAL PUMPS
RATED FLOW: 190 m3/h



NOTES:
1. EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY CL1-.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA
RICHARD GARRETT
04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

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0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
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2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	GP	RVG	LY	RVG	FY
2.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
PRODUCED WATER DISPOSAL SYSTEM
PHASE 1F/1G/1H

DRAWING NO.
CL1-42-PFD-01-0145-002

REVISION NO.
2.A.0

CL1-42-PFD-01-0146-001_3.A.0

T-0820
COAGULANT BULK STORAGE TANK
NOMINAL CAPACITY: 27.8 m3

PK-0822
COAGULANT CHEMICAL INJECTION SKID PACKAGE

P-0822 A/B
COAGULANT PUMPS
RATED FLOW: 0.042 Am3/h

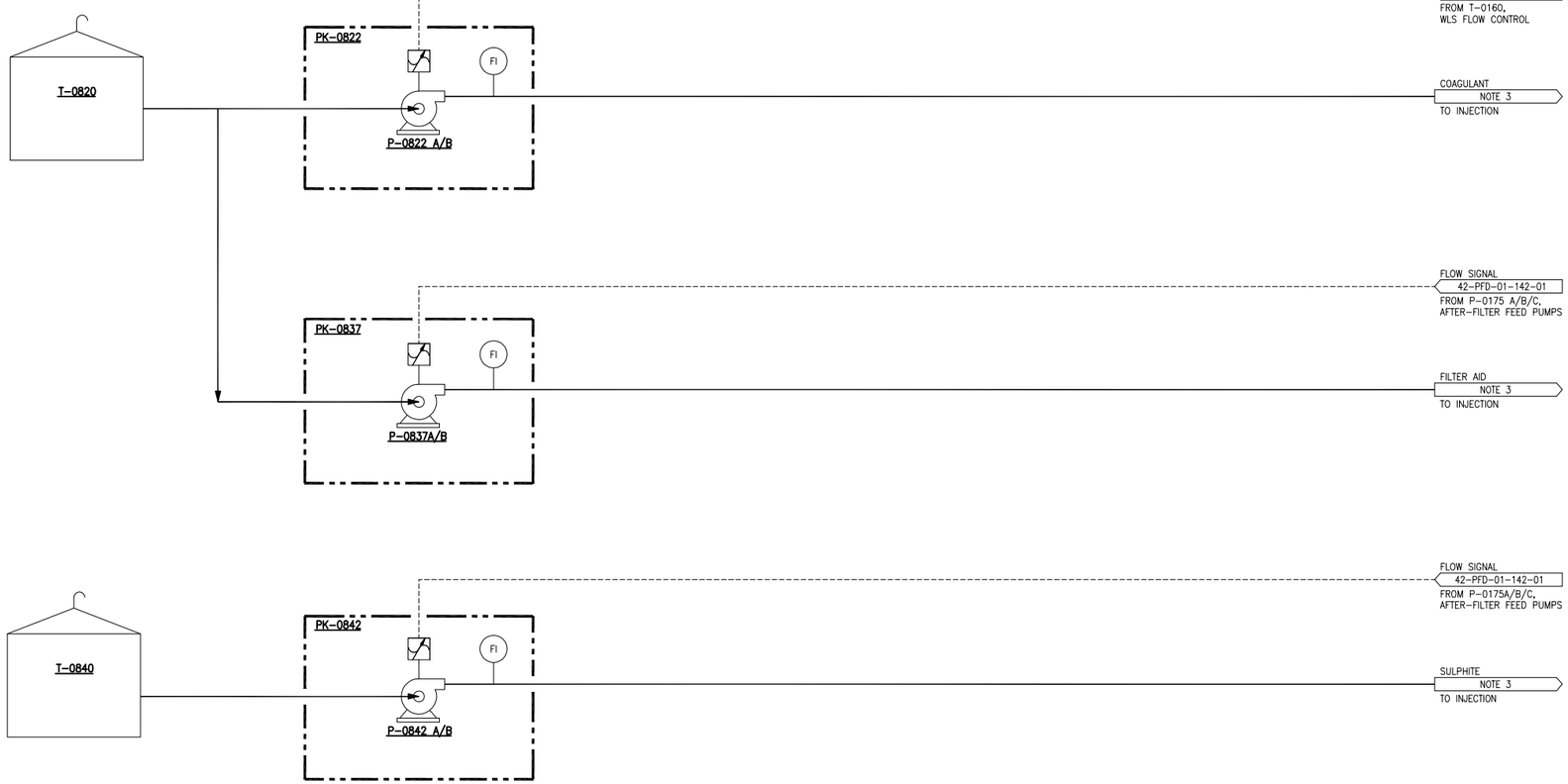
PK-0837
FILTER AID CHEMICAL INJECTION SKID PACKAGE

P-0837A/B
FILTER AID PUMPS
RATED FLOW: 0.042 Am3/h

T-0840
SULPHITE BULK STORAGE TANK
NOMINAL CAPACITY: 24 m3

PK-0842
SULPHITE CHEMICAL INJECTION PACKAGE

P-0842 A/B
SULPHITE PUMP
RATED FLOW: 0.1 Am3/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. INJECTION POINT LOCATED ON DWG. CL1G-42-PFD-01-142-01.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GARRETT

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

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0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
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3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	[illegible]	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

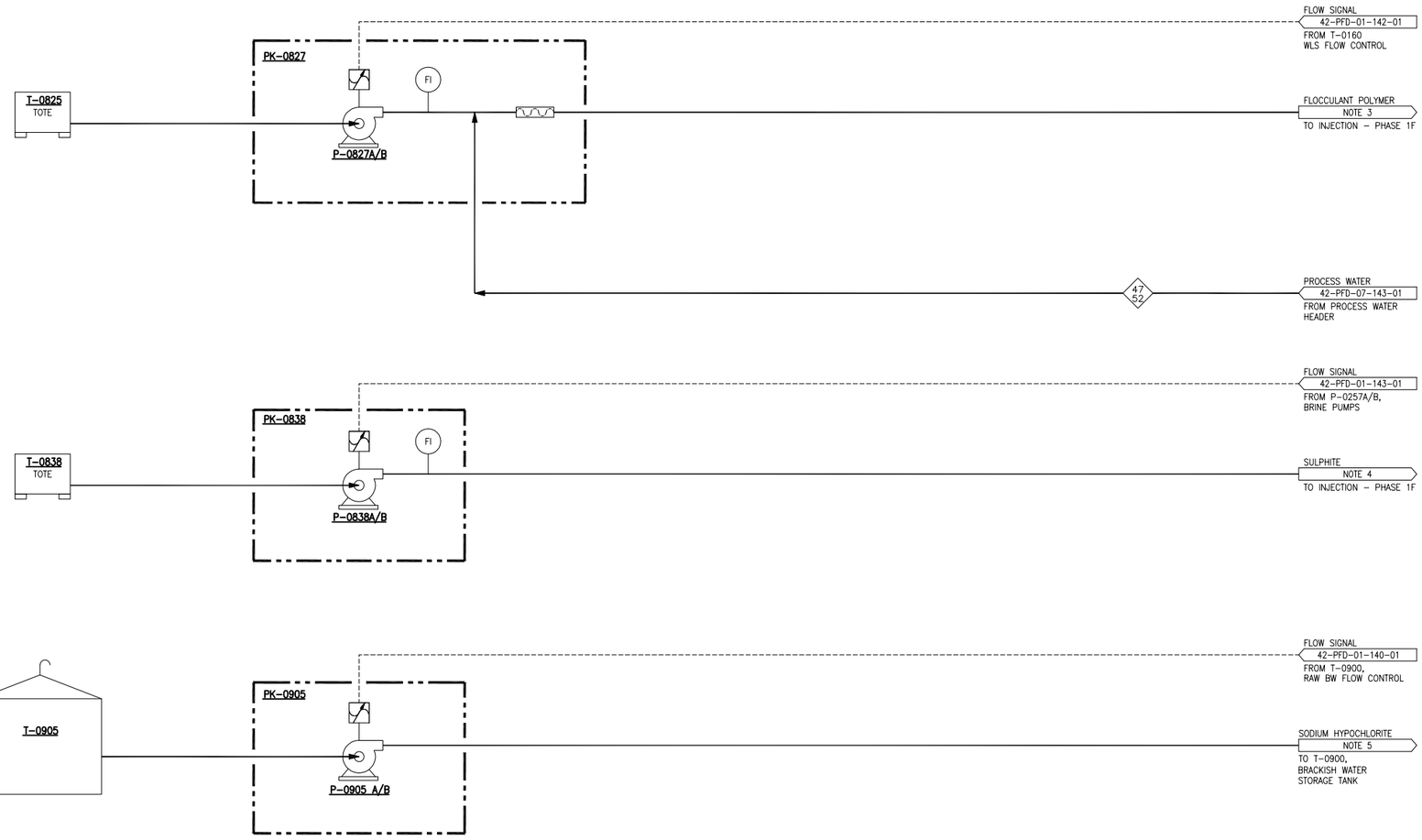
TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
CHEMICAL INJECTION – AREA 01
PHASE 1F

DRAWING NO.
CL1-42-PFD-01-0146-001

REVISION NO.
3.A.0

CL1-42-PFD-01-0146-002_3.A.0

T-0825 FLOCCULANT POLYMER TOTE	PK-0827 FLOCCULANT POLYMER CHEMICAL INJECTION SKID PACKAGE	P-0827 A/B FLOCCULANT POLYMER PUMPS	T-0838 BRINE SULPHITE TOTE TANK	PK-0838 BRINE SULPHITE CHEMICAL INJECTION PACKAGE	P-0838A/B BRINE SULFITE PUMPS	T-0905 SODIUM HYPOCHLORITE TANK	P-0905 A/B SODIUM HYPOCHLORITE PUMPS	PK-0905 SODIUM HYPOCHLORITE INJECTION PACKAGE
CAPACITY: 1 m3		RATED FLOW: 0.002 Am3/h	CAPACITY: 1 m3		RATED FLOW: 0.02 Am3/h	NOMINAL CAPACITY: 5.7 m3	RATED FLOW: 0.027 Am3/h	



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1–".
3. INJECTION POINT LOCATED ON DWG. CL1G-42-PFD-01-142-01.
4. INJECTION POINT LOCATED ON DWG. CL1G-42-PFD-01-143-01.
5. INJECTION POINT LOCATED ON DWG. CL1G-42-PFD-01-140-01.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEERS ASSOCIATION OF ALBERTA — RICHARD GARNER

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
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3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO: Vista Projects

REVISION DESCRIPTION: ISSUED FOR DESIGN

PROJECT NO.: CL1H

LSD: S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE: 2019/04/05

SCALE: NONE

cenovus ENERGY

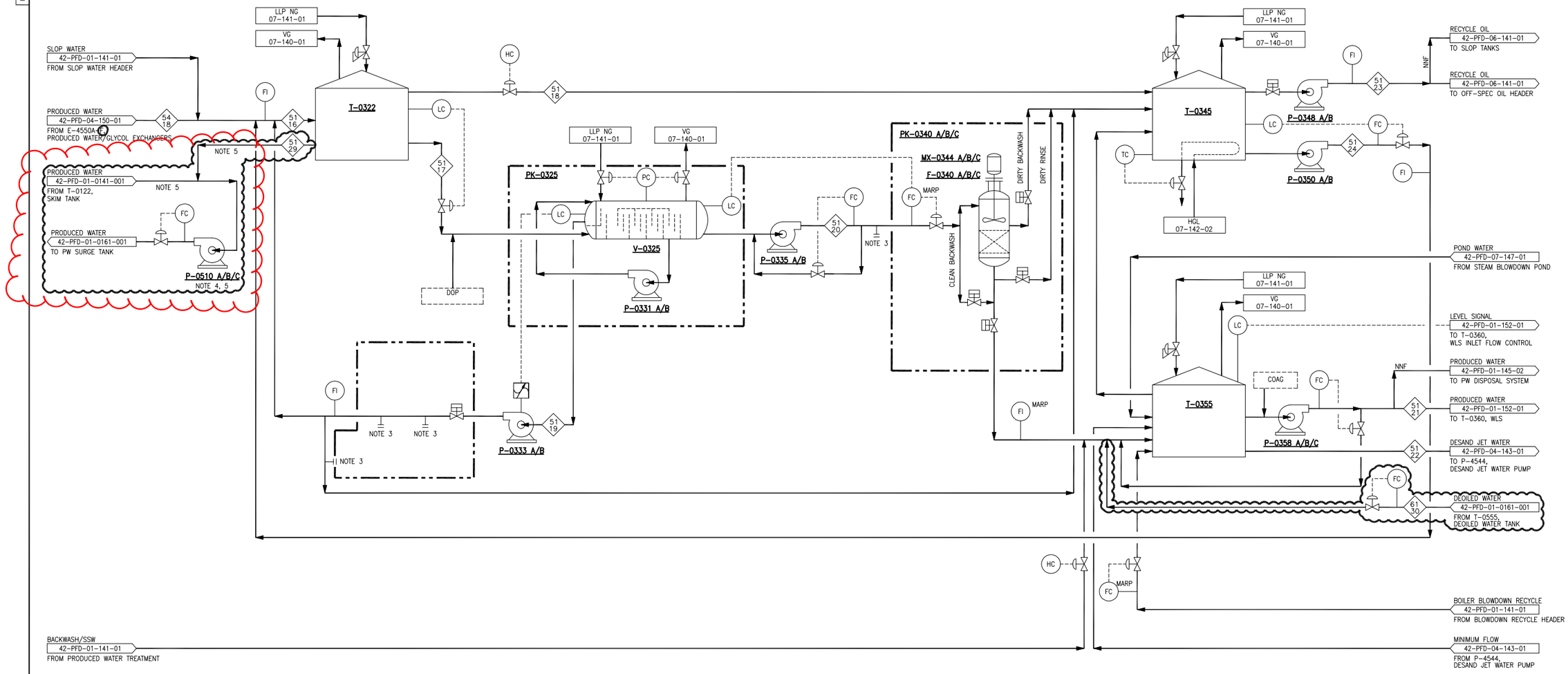
TITLE: CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
CHEMICAL INJECTION – AREA 01
PHASE 1F

DRAWING NO.: CL1–42–PFD–01–0146–002

REVISION NO.: 3.A.0

CL1-42-PFD-01-0151-001_0.B.0

P-0510 A/B/C PW TRANSFER PUMPS	T-0322 SKIM TANK	P-0333 A/B IGF OIL PUMPS	V-0325 IGF VESSEL	PK-0325 IGF PACKAGE	P-0331 A/B IGF EDUCTOR SUPPLY PUMPS	P-0335 A/B ORF FEED PUMPS	PK-0340 A/B/C ORF PACKAGES	F-0340 A/B/C OIL REMOVAL FILTERS	MX-0344 A/B/C ORF AGITATORS	T-0345 OIL RECYCLE TANK	P-0348 A/B OIL RECYCLE PUMPS	P-0350 A/B WATER RECYCLE PUMPS	T-0355 DEOILED WATER TANK	P-0358 A/B/C DEOILED WATER PUMPS
RATED FLOW: 317 Am3/h	NOMINAL CAPACITY: 3468 m3	RATED FLOW: 40 Am3/h	SIZE: 3048 mm DIA X 16764 mm S/S		RATED FLOW: 265 Am3/h	RATED FLOW: 798 Am3/h		SIZE: 3658 mm DIA X 984 mm S/S		NOMINAL CAPACITY: 590 m3	RATED FLOW: 75 Am3/h	RATED FLOW: 216 Am3/h	NOMINAL CAPACITY: 3229 m3	RATED FLOW: 442 Am3/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1G EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY CL1-.
3. FUTURE TIE-IN POINTS FOR IGF OIL FILTERS.
4. P-0510A IS DEDICATED TO CL1F SKIM TANK AT SUCTION AND P-0510B IS DEDICATED TO CL1G SKIM TANK AT SUCTION. BOTH PUMPS ARE INSTALLED IN PHASE H.
5. P-0510C IS THE COMMON SPARE. PUMP IS INSTALLED IN PHASE H.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GARRETT

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
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2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	GP	RVG	LY	RVG	FY
0.B.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO: Vista Projects

REVISION DESCRIPTION: ISSUED FOR DESIGN

PROJECT NO.: CL1H

LSD: S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE: 2019/04/05

SCALE: NONE

cenovus ENERGY

TITLE: CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
PRODUCED WATER DEOILING SYSTEM
PHASE 1G

DRAWING NO.: CL1-42-PFD-01-0151-001

REVISION NO.: 0.B.0

CL1-42-PFD-01-0152-001_0.B.0

PK-0700 LIME STORAGE AND FEED PACKAGE	PK-0710 MAGOX STORAGE AND FEED PACKAGE	F-0702 LIME STORAGE SILO VENT FILTER	T-0700 LIME STORAGE SILO	X-0703 LIME VOLUMETRIC FEEDER	MX-0704 LIME SLURRY TANK AGITATOR	T-0705 LIME SLURRY TANK	P-0706 A/B LIME SLURRY PUMPS RATED FLOW: 45 Am3/h NOTE 3	P-0368 A/B SLUDGE RECYCLE PUMPS RATED FLOW: 84 Am3/h	PK-0360 WARM LIME SOFTENER PACKAGE	PK-0495 SLUDGE CENTRIFUGE PACKAGE	T-0370 CLEAR WELL NOMINAL CAPACITY: 481 m3	P-0375 A/B/C AFTER-FILTER FEED PUMPS RATED FLOW: 450 Am3/h	Z-0490 CENTRATE SUMP	PK-0380 A-D WLS AFTER-FILTER PACKAGE	MX-0383 A/B/C/D WLS AFTER-FILTER AGITATORS	F-0380 A/B/C/D WLS AFTER-FILTERS SIZE: 3658 mm DIA X 984 mm S/S
F-0712 MAGOX STORAGE SILO VENT FILTER	T-0710 MAGOX STORAGE SILO	X-0713 MAGOX VOLUMETRIC FEEDER	MX-0714 MAGOX SLURRY TANK AGITATOR	T-0715 MAGOX SLURRY TANK	P-0716 MAGOX SLURRY PUMP RATED FLOW: 45 Am3/h NOTE 3	P-0497 A/B SLUDGE BLOWDOWN PUMPS RATED FLOW: 10 Am3/h	T-0360 WARM LIME SOFTENER SIZE: 16460 mm DIA X 6860 mm HIGH	C-0495 SLUDGE CENTRIFUGE MOTOR POWER: 56 kW	P-0490 A/B CENTRATE PUMPS RATED FLOW: 25 Am3/h	X-0359 DIRECT STEAM INJECTION HEATER DESIGN DUTY: 78.7 GJ/h					

PROCESS WATER
42-PFD-07-143-01
FROM P-7452 A/B/C, PROCESS WATER SUPPLY PUMPS

PK-0700 F-0702 T-0700 X-0703 MX-0704 FC LC T-0705
PK-0710 F-0712 T-0710 X-0713 MX-0714 FC LC T-0715
PC P-0716 NOTE 3
PC P-0706 A/B NOTE 3 HIGH LEVEL OVERRIDE

FLOW SIGNAL 42-PFD-01-156-02 TO PK-0727, FLOCCULANT POLYMER CHEMICAL INJECTION PACKAGE
FLOW SIGNAL 42-PFD-01-156-01 TO PK-0722, COAGULANT CHEMICAL INJECTION PACKAGE
LEVEL SIGNAL 42-PFD-02-140-01 FROM T-3000, BFW TANK
LEVEL SIGNAL 42-PFD-01-151-01 FROM T-0355, DEOILED WATER TANK
DEOILED PRODUCED WATER 42-PFD-01-151-01 FROM P-0358 A/B/C, DEOILED WATER PUMPS
RAW BRACKISH WATER 42-PFD-01-140-01 FROM BRACKISH WATER SYSTEM
LP STEAM 42-PFD-02-141-01 FROM UTILITY STEAM HEADER

RATIO CONTROL
RATIO CONTROL
FC TC TI COAG 01-156-01 MARP
51 21 51 28 51 01 52 15

VG 07-140-01 LLP NG 07-141-01 FLOC 01-156-02 LLP NG 07-141-01 VG 07-140-01 TURBIDITY AI
X-0359 T-0360 PK-0360 T-0370 LC P-0375 A/B/C
FA 01-156-01 SLPHT 01-156-01 51 25
WLS BYPASS
WLS RECYCLE NNF
P-0368 A/B P-0497 A/B DWP
DC C-0495 PK-0495 DISPOSAL BIN

SAC/WAC FAST RINSE/CLEAN 42-PFD-01-153-01 FROM PRODUCED WATER TREATMENT
FLOW SIGNAL 42-PFD-01-156-01 TO PK-0737, FILTER AID CHEMICAL INJECTION PACKAGE
FLOW SIGNAL 42-PFD-01-156-01 TO PK-0742, SULPHITE CHEMICAL INJECTION PACKAGE

MX-0383 A/B/C/D F-0380 A/B/C/D FC
BACKWASH 42-PFD-01-153-01 TO DEOILED WATER TANK
BACKWASH IN
RINSE OUT
START-UP/REGEN WASTE
TURBIDITY AI NC
51 26
LIME SOFTENED WATER 42-PFD-01-153-01 TO V-0420 A/B/C/D/E/F, PRIMARY SAC SOFTENERS
PK-0380 A/B/C/D

LC P-0490 A/B Z-0490

NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1G, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. SLURRY PUMPS, P-0706A AND P-0716, HAVE COMMON SPARE, P-0706B.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD GARRETT ALBERTA 26070

04/04/2019

PERMIT TO PRACTICE VISTA PROJECTS LIMITED
APEGA PERMIT No. P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	GP	RVG	LY	RVG	FY
0.B.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO: Vista Projects

REVISION DESCRIPTION: ISSUED FOR DESIGN
PROJECT NO.: CL1H
LSD: S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M
ISSUE DATE: 2019/04/05
SCALE: NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
WARM LIME SOFTENER SYSTEM
PHASE 1G

DRAWING NO.: CL1-42-PFD-01-0152-001
REVISION NO.: 0.B.0

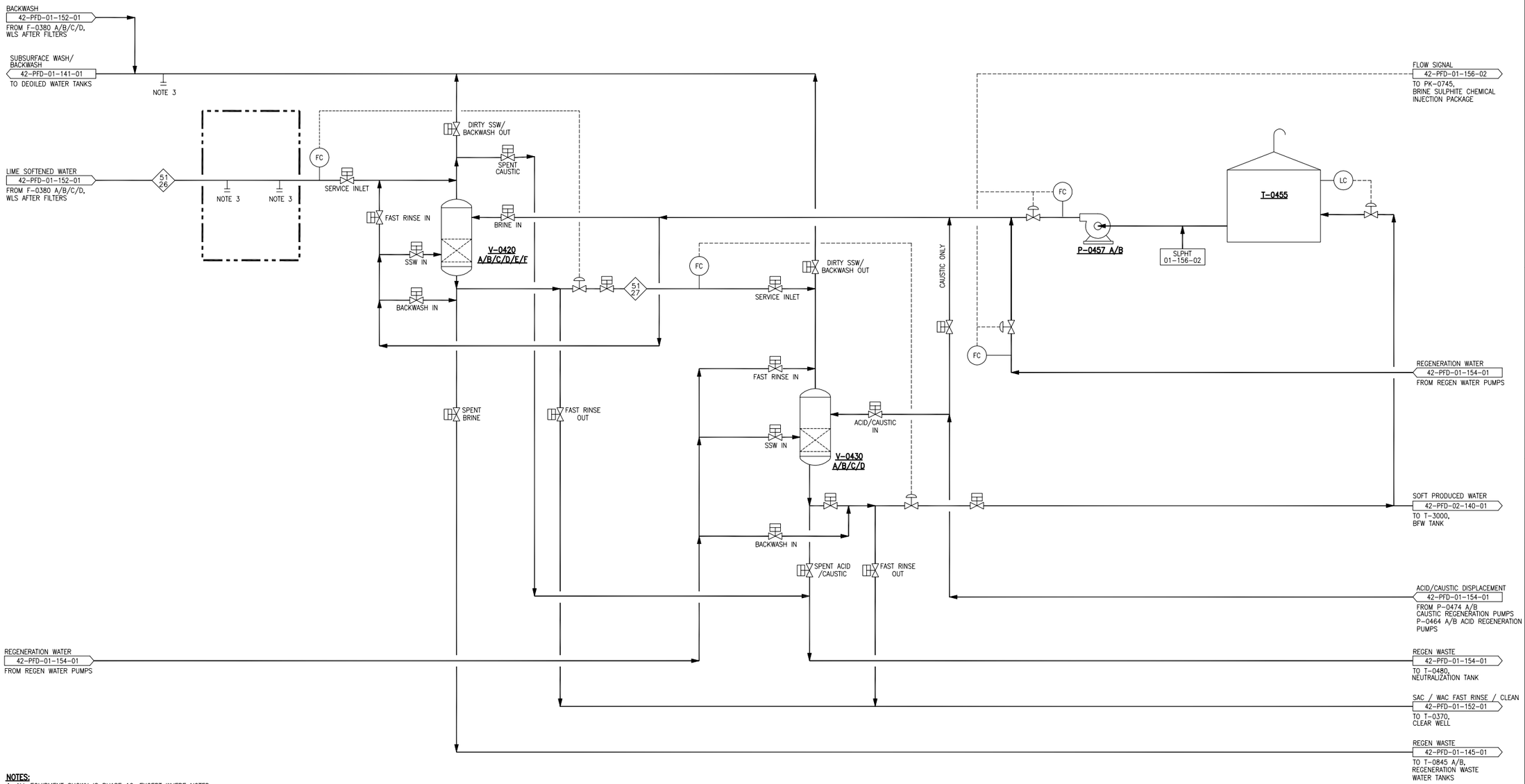
CL1-42-PFD-01-0153-001_0.B.0

V-0420 A/B/C/D/E/F
PRIMARY SAC SOFTENERS
SIZE: 3048 mm I.D. X 3810 mm S/S

V-0430 A/B/C/D
POLISHER WAC SOFTENERS
SIZE: 3048 mm I.D. X 3810 mm S/S

P-0457 A/B
BRINE PUMPS
RATED FLOW: 20 Am3/h

T-0455
PRODUCED WATER BRINE SATURATOR
NOMINAL CAPACITY: 160 m3



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1G, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY CL1-.
3. FUTURE TIE-IN POINTS FOR SUSPENDED SOLIDS FILTERS.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD BARRETT ALBERTA

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
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2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	GP	RVG	LY	RVG	FY
0.B.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
WATER TREATMENT (ION EXCHANGE) SYSTEM
PHASE 1G

DRAWING NO.
CL1-42-PFD-01-0153-001

REVISION NO.
0.B.0

CL1-42-PFD-01-0154-001_0.B.0

PK-0466 ACID FUME SCRUBBER PACKAGE	V-0466 ACID FUME SCRUBBER	T-0469 SCRUBBER WATER RECIRCULATION TANK	T-0460 ACID STORAGE TANK	T-0470 CAUSTIC STORAGE TANK	P-0468 SCRUBBER WATER RECIRCULATION PUMP	P-0464 A/B ACID REGENERATION PUMPS	P-0474 A/B CAUSTIC REGENERATION PUMPS	T-0480 NEUTRALIZATION TANK	P-0482 A/B NEUTRALIZED WASTE PUMPS
	SIZE: 610 mm I.D. x 2312 mm F/F	NOMINAL CAPACITY: 1.09 m3	NOMINAL CAPACITY: 323 m3	NOMINAL CAPACITY: 323 m3	RATED FLOW: 5.7 Am3/h	RATED FLOW: 14.0 Am3/h	RATED FLOW: 16.3 Am3/h	NOMINAL CAPACITY: 323 m3	RATED FLOW: 62.5 Am3/h

BACKWASH/SUBSURFACE WASH FAST RINSE
42-PFD-01-153-01
TO V-0420 A-F, PRIMARY SAC SOFTENERS,

BACKWASH/SUBSURFACE WASH FAST & INT RINSE
42-PFD-01-153-01
TO V-0430 A-D, POLISHER WAC SOFTENERS,

REGENERATION WATER
42-PFD-02-140-01
FROM REGEN WATER PUMPS

ACID/CAUSTIC/DISPLACEMENT
42-PFD-01-153-01
TO V-0430 A-D, POLISHER WAC SOFTENERS

FC

TC

T-0470

ELECTRIC HEATER

P-0474 A/B

CAUSTIC DOSING LINE

T-0460

P-0464 A/B

ACID DOSING LINE

RO

LLP NG
07-141-01

REGENERATION WASTE
42-PFD-01-153-01
FROM V-0430 A-D, POLISHER WAC SOFTENERS

T-0480

LC

pH

AC

RO

REGEN WASTE
42-PFD-01-145-01
TO T-0845 A/B, REGEN WASTE WATER TANKS

V-0466

T-0469

P-0468

PK-0466

P-0482 A/B

NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1G, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY CL1-.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GARRETT 55108

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED

APEGA PERMIT No.
P 04559

The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	GP	RVG	LY	RVG	FY
0.B.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	ZGA	KUL	JEG	

CONSULTANT NAME AND LOGO

Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

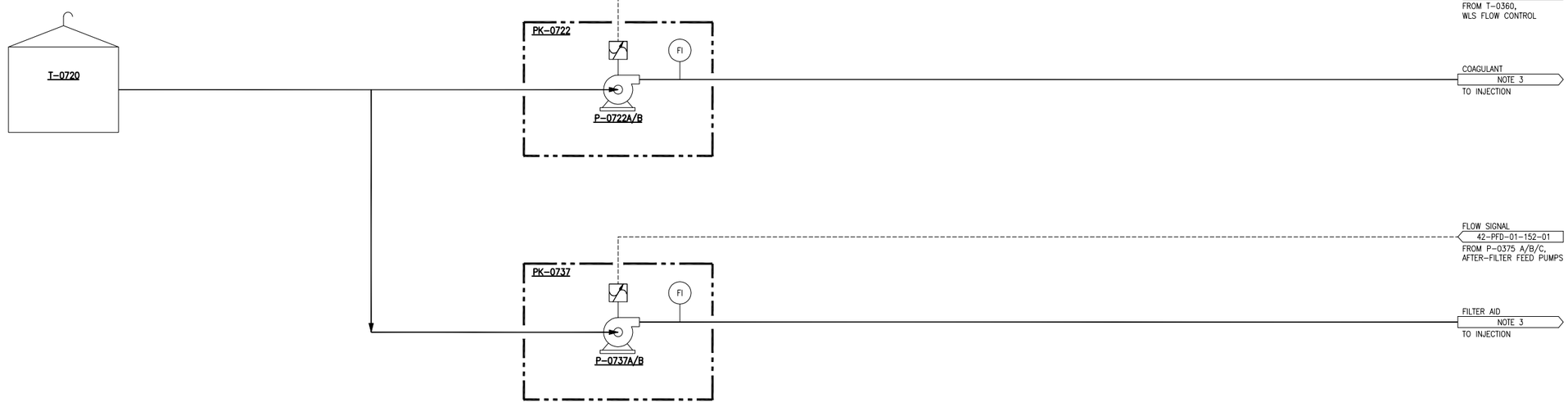
TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
ACID/CAUSTIC/NEUTRALIZATION SYSTEM
PHASE 1G

DRAWING NO.
CL1-42-PFD-01-0154-001

REVISION NO.
0.B.0

CL1-42-PFD-01-0156-001_0.B.0

T-0720 COAGULANT BULK STORAGE TANK	PK-0722 COAGULANT CHEMICAL INJECTION SKID PACKAGE	P-0722 A/B COAGULANT PUMPS	PK-0737 FILTER AID CHEMICAL INJECTION SKID PACKAGE	P-0737A/B FILTER AID PUMPS	T-0740 SULPHITE BULK STORAGE TANK	PK-0742 SULPHITE CHEMICAL INJECTION PACKAGE	P-0742 A/B SULPHITE PUMP
NOMINAL CAPACITY: 27.8 m3		RATED FLOW: 0.042 Am3/h		RATED FLOW: 0.042 Am3/h	NOMINAL CAPACITY: 24.8 m		RATED FLOW: 0.1 Am3/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1G, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. INJECTION POINT LOCATED ON DWG. CL1G-42-PFD-01-152-01.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD GARRETT ALBERTA

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	GP	RVG	LY	RVG	FY
0.B.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
CHEMICAL INJECTION – AREA 01
PHASE 1G

DRAWING NO.
CL1-42-PFD-01-0156-001

REVISION NO.
0.B.0

CL1-42-PFD-01-0156-002_0.B.0

T-0725
FLOCCULANT POLYMER TOTE
CAPACITY: 1 m3

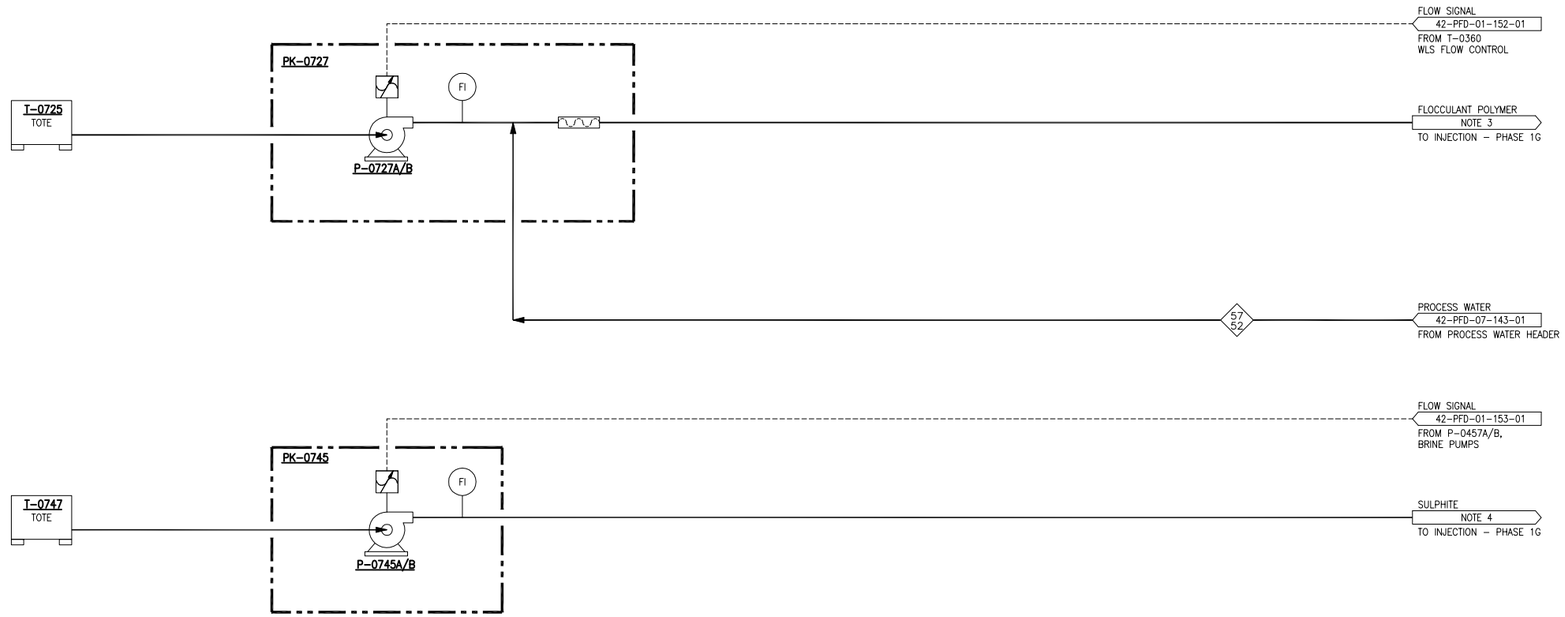
PK-0727
FLOCCULANT POLYMER CHEMICAL INJECTION SKID PACKAGE

P-0727A/B
FOCCULANT POLYMER PUMPS
RATED FLOW: 0.002 Am3/h

T-0747
BRINE SULPHITE TOTE TANK
CAPACITY: 1 m3

PK-0745
BRINE SULPHITE CHEMICAL INJECTION PACKAGE

P-0745A/B
BRINE SULPHITE PUMPS
RATED FLOW: 0.02 Am3/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1G, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. INJECTION POINT LOCATED ON DWG. CL1G-42-PFD-01-152-01.
4. INJECTION POINT LOCATED ON DWG. CL1G-42-PFD-01-153-01.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD GARRETT REGISTERED

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	GP	RVG	LY	RVG	FY
0.B.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	[illegible]	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
CHEMICAL INJECTION – AREA 01
PHASE 1G

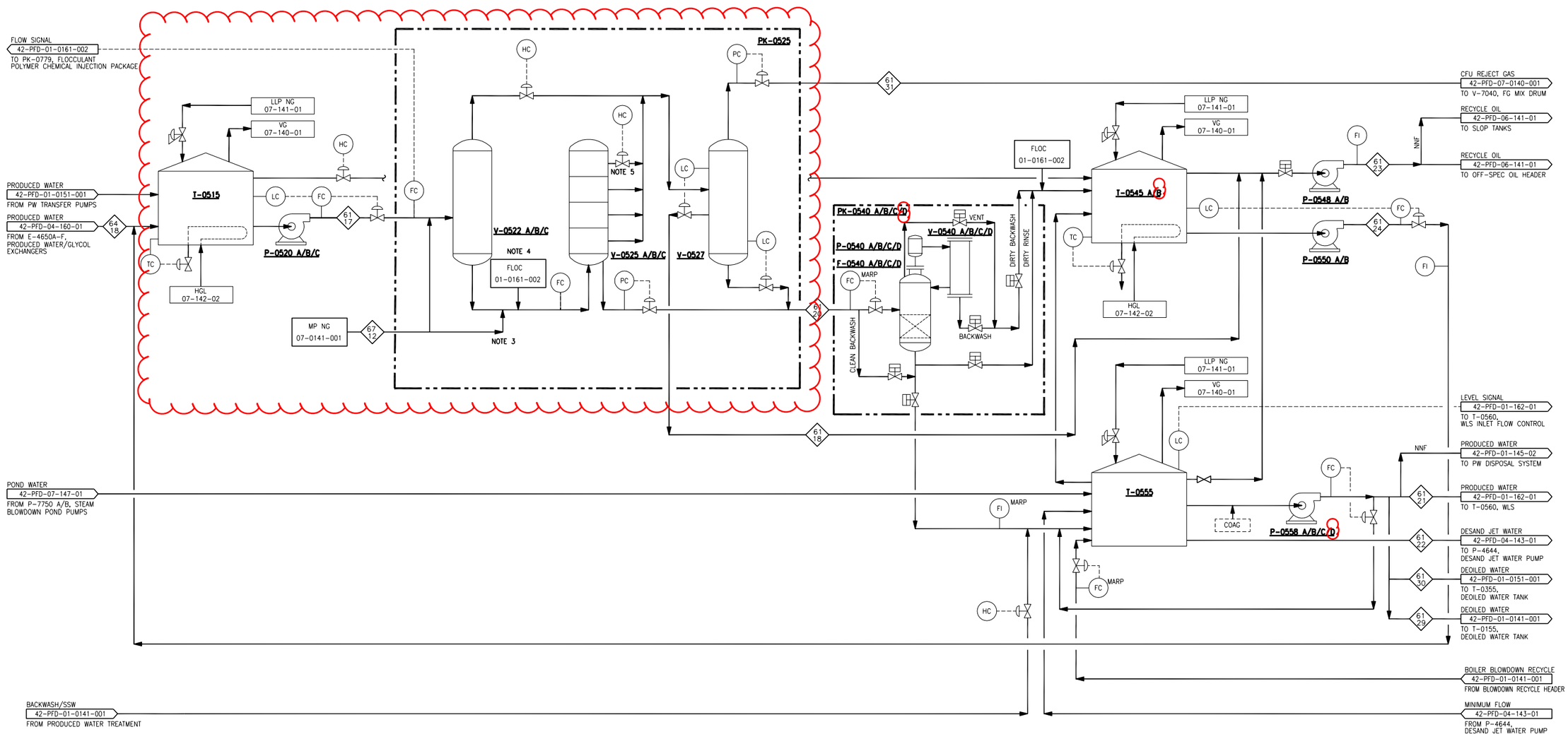
DRAWING NO.
CL1-42-PFD-01-0156-002

REVISION NO.
0.B.0

CL1-42-PFD-01-0161-001_0.A.2

I-0515 PW SURGE TANK	P-0520 A/B/C CFU FEED PUMPS	V-0522 A/B/C SKIM VESSELS	V-0525 A/B/C COMPACT FLOTATION UNITS (CFU)	V-0527 REJECT VESSEL	PK-0525 COMPACT FLOTATION UNIT PACKAGE	V-0540 A/B/C/D ORF MEDIA SCRUBBERS	PK-0540 A/B/C/D ORF PACKAGES	F-0540 A/B/C/D OIL REMOVAL FILTERS	P-0540 A/B/C/D ORF SCRUBBER PUMPS	I-0545 A/B OIL RECYCLE TANKS	P-0548 A/B OIL RECYCLE PUMPS	P-0550 A/B WATER RECYCLE PUMPS
NOMINAL CAPACITY: 590 m^3	RATED FLOW: 750 Am3/h					SIZE: 508 mm X 2735 mm FOF		SIZE: 3658 mm DIA X 2286 mm S/S	RATED FLOW: 670 Am3/h	NOMINAL CAPACITY: 590 m^3	RATED FLOW: 75 Am^3/h	RATED FLOW: 216 Am^3/h

I-0555 DEOILED WATER TANK	P-0558 A/B/C/D DEOILED WATER PUMPS
NOMINAL CAPACITY: 3229 m^3	RATED FLOW: 500 Am3/h



NOTES:

1. ALL EQUIPMENT SHOWN IS PHASE 1H EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY CL1-.
3. MP NATURAL GAS INJECTION AT THE INLET OF EACH STAGE OF CFU (4 STAGES).
4. CHEMICAL INJECTION AT THE INLET OF EACH STAGE OF CFU (4 STAGES).
5. TYPICAL OF FOUR. ONLY THE FIRST STAGE REJECT HAND CONTROL VALVE SHOWN.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GARRETT

2019-06-19

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION - REISSUED FOR REGULATORY APPROVAL	2012/07/25	IS	APC	LY	KUL	BZS
0.A.0	PHASE 1H EXPANSION - ISSUED FOR DESIGN	2019/04/05	KSO	RVG	ZGA	KUL	JEG
0.A.1	PHASE 1H EXPANSION - REISSUED FOR DESIGN	2019/06/11	KSO	RVG	ZGA	KUL	JEG
0.A.2	PHASE 1H EXPANSION - REISSUED FOR DESIGN	2019/06/19	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO: Vista Projects

REVISION DESCRIPTION: REISSUED FOR DESIGN

PROJECT NO.: CL1H

LSD: S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE: 2019/06/19

SCALE: NONE

cenovus ENERGY

TITLE: CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
PRODUCED WATER DEOILING SYSTEM
PHASE 1H

DRAWING NO.: CL1-42-PFD-01-0161-001

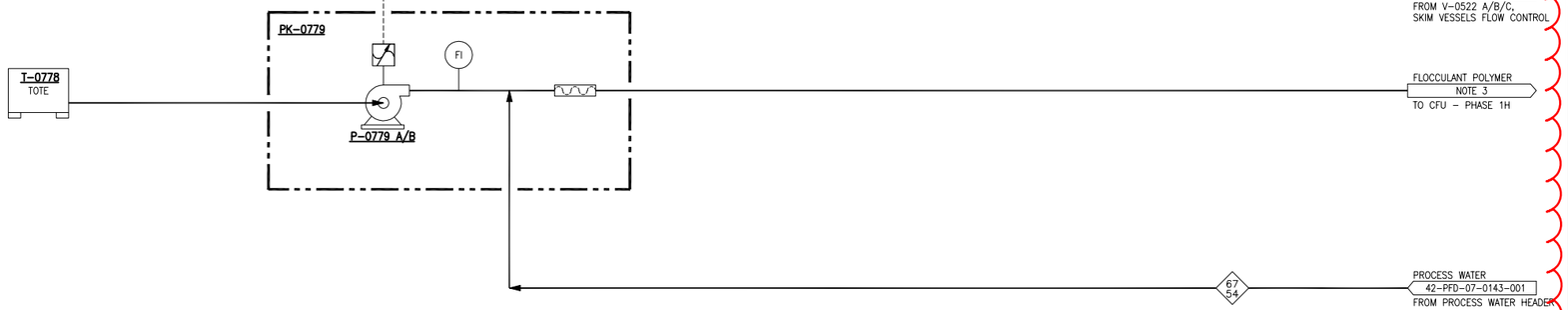
REVISION NO.: 0.A.2

CL1-42-PFD-01-0161-002_0.A.0

T-0778
FLOCCULANT POLYMER TOTE
CAPACITY: 1 m3

PK-0779
FLOCCULANT POLYMER INJECTION PACKAGE

P-0779 A/B
FOCCULANT POLYMER PUMPS
RATED FLOW: 0.002 Am3/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1H, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. INJECTION POINT LOCATED ON DWG. CL1-42-PFD-01-0161-001.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD GARRETT REGISTERED SEAL

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	RVC	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

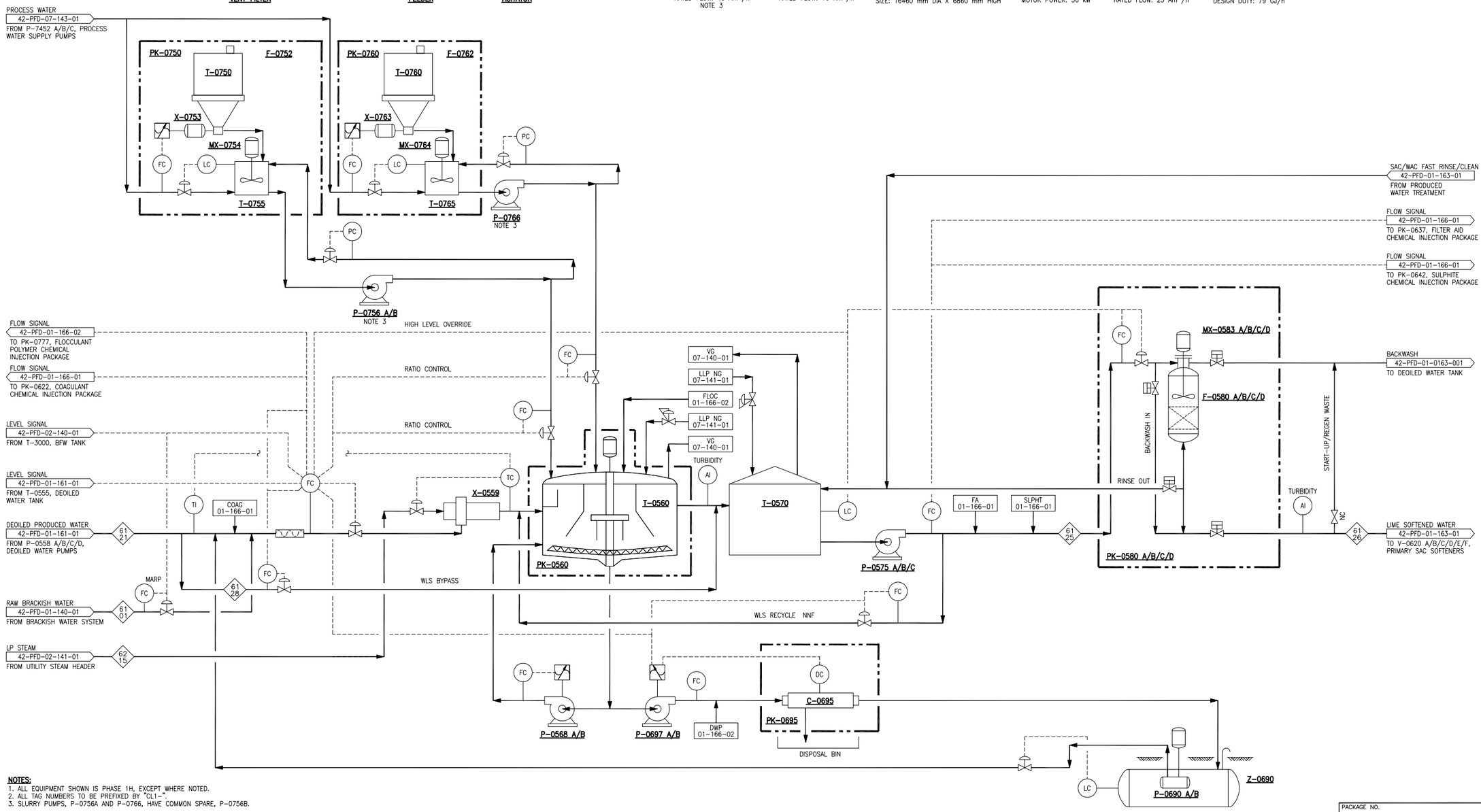
TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
CHEMICAL INJECTION – CFU
PHASE 1H

DRAWING NO.
CL1-42-PFD-01-0161-002

REVISION NO.
0.A.0

CL1-42-PFD-01-0162-001_0.A.0

PK-0750 LIME STORAGE AND FEED PACKAGE	PK-0760 MAGOX STORAGE AND FEED PACKAGE	F-0752 LIME STORAGE SILO VENT FILTER	T-0750 LIME STORAGE SILO	X-0753 LIME VOLUMETRIC FEEDER	MX-0754 LIME SLURRY TANK AGITATOR	T-0755 LIME SLURRY TANK	P-0756 A/B LIME SLURRY PUMPS RATED FLOW: 45 Am³/h NOTE 3	P-0568 A/B SLUDGE RECYCLE PUMPS RATED FLOW: 84 Am³/h	PK-0560 WARM LIME SOFTENER PACKAGE	PK-0695 SLUDGE CENTRIFUGE PACKAGE	T-0570 CLEAR WELL NOMINAL CAPACITY: 481 m³	P-0575 A/B/C AFTER-FILTER FEED PUMPS RATED FLOW: 450 Am³/h	Z-0690 CENTRATE SUMP	PK-0580 A-D WLS AFTER-FILTER PACKAGE	MX-0583 A/B/C/D WLS AFTER-FILTER AGITATORS	F-0580 A/B/C/D WLS AFTER-FILTERS SIZE: 3658 mm DIA X 984 mm S/S
F-0762 MAGOX STORAGE SILO VENT FILTER	T-0760 MAGOX STORAGE SILO	X-0763 MAGOX VOLUMETRIC FEEDER	MX-0764 MAGOX SLURRY TANK AGITATOR	T-0765 MAGOX SLURRY TANK	P-0766 MAGOX SLURRY PUMP RATED FLOW: 45 Am³/h NOTE 3	P-0697 A/B SLUDGE BLOWDOWN PUMPS RATED FLOW: 10 Am³/h	T-0560 WARM LIME SOFTENER SIZE: 16460 mm DIA X 6860 mm HIGH	C-0695 SLUDGE CENTRIFUGE MOTOR POWER: 56 kW	P-0690 A/B CENTRATE PUMPS RATED FLOW: 25 Am³/h	X-0559 DIRECT STEAM INJECTION HEATER DESIGN DUTY: 79 GJ/h					



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1H, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. SLURRY PUMPS, P-0756A AND P-0766, HAVE COMMON SPARE, P-0756B.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD GARRETT ALBERTA

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION - REISSUED FOR REGULATORY APPROVAL	2012/07/25	IS	APC	LY	KUL	BZS
0.A.0	PHASE 1H EXPANSION -ISSUED FOR DESIGN	2019/04/05	DSH		ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
WARM LIME SOFTENER SYSTEM
PHASE 1H

DRAWING NO.
CL1-42-PFD-01-0162-001

REVISION NO.
0.A.0

CL1-42-PFD-01-0163-001_0.A.0

V-0620 A/B/C/D/E/F
PRIMARY SAC SOFTENERS
SIZE: 3048 mm I.D. X 3810 mm S/S

V-0630 A/B/C/D
POLISHER WAC SOFTENERS
SIZE: 3048 mm I.D. X 3810 mm S/S

P-0657 A/B
BRINE PUMPS
RATED FLOW: 20 Am3/h

T-0655
PRODUCED WATER BRINE SATURATOR
NOMINAL CAPACITY: 160 m3

BACKWASH
42-PFD-01-0162-001
FROM F-0580 A/B/C/D, WLS AFTER FILTERS

SUBSURFACE WASH/ BACKWASH
42-PFD-01-141-01
TO DEOILED WATER TANKS

NOTE 3

LIME SOFTENED WATER
42-PFD-01-0162-001
FROM F-0580 A/B/C/D, WLS AFTER FILTERS

61 26

NOTE 3 NOTE 3

FC

SERVICE INLET

DIRTY SSW/ BACKWASH OUT

SPENT CAUSTIC

FAST RINSE IN

BRINE IN

SSW IN

V-0620 A/B/C/D/E/F

BACKWASH IN

61 27

FC

SERVICE INLET

DIRTY SSW/ BACKWASH OUT

CAUSTIC ONLY

FC

FLOW SIGNAL
42-PFD-01-156-02
TO PK-0645, BRINE SULPHITE CHEMICAL INJECTION PACKAGE

FC

P-0657 A/B

SLPHT 01-0166-002

T-0655

LC

REGENERATION WATER
42-PFD-01-0164-001
FROM REGEN WATER PUMPS

SPENT BRINE

FAST RINSE OUT

FAST RINSE IN

ACID/CAUSTIC IN

SSW IN

V-0630 A/B/C/D

BACKWASH IN

SPENT ACID /CAUSTIC

FAST RINSE OUT

SOFT PRODUCED WATER
42-PFD-02-140-01
TO T-3000, BFW TANK

ACID/CAUSTIC DISPLACEMENT
42-PFD-01-0164-001
FROM P-0674 A/B CAUSTIC REGENERATION PUMPS P-0664 A/B ACID REGENERATION PUMPS

REGENERATION WATER
42-PFD-01-0164-001
FROM REGEN WATER PUMPS

REGEN WASTE
42-PFD-01-0164-001
TO T-0680, NEUTRALIZATION TANK

SAC / WAC FAST RINSE / CLEAN
42-PFD-01-0162-001
TO T-0570, CLEAR WELL

REGEN WASTE
42-PFD-01-145-01
TO T-0845 A/B, REGENERATION WASTE WATER TANKS

NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1H, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY CL1-.
3. FUTURE TIE-IN POINTS FOR SUSPENDED SOLIDS FILTERS.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD BARRETT ALBERTA

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION – REISSUED FOR REGULATORY APPROVAL		IS				
0.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH		ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
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PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

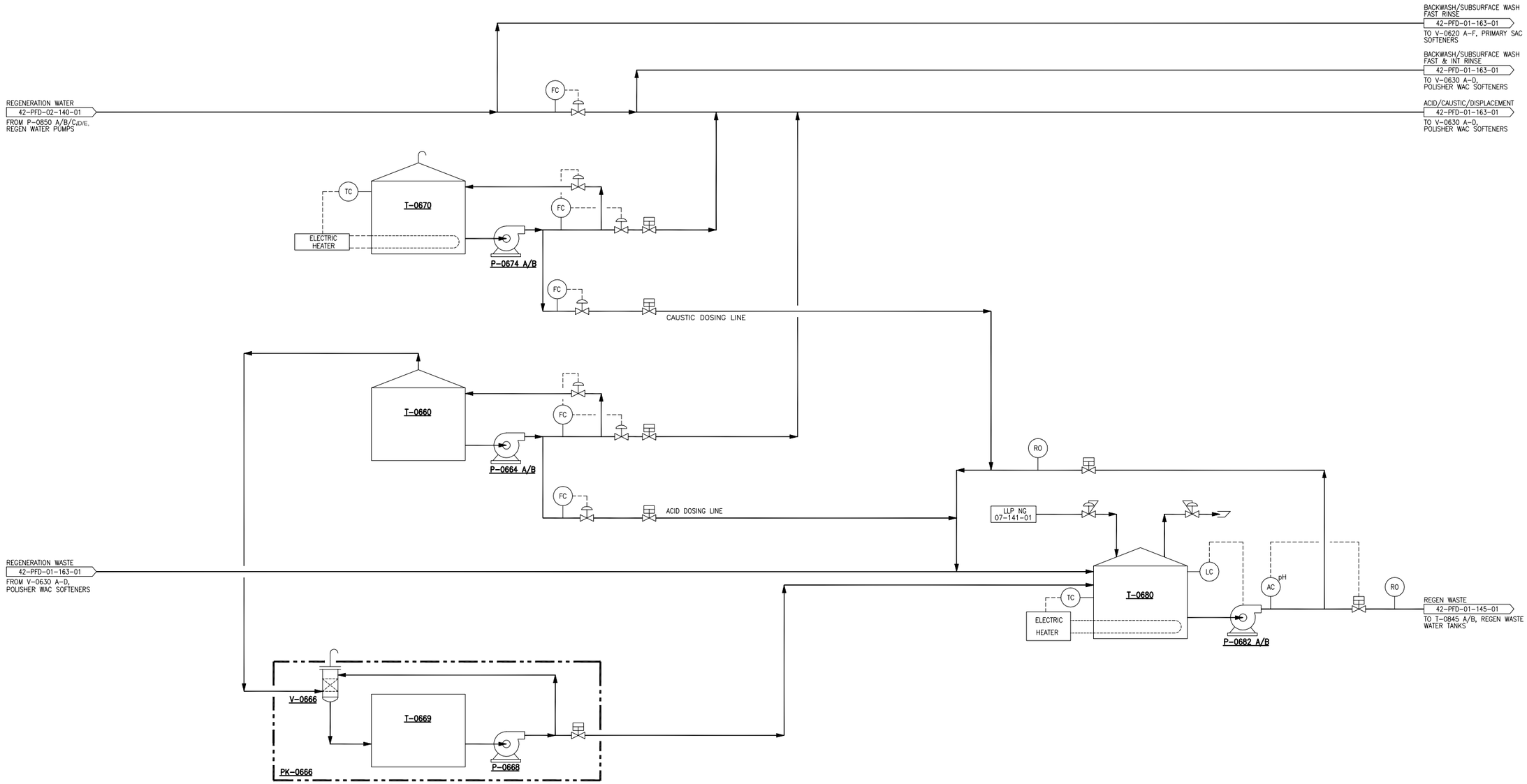
TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
WATER TREATMENT (ION EXCHANGE) SYSTEM
PHASE 1H

DRAWING NO.
CL1-42-PFD-01-0163-001

REVISION NO.
0.A.0

CL1-42-PFD-01-0164-001_0.A.0

PK-0666 ACID FUME SCRUBBER PACKAGE	V-0666 ACID FUME SCRUBBER SIZE: 610 mm I.D. x 2312 mm F/F	T-0669 SCRUBBER WATER RECIRCULATION TANK NOMINAL CAPACITY: 1.09 m³	T-0660 ACID STORAGE TANK NOMINAL CAPACITY: 323 m³	T-0670 CAUSTIC STORAGE TANK NOMINAL CAPACITY: 323 m³	P-0668 SCRUBBER WATER RECIRCULATION PUMP RATED FLOW: 5.7 Am³/h	P-0664 A/B ACID REGENERATION PUMPS RATED FLOW: 14.0 Am³/h	P-0674 A/B CAUSTIC REGENERATION PUMPS RATED FLOW: 16.3 Am³/h	T-0680 NEUTRALIZATION TANK NOMINAL CAPACITY: 323 m³	P-0682 A/B NEUTRALIZED WASTE PUMPS RATED FLOW: 62.5 Am³/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1H, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY CL1-.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD GARRETT 26170

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION – REISSUED FOR REGULATORY APPROVAL	2012/07/25	IS	APC	LY	KUL	BZS
0.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	[illegible]	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

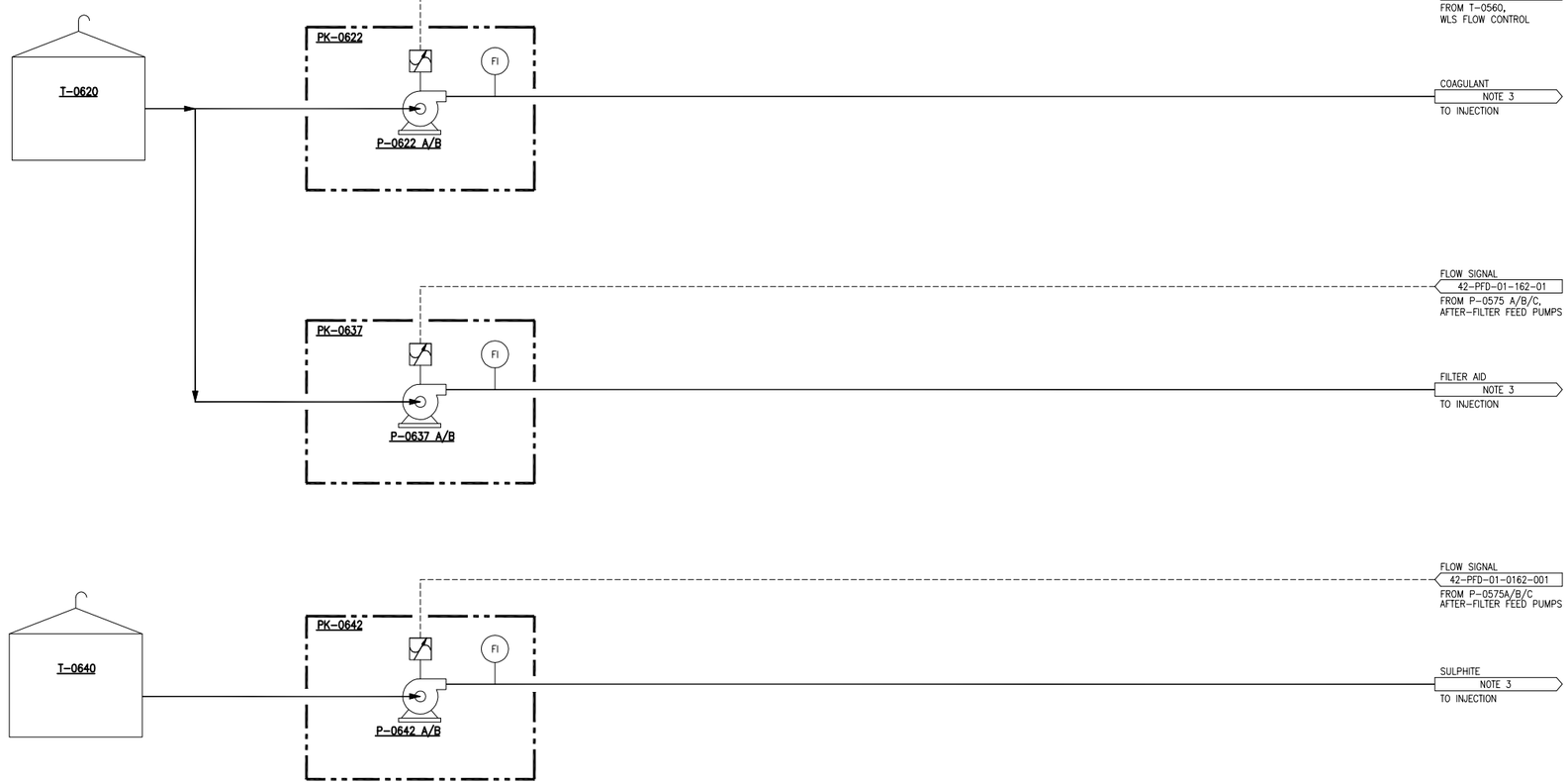
TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
ACID/CAUSTIC/NEUTRALIZATION SYSTEM
PHASE 1H

DRAWING NO.
CL1-42-PFD-01-0164-001

REVISION NO.
0.A.0

CL1-42-PFD-01-0166-001_0.A.0

T-0620 COAGULANT BULK STORAGE TANK	PK-0622 COAGULANT CHEMICAL INJECTION SKID PACKAGE	P-0622 A/B COAGULANT PUMPS	PK-0637 FILTER AID CHEMICAL INJECTION SKID PACKAGE	P-0637 A/B FILTER AID PUMPS	T-0640 SULPHITE BULK STORAGE TANK	PK-0642 SULPHITE CHEMICAL INJECTION PACKAGE	P-0642 A/B SULPHITE PUMP
NOMINAL CAPACITY: 27.8 m^3		RATED FLOW: 0.042 Am^3/h		RATED FLOW: 0.042 Am^3/h	NOMINAL CAPACITY: 24.8 m^3		RATED FLOW: 0.1 Am^3/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1H, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. INJECTION POINT LOCATED ON DWG. CL1H-42-PFD-01-162-01.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD BARRETT

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED

APEGA PERMIT No.
P 04559

The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION – REISSUED FOR REGULATORY APPROVAL	2012/07/25	DI	APC	LY	KUL	BZS
0.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	[illegible]	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO

Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
CHEMICAL INJECTION – AREA 01
PHASE 1H

DRAWING NO.
CL1-42-PFD-01-0166-001

REVISION NO.
0.A.0

CL1-42-PFD-01-0166-002_0.A.1

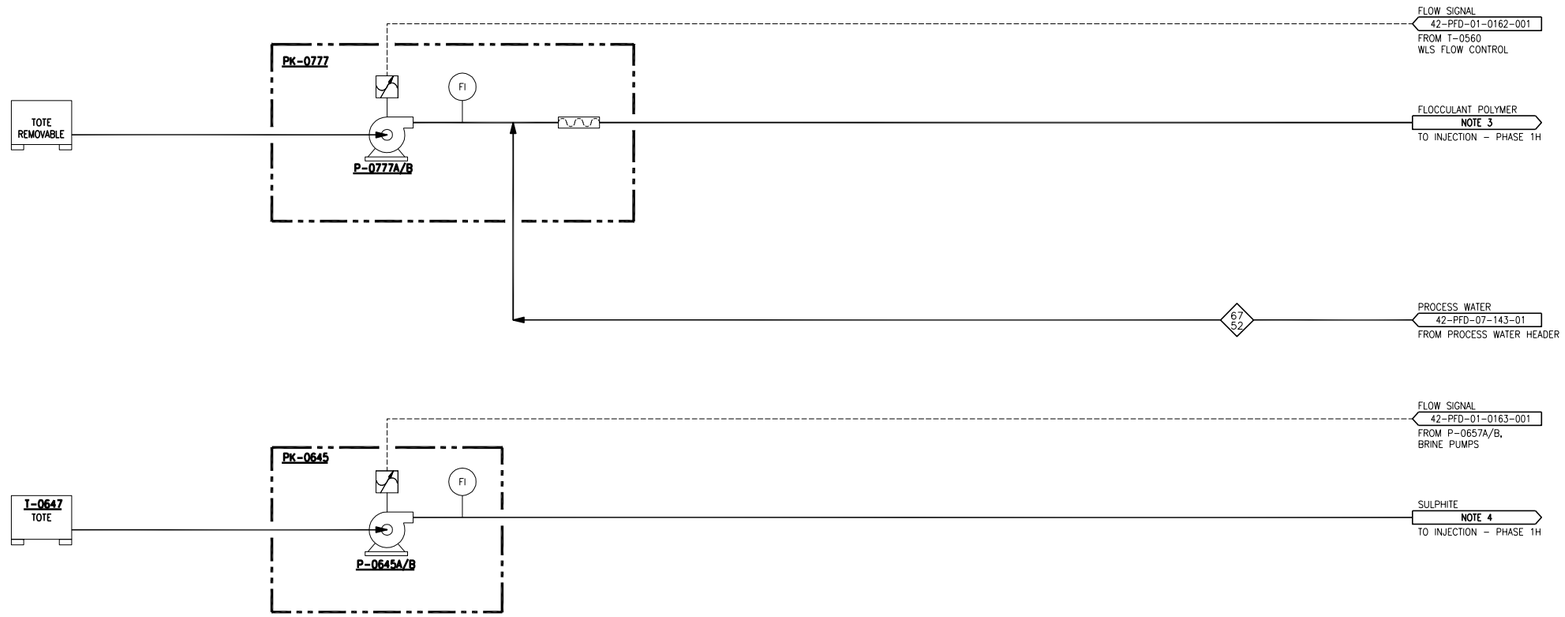
PK-0777
FLOCCULANT POLYMER INJECTION PACKAGE

P-0777A/B
FLOCCULANT POLYMER PUMPS
RATED FLOW: 0.0044 Am3/h

T-0647
BRINE SULPHITE TOTE TANK
CAPACITY: 1 m3

PK-0645
BRINE SULPHITE CHEMICAL INJECTION PACKAGE

P-0645A/B
BRINE SULPHITE PUMPS
RATED FLOW: 0.02 Am3/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1H, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. INJECTION POINT LOCATED ON DWG. CL1G-42-PFD-01-162-01.
4. INJECTION POINT LOCATED ON DWG. CL1G-42-PFD-01-163-01.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA

2019-06-11

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
Signature
Date Jun 12, 2019
PERMIT NUMBER: P 4559
The Association of Professional Engineers and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION – REISSUED FOR REGULATORY APPROVAL		RY				
0.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	DSH	RVG	ZGA	KUL	JEG
0.A.1	PHASE 1H EXPANSION – REISSUED FOR DESIGN	2019/06/11	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
REISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/06/11

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
CHEMICAL INJECTION – AREA 01
PHASE 1H

DRAWING NO.
CL1-42-PFD-01-0166-002

REVISION NO.
0.A.1

CL1-42-PFD-02-0140-001_4.A.1

P-0850A/B/C/D/E
REGENERATION WATER PUMPS
RATED FLOW: 141 Am^3/h
NOTE 4

P-7442 A/B
PROCESS WATER MAKE-UP PUMPS
RATED FLOW: 140 Am^3/h

T-3000
BFW TANK
NOMINAL CAPACITY: 7987 m^3

P-3010 A/B/C/D/E/F/G/H
BFW BOOSTER PUMPS
RATED FLOW: 422 Am^3/h
NOTE 4

E-4430A/B & E-4530A/B & (E-4630A/B)(1PX2S)
SALES OIL/BFW EXCHANGERS
DESIGN DUTY: 11.56 GJ/h
NOTE 3,4

E-4470A/B & E-4570A-F & (E-4670A/B)(1PX2S)
SALES OIL/BFW EXCHANGERS
DESIGN DUTY: 11.56 GJ/h
NOTE 3,4

E-4445A-F & E-4545A-F & (E-4645A-F)
PRODUCED WATER/BFW EXCHANGERS
DESEGN DUTY: 70.13 GJ/h
NOTE 3,4

E-4440A-D & E-4540A-D & (E-4640A-D) (4PX2S)
EMULSION/BFW EXCHANGERS
DESIGN DUTY: 223.1 GJ/h
NOTE 3,4

P-3015 A/B/C/D/E/F/G/H
BFW CHARGE PUMPS
RATED FLOW: 458 Am^3/h
NOTE 4

TEMPERATURE SIGNAL
42-PFD-04-160-01
FROM EMULSION

TEMPERATURE SIGNAL
42-PFD-04-150-01
FROM EMULSION

TEMPERATURE SIGNAL
42-PFD-04-140-01
FROM EMULSION

PHASE 1H
PHASE 1G
PHASE 1F

LEVEL SIGNAL
42-PFD-01-142-01
TO T-0160,
WLS FLOW CONTROL

LEVEL SIGNAL
42-PFD-01-152-01
TO T-0360,
WLS FLOW CONTROL

LEVEL SIGNAL
42-PFD-01-162-01
TO T-0560,
WLS FLOW CONTROL

E-4630 A/B
E-4670 A/B
NOTE 5

E-4530 A/B
E-4570 A/B
NOTE 4

E-4430 A/B
E-4470 A/B

SO
04-160-01

SO
04-150-01

SO
04-140-01

TC
DPC
LC
FC
PC

62 03
52 03
42 03
42 02
42 04
52 04
62 04
42 05

BOILER BLOWDOWN RECYCLE
42-PFD-02-0161-005
FROM E-5710
BLOWDOWN/GLYCOL EXCHANGER

BOILER BLOWDOWN RECYCLE
42-PFD-02-161-01
FROM E-3075,
BLOWDOWN/GLYCOL EXCHANGER

BOILER BLOWDOWN RECYCLE
42-PFD-02-151-01
FROM E-3055,
BLOWDOWN/ GLYCOL EXCHANGER

BOILER BLOWDOWN RECYCLE
42-PFD-02-141-01
FROM E-3035,
BLOWDOWN/ GLYCOL EXCHANGER

SOFT PRODUCED WATER
42-PFD-01-143-01
FROM WATER TREATMENT

SOFT PRODUCED WATER
42-PFD-01-153-01
FROM WATER TREATMENT

SOFT PRODUCED WATER
42-PFD-01-163-01
FROM WATER TREATMENT

POND WATER
42-PFD-07-147-01
FROM P-7750 A/B,
STEAM BLOWDOWN POND PUMPS

LLP NG
07-141-01

VG
07-140-01

T-3000

P-3010 A/B/C/D/E/F/G/H
NOTE 4

SLPHT
02-142-01

P-7442 A/B

P-0850 A/B/C/D/E
NOTE 4

E-4440 A-D
EMUL
04-140-01

E-4540 A-D
NOTE 4
EMUL
04-150-01

E-4640 A-D
NOTE 5
EMUL
04-160-01

E-4445 A-F
PW
04-140-01

E-4545 A-F
NOTE 4
PW
04-150-01

E-4645 A-F
NOTE 5
PW
04-160-01

CHLT
02-142-01

P-3015 A/B/C/D/E/F/G/H
NOTE 4

NNF

BOILER FEED WATER
42-PFD-02-0161-005
TO E-5705
BFW/BLOWDOWN EXCHANGER

BOILER FEED WATER
42-PFD-02-161-01
TO E-3065 A/B,
BFW/BLOWDOWN EXCHANGERS

BOILER FEED WATER
42-PFD-02-151-01
TO E-3045 A/B,
BFW/BLOWDOWN EXCHANGERS

BOILER FEED WATER
42-PFD-02-141-01
TO E-3025 A/B,
BFW/BLOWDOWN EXCHANGERS

BFW MINIMUM FLOW
42-PFD-07-147-01
TO Z-7740,
STEAM BLOWDOWN POND

PROCESS MAKE-UP WATER
42-PFD-07-143-01
TO T-7450
PROCESS WATER TANK

REGEN WATER
42-PFD-01-144-01
TO WATER TREATMENT

REGEN WATER
42-PFD-01-154-01
TO WATER TREATMENT

REGEN WATER
42-PFD-01-164-01
TO WATER TREATMENT

NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. DESIGN DUTY IS THE TOTAL DUTY FOR ALL SHELLS.
4. P-3010D/E, P-3015D/E, P-0850D/E, E-4540A-D, E-4530A/B, E-4570A/B AND E-4545A-F ARE INSTALLED AS PART OF PHASE 1G.
5. P-3010F/G/H, P-3015F/G/H, E-4640A-D, E-4630A/B, E-4730A/B AND E-4645A-F ARE INSTALLED AS PART OF PHASE 1H.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER PROVINCE OF ALBERTA RICHARD GADSBY 29128

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
Signature
Date Jun 20, 2019
PERMIT NUMBER: P 4559
The Association of Professional Engineers and Geoscientists of Alberta

2019-06-20

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION - REISSUED FOR REGULATORY APPROVAL	2012/07/25	RY	APC	LY	KUL	BZS
4.A.0	PHASE 1H EXPANSION - ISSUED FOR DESIGN	2019/04/05	EMJ	RVG	ZGA	KUL	JEG
4.A.1	PHASE 1H EXPANSION - REISSUED FOR DESIGN	2019/06/20	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
BOILER FEED WATER SYSTEM
PHASE 1F/1G/1H

REVISION DESCRIPTION
REISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/06/20

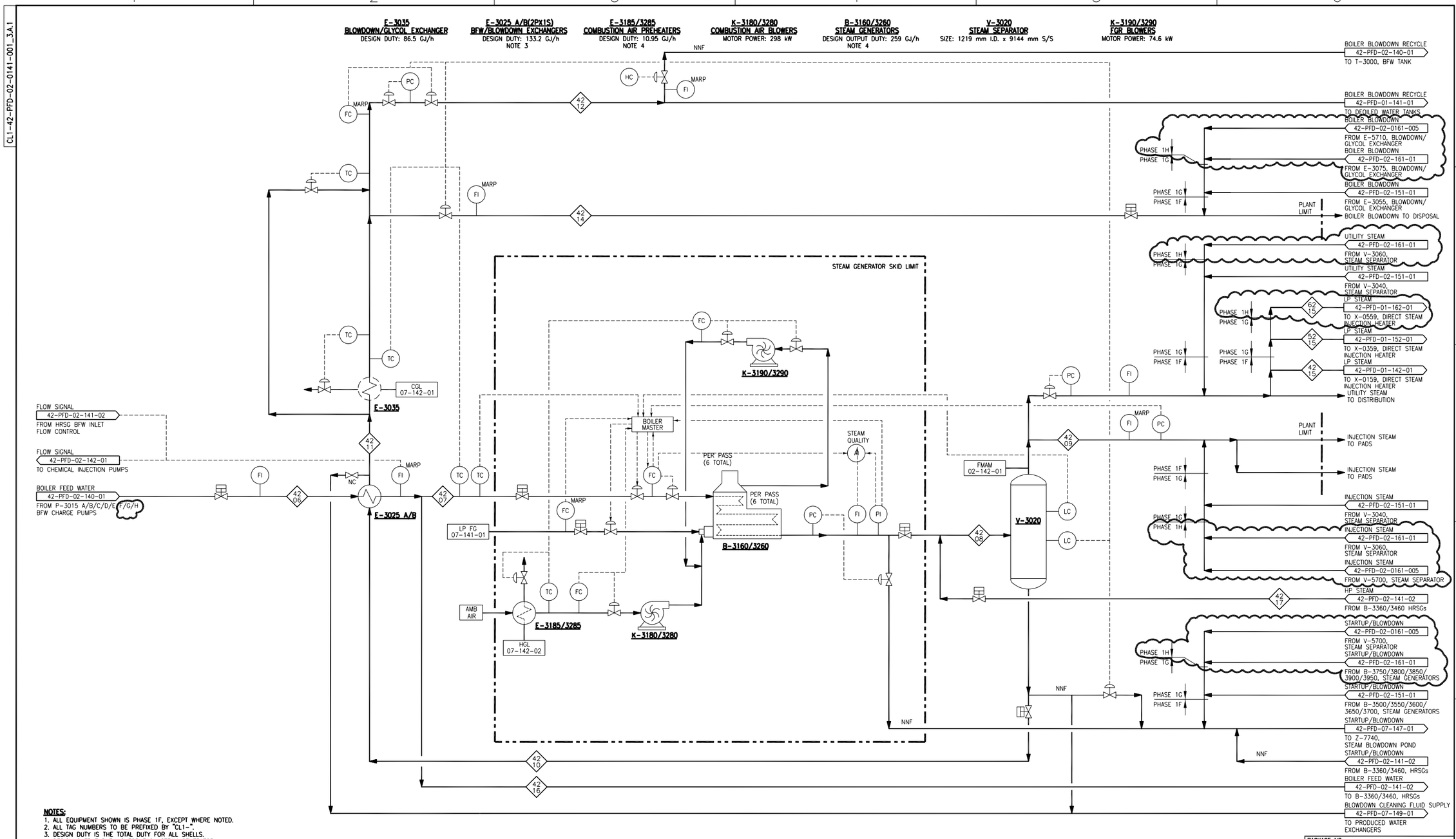
SCALE
NONE

DRAWING NO.
CL1-42-PFD-02-0140-001

REVISION NO.
4.A.1

CL1-42-PFD-02-0141-001_3.A.1

E-3035 BLOWDOWN/GLYCOL EXCHANGER	E-3025 A/B(2PX1S) BFW/BLOWDOWN EXCHANGERS	E-3185/3285 COMBUSTION AIR PREHEATERS	K-3180/3280 COMBUSTION AIR BLOWERS	B-3160/3260 STEAM GENERATORS	V-3020 STEAM SEPARATOR	K-3190/3290 FGR BLOWERS
DESIGN DUTY: 86.5 GJ/h	DESIGN DUTY: 133.2 GJ/h NOTE 3	DESIGN DUTY: 10.95 GJ/h NOTE 4	MOTOR POWER: 298 kW	DESIGN OUTPUT DUTY: 259 GJ/h NOTE 4	SIZE: 1219 mm I.D. x 9144 mm S/S	MOTOR POWER: 74.6 kW



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. DESIGN DUTY IS THE TOTAL DUTY FOR ALL SHELLS.
4. DESIGN OUTPUT DUTY IS FOR EACH STEAM GENERATOR.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PERMIT TO PRACTICE VISTA PROJECTS LIMITED
Signature
Date Jun 12, 2019
PERMIT NUMBER: P 4559
The Association of Professional Engineers and Geoscientists of Alberta

2019-06-11

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION - REISSUED FOR REGULATORY APPROVAL	2012/07/25	RY	APC	LY	KUL	BZS
3.A.0	PHASE 1H EXPANSION - ISSUED FOR DESIGN	2019/04/05	EMJ	RVG	ZGA	KUL	JEG
3.A.1	PHASE 1H EXPANSION - REISSUED FOR DESIGN	2019/06/11	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO: Vista Projects

REVISION DESCRIPTION: REISSUED FOR DESIGN

PROJECT NO.: CL1H

LSD: S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE: 2019/06/11

SCALE: NONE

cenovus ENERGY

TITLE: CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
STEAM GENERATION SYSTEM (OTSG)
PHASE 1F/1G/1H

DRAWING NO.: CL1-42-PFD-02-0141-001

REVISION NO.: 3.A.1

CL1-42-PFD-02-0141-002_4.A.0

B-3360/3460
HEAT RECOVERY STEAM GENERATORS (HRSGs)
DESIGN ABSORBED DUTY: 354 GJ/h (EACH)
NOTE 3

EH-2994
HP NATURAL GAS HEATER
DUTY: 0.306 GJ/h
DESIGN: 9320 kPag @ 100°C / -40°C

GT-2900/2950
GAS TURBINES
DESIGN OUTPUT POWER: 46MW

F-2995 A/B
HP NATURAL GAS FILTERS/SEPARATORS

HP STEAM
42-PFD-02-141-01
TO V-3020,
STEAM SEPARATOR

42 17

PC

PC

START UP/BLOWDOWN HEADER
42-PFD-02-141-01
TO STEAM BLOWDOWN POND

NNF

STACK

B-3360/3460

FLOW SIGNAL
42-PFD-02-141-01
TO CHEMICAL INJECTION PUMPS

BOILER FEED WATER
42-PFD-02-141-01
FROM E-3025 A/B
BFW/BLOWDOWN EXCHANGERS

42 16

MARP

FC

FC

TYPICAL FOR ONE PASS

DUCT BURNERS

BMS

MARP

FC

LP FG
07-141-01

HRSGs-PACKAGE

ELECTRIC HEATER

TC

EH-2994

F-2995A/B

TO FLARE

47 02

HP NATURAL GAS
42-PFD-07-141-01
FROM HEADER

GTG-PACKAGE

FE

AMBIENT AIR

FILTER

COMBUSTOR

GEN

POWER TURBINE

GT-2900/2950

AIR COMPRESSOR

NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. DESIGN ABSORBED IS FOR EACH HRSG.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEERS ASSOCIATION OF ALBERTA

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/05/08	GP	RVG	LY	RVG	FY
4.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	EMJ	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
STEAM GENERATION SYSTEM (COGENERATION)
PHASE 1F

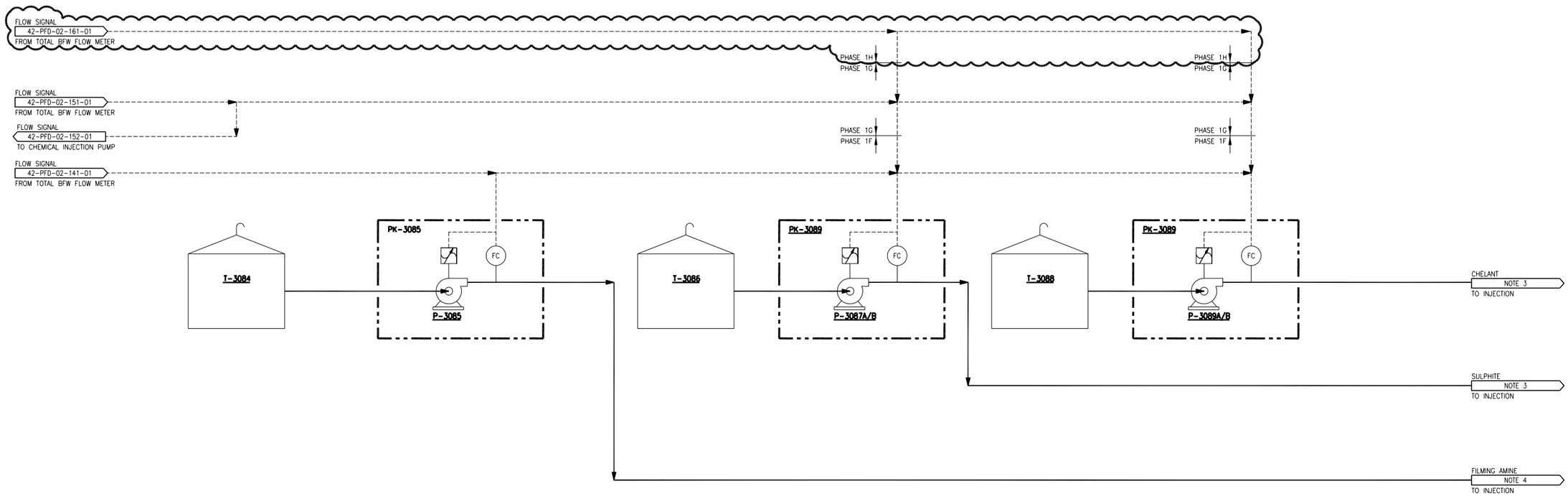
DRAWING NO.
CL1-42-PFD-02-0141-002

REVISION NO.
4.A.0

K:\Projects\Cenovus\2195\Piping\Drafting\PFD\01 - IFR - (IN PROGRESS)\CL1-42-PFD-02-0141-002_4.A.0.dwg Ken Sorensen 4/3/2019 11:23 AM

CL1-42-PFD-02-0142-001_3.A.1

T-3084 FILMING AMINE STORAGE TANK	PK-3085 FILMING AMINE CHEMICAL PACKAGE	P-3085 FILMING AMINE INJECTION PUMPS	T-3086 SULPHITE STORAGE TANK	PK-3087 SULPHITE CHEMICAL INJECTION SKID PACKAGE	P-3087A/B SULPHITE INJECTION PUMPS	T-3088 CHELANT STORAGE TANK	PK-3089 CHELANT INJECTION PACKAGE	P-3089A/B CHELANT INJECTION PUMPS
NOMINAL CAPACITY: 5.9 m³		RATED FLOW: 0.01 Am³/h	NOMINAL CAPACITY: 122 m³		RATED FLOW: 0.125 Am³/h	NOMINAL CAPACITY: 16.69 m³		RATED FLOW: 0.02 Am³/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. INJECTION POINT LOCATED ON DWG. CL1H-42-PFD-02-140-01.
4. INJECTION POINT LOCATED ON DWG. CL1H-42-PFD-02-141-01.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
Signature
Date Jun 12, 2019
PERMIT NUMBER: P 4559
The Association of Professional Engineers and Geoscientists of Alberta

2019-06-11

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION - REISSUED FOR REGULATORY APPROVAL	2012/07/25	RY	APC	LY	KUL	BZS
3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	EMJ	RVG	ZGA	KUL	JEG
3.A.1	PHASE 1H EXPANSION – REISSUED FOR DESIGN	2019/06/11	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO: Vista Projects

REVISION DESCRIPTION: REISSUED FOR DESIGN

PROJECT NO.: CL1H

LSD: S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE: 2019/06/11

SCALE: NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
CHEMICAL INJECTION – AREA 02
PHASE 1F/1G/1H

DRAWING NO.: CL1-42-PFD-02-0142-001

REVISION NO.: 3.A.1

E-3055
BLOWDOWN/GLYCOL EXCHANGER
DESIGN DUTY: 86.5 GJ/h

E-3045 A/B(2PX1S)
BFW/BLOWDOWN EXCHANGERS
DESIGN DUTY: 133.2 GJ/h
NOTE 3

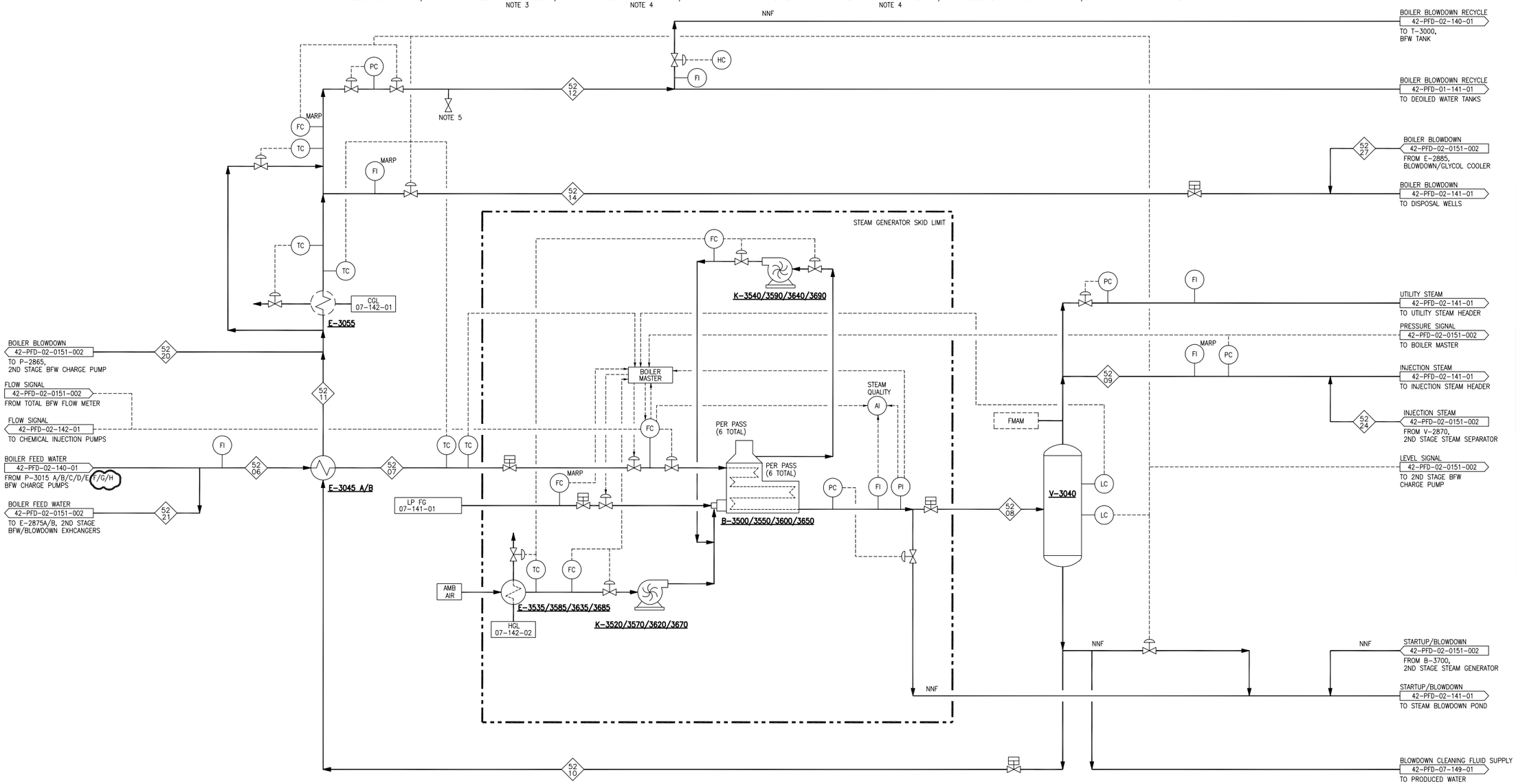
E-3535/3585/3635/3685
COMBUSTION AIR PREHEATERS
DESIGN DUTY: 10.95 GJ/h
NOTE 4

K-3520/3570/3620/3670
COMBUSTION AIR BLOWERS
MOTOR POWER: 298 kW

B-3500/3550/3600/3650
STEAM GENERATORS
DESIGN OUTPUT DUTY: 259 GJ/h
NOTE 4

V-3040
STEAM SEPARATOR
SIZE: 1219 mm I.D. x 9144 mm S/S

K-3540/3590/3640/3690
FGR BLOWERS
MOTOR POWER: 74.6 kW



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1G, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. DESIGN DUTY IS THE TOTAL DUTY FOR ALL SHELLS.
4. DESIGN DUTY FOR EACH UNIT IS SHOWN.
5. FUTURE TIE-IN POINT FOR DIVERTING 2ND STAGE BLOWDOWN TO DEOILED WATER TANKS AND/OR THE BFW TANK.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD GARRETT ALBERTA

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	GP	RVG	LY	RVG	FY
0.B.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	EMJ		ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
STEAM GENERATION SYSTEM (OTSG)
PHASE 1G

DRAWING NO.
CL1-42-PFD-02-0151-001

REVISION NO.
0.B.0

P-2865
2ND STAGE BFW CHARGE PUMP
RATED FLOW: 147 Am3/h

E-2885
2ND STAGE BLOWDOWN/GLYCOL COOLER
DESIGN DUTY: 22.9 GJ/h

E-2875A/B
2ND STAGE BFW/BLOWDOWN EXCHANGERS
DESIGN DUTY: 33.6 GJ/h
NOTE 3

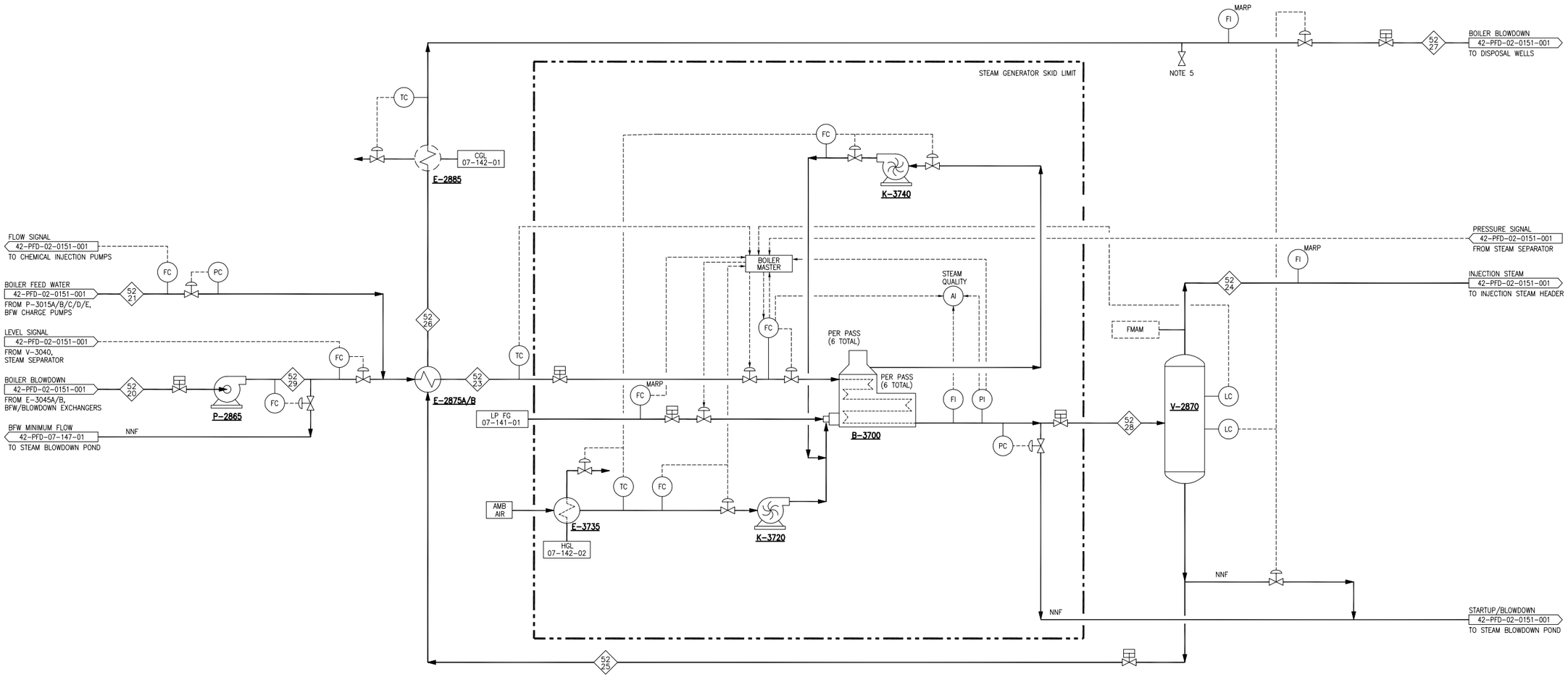
E-3735
COMBUSTION AIR PREHEATER
DESIGN DUTY: 10.95 GJ/h
NOTE 4

K-3720
COMBUSTION AIR BLOWER
MOTOR POWER: 298 kW

B-3700
2ND STAGE STEAM GENERATOR
RATED FIRED DUTY: 259 GJ/h
NOTE 4

V-2870
2ND STAGE STEAM SEPARATOR
SIZE: 1219 mm I.D. x 6096 mm S/S

K-3740
FGR BLOWERS
MOTOR POWER: 74.6 kW



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1G EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-"
3. DESIGN DUTY IS THE TOTAL DUTY FOR ALL SHELLS.
4. DESIGN DUTY FOR EACH UNIT IS SHOWN.
5. FUTURE TIE-IN POINT FOR DIVERTING 2ND STAGE BLOWDOWN TO DEOILED WATER TANKS AND/OR THE BFW TANK.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD GAROSTE ALBERTA

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED

APEGA PERMIT No.
P 04559

The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	KJS	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	RZ	RVG	LY	RVG	FY
0.B.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	EMJ	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
STEAM GENERATION SYSTEM (2ND STAGE OTSG)
PHASE 1G

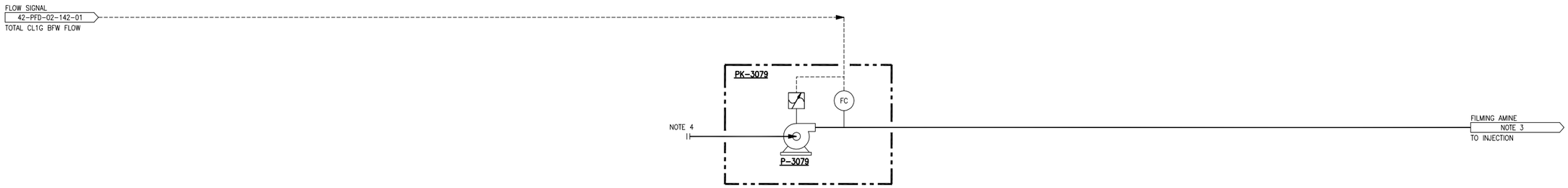
DRAWING NO.
CL1-42-PFD-02-0151-002

REVISION NO.
0.B.0

CL1-42-PFD-02-0152-001_0.B.0

PK-3079
FILMING AMINE CHEMICAL PACKAGE

P-3079
FILMING AMINE INJECTION PUMP
RATED FLOW: 0.01 Am3/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1G EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. INJECTION POINT LOCATED ON DWG. CL1G-42-PFD-02-0151-001.
4. FUTURE TIE-IN FOR FILMING AMINE STORAGE TANK.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GARDINER 58758

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED

APEGA PERMIT No.
P 04559

The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	RZ	RVG	LY	RVG	FY
0.B.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	EMJ		ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
CHEMICAL INJECTION – AREA 02
PHASE 1G

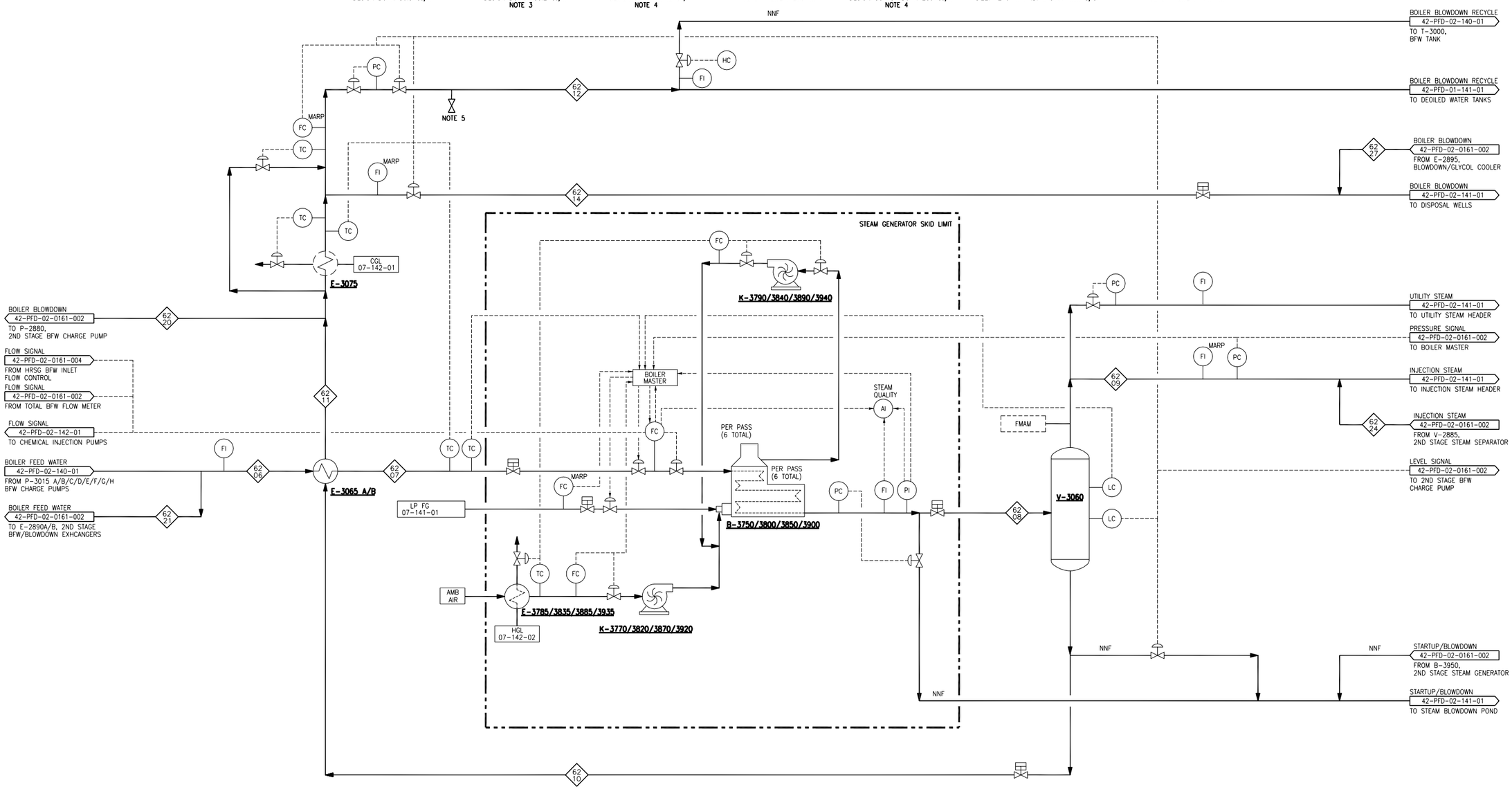
DRAWING NO.
CL1-42-PFD-02-0152-001

REVISION NO.
0.B.0

K:\Projects\Cenovus\2195\Piping\Drafting\PFD\01 - IFR - (IN PROGRESS)\CL1-42-PFD-02-0152-001_0.B.0.dwg Ken Sorensen 4/3/2019 11:23 AM

CL1-42-PFD-02-0161-001_0.A.1

E-3075 BLOWDOWN/GLYCOL EXCHANGER	E-3065 A/B(2PX1S) BFW/BLOWDOWN EXCHANGERS	E-3785/3835/3885/3935 COMBUSTION AIR PREHEATERS	K-3770/3820/3870/3920 COMBUSTION AIR BLOWERS	B-3750/3800/3850/3900 STEAM GENERATORS	V-3060 STEAM SEPARATOR	K-3790/3840/3890/3940 FGR BLOWERS
DESIGN DUTY: 86.5 GJ/h	DESIGN DUTY: 133.2 GJ/h NOTE 3	DESIGN DUTY: 10.95 GJ/h NOTE 4	MOTOR POWER: 298 kW	DESIGN OUTPUT DUTY: 259 GJ/h NOTE 4	SIZE: 1219 mm I.D. x 9144 mm S/S	MOTOR POWER: 74.6 kW



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1H, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. DESIGN DUTY IS THE TOTAL DUTY FOR ALL SHELLS.
4. DESIGN DUTY FOR EACH UNIT IS SHOWN.
5. FUTURE TIE-IN POINT FOR DIVERTING 2ND STAGE BLOWDOWN TO DEOILED WATER TANKS AND/OR THE BFW TANK.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GARRETT

2019-06-11

PERMIT TO PRACTICE VISTA PROJECTS LIMITED
Signature
Date Jun 12, 2019
PERMIT NUMBER: P 4559
The Association of Professional Engineers and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION – ISSUED FOR REGULATORY APPROVAL		AP				
0.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	EMJ	RVG	ZGA	KUL	JEG
0.A.1	PHASE 1H EXPANSION – REISSUED FOR DESIGN	2019/06/11	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO: Vista Projects

REVISION DESCRIPTION: REISSUED FOR DESIGN

PROJECT NO.: CL1H

LSD: S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE: 2019/06/11

SCALE: NONE

cenovus ENERGY

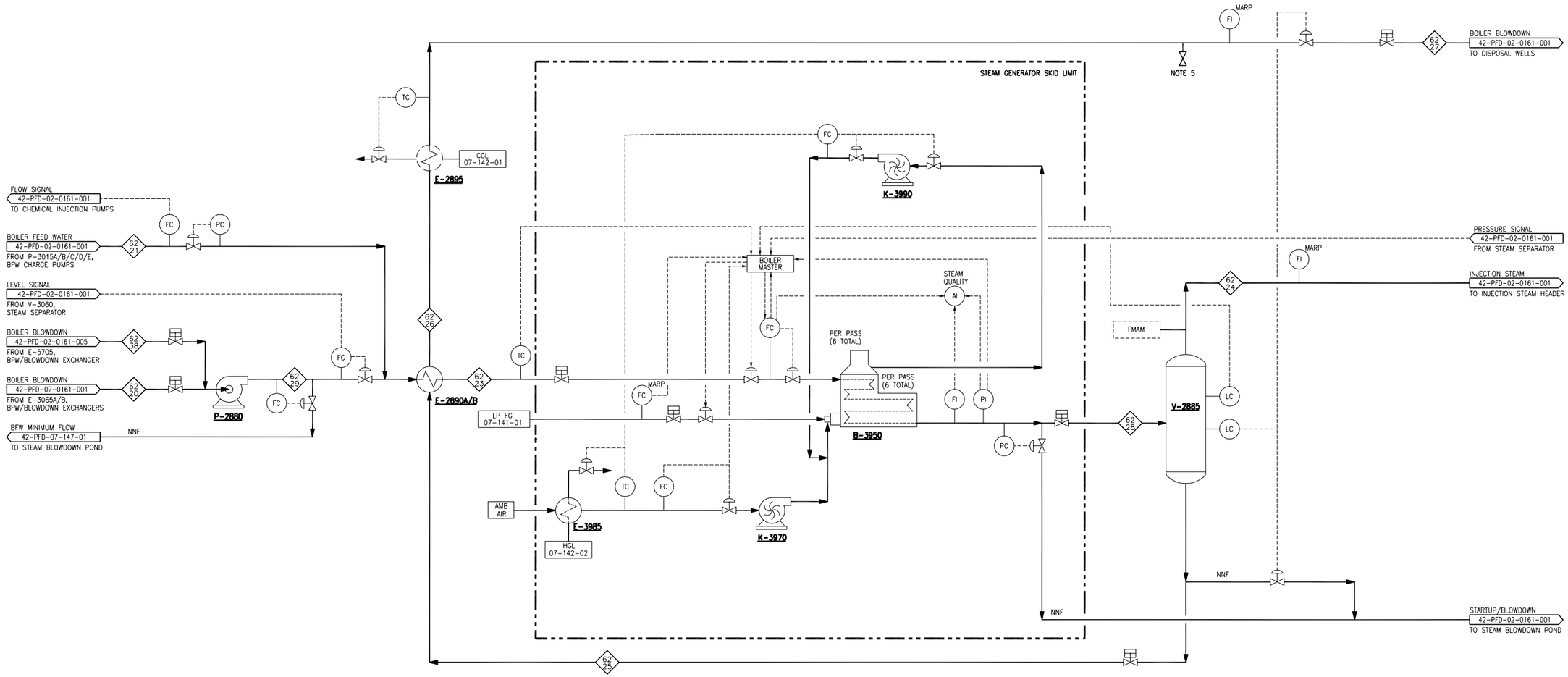
TITLE: CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
STEAM GENERATION SYSTEM (OTSG)
PHASE 1H

DRAWING NO.: CL1-42-PFD-02-0161-001

REVISION NO.: 0.A.1

CL1-42-PFD-02-0161-002_0.A.1

P-2880 2ND STAGE BFW CHARGE PUMP	E-2895 2ND STAGE BLOWDOWN/GLYCOL COOLER	E-2890A/B 2ND STAGE BFW/BLOWDOWN EXCHANGERS	E-3985 COMBUSTION AIR PREHEATER	K-3970 COMBUSTION AIR BLOWER	B-3950 2ND STAGE STEAM GENERATOR	V-2885 2ND STAGE STEAM SEPARATOR	K-3990 FGR BLOWERS
RATED FLOW: 209 Am3/h	DESIGN DUTY: 22.9 GJ/h	DESIGN DUTY: 33.6 GJ/h NOTE 3	DESIGN DUTY: 10.95 GJ/h NOTE 4	MOTOR POWER: 298 kW	RATED FIRED DUTY: 259 GJ/h NOTE 4	SIZE: 1219 mm I.D. x 6096 mm S/S	MOTOR POWER: 74.6 kW



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1H EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. DESIGN DUTY IS THE TOTAL DUTY FOR ALL SHELLS.
4. DESIGN DUTY FOR EACH UNIT IS SHOWN.
5. FUTURE TIE-IN POINT FOR DIVERTING 2ND STAGE BLOWDOWN TO DEOILED WATER TANKS AND/OR THE BFW TANK.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
Signature
Date Jun 12, 2019
PERMIT NUMBER: P 4559
The Association of Professional Engineers and Geoscientists of Alberta

2019-06-11

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	KSO	RVG	ZGA	KUL	JEG
0.A.1	PHASE 1H EXPANSION – REISSUED FOR DESIGN	2019/06/11	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
REISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/06/11

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
STEAM GENERATION SYSTEM (2ND STAGE OTSG)
PHASE 1H

DRAWING NO.
CL1-42-PFD-02-0161-002

REVISION NO.
0.A.1

CL1-42-PFD-02-0161-004_0.A.0

B-5600/5650
HEAT RECOVERY STEAM GENERATORS (HRSGs)
DESIGN ABSORBED DUTY: 354 GJ/h (EACH)
NOTE 3

EH-5494
HP NATURAL GAS HEATER
DUTY: 0.306 GJ/h
DESIGN: 9320 kPag @ 100°C / -40°C

GT-5500/5550
GAS TURBINES
DESIGN OUTPUT POWER: 46MW

F-5495 A/B
HP NATURAL GAS FILTERS/SEPARATORS

HP STEAM
42-PFD-02-0161-005
TO V-5700,
STEAM SEPARATOR

62
15

PC

START UP/BLOWDOWN
42-PFD-02-0161-005
TO STEAM BLOWDOWN POND

NNF

PC

STACK

B-5600/5650

FLOW SIGNAL
42-PFD-02-0161-001
TO CHEMICAL INJECTION PUMPS

MARP

FC

FC

BOILER FEED WATER
42-PFD-02-0161-005
FROM E-5605,
BFW/BLOWDOWN EXCHANGER

62
32

TYPICAL FOR ONE PASS

DUCT BURNERS

BMS

MARP

FC

LP FG
07-0141-001

HRSGs-PACKAGE

ELECTRIC HEATER

TC

EH-5494

F-5495A/B

TO FLARE

47
04

HP NATURAL GAS
42-PFD-07-0141-001
FROM HEADER

GTG-PACKAGE

FE

AMBIENT AIR

FILTER

COMBUSTOR

GEN

POWER TURBINE

GT-5500/5550

AIR COMPRESSOR

NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1H, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. DESIGN ABSORBED DUTY IS FOR EACH HRSG.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA

2019-06-11

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
Signature
Date Jun 12, 2019
PERMIT NUMBER: P 4559
The Association of Professional Engineers and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/06/11	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/06/11

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
STEAM GENERATION SYSTEM (COGENERATION)
PHASE 1H

DRAWING NO.
CL1-42-PFD-02-0161-004

REVISION NO.
0.A.0

CL1-42-PFD-02-0161-005_0.A.0

E-5710
BLOWDOWN/GLYCOL EXCHANGER
DESIGN DUTY: 36.1 GJ/h

E-5705
BFW/BLOWDOWN EXCHANGER
DESIGN DUTY: 56.3 GJ/h

V-5700
STEAM SEPARATOR
SIZE: 1219 mm I.D. x 6096 mm S/S

BOILER BLOWDOWN
42-PFD-02-0161-002
TO P-2880,
2ND STAGE BFW CHARGE PUMP

HP STEAM
42-PFD-02-0161-004
FROM B-5600/5650,
HRSGs

BOILER FEED WATER
42-PFD-02-0140-001
FROM P-3015 A/B/C/D/E/F/G/H
BFW CHARGE PUMPS

NNF

BOILER BLOWDOWN RECYCLE
42-PFD-02-0140-001
TO T-3000,
BFW TANK

BOILER BLOWDOWN RECYCLE
42-PFD-01-0141-001
TO DEOILED WATER TANKS

BOILER BLOWDOWN
42-PFD-02-0141-001
TO DISPOSAL WELLS

INJECTION STEAM
42-PFD-02-0141-001
TO INJECTION STEAM HEADER

STARTUP/BLOWDOWN
42-PFD-02-0161-004
FROM B-5600/5650,
HRSGs

STARTUP/BLOWDOWN
42-PFD-02-0141-001
TO STEAM BLOWDOWN POND

BOILER FEED WATER
42-PFD-02-0161-004
TO B-5600/5650,
HRSGs

CGL 07-0142-001

FMAM

MARP

PC, FC, TC, FI, HC, LC

62 30, 62 31, 62 32, 62 33, 62 34, 62 35, 62 36, 62 38

NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1H, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
Signature
Date Jun 12, 2019
PERMIT NUMBER: P 4559
The Association of Professional Engineers and Geoscientists of Alberta

2019-06-11

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/06/11	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/06/11

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
STEAM GENERATION SYSTEM (COGENERATION)
PHASE 1H

DRAWING NO.
CL1-42-PFD-02-0161-005

REVISION NO.
0.A.0

CL1-42-PFD-04-0140-001_4.A.1

V-4415 INLET DEGASSER	E-4440 A/B/C/D(4PX2S) EMULSION/BFW EXCHANGERS	V-4400 FWKO DRUM	V-4420/4460 TREATERS	E-4430 A/B(1PX2S) SALES OIL/BFW EXCHANGERS	E-4470 A/B(1PX2S) SALES OIL/BFW EXCHANGERS	E-4435 A/B(2PX4S) SALES OIL/GLYCOL EXCHANGERS	E-4475 A/B(2PX4S) SALES OIL/GLYCOL EXCHANGERS	E-4480 OIL SLOPS COOLER	E-4445 A-F PRODUCED WATER/BFW EXCHANGERS	E-4450 A/B/C/D/E/F PRODUCED WATER/GLYCOL EXCHANGERS
SIZE: 4267 mm I.D. x 21336 mm S/S	DESIGN DUTY: 223.1 GJ/h NOTE 5	SIZE: 4267 mm O.D. X 28956 mm S/S	SIZE: 4267 mm O.D. X 33528 mm S/S	DESIGN DUTY: 11.56 GJ/h NOTE 5	DESIGN DUTY: 11.56 GJ/h NOTE 5	DESIGN DUTY: 28.72 GJ/h NOTE 5	DESIGN DUTY: 28.72 GJ/h NOTE 5	DESIGN DUTY: 2.57 GJ/h	DESIGN DUTY: 70.13 GJ/h NOTE 4,5	DESIGN DUTY: 87.3 GJ/h NOTE 3,4,5

FLOW SIGNAL 42-PFD-04-142-01 TO CHEMICAL INJECTION

EMULSION FROM PIPELINE — PLANT LIMIT — PHASE 1F / PHASE 1G

EMULSION 42-PFD-04-150-01 TO V-4515, INLET DEGASSER — PHASE 1G / PHASE 1H

EMULSION 42-PFD-04-160-01 TO V-4615, INLET DEGASSER

MP NG 07-141-01 — CLRF 04-142-01 — DMSF 04-142-01 — DJW 04-143-01 — DS 04-143-01

V-4415 — E-4440 A-D — BFW 02-140-01

TEMPERATURE SIGNAL 42-PFD-02-140-01 TO BFW CONTROL

OFF-SPEC OIL & RECOVERED DILUENT 42-PFD-06-141-01 FROM OFF-SPEC OIL HEADER

DILUENT 42-PFD-06-140-01 FROM E-4065 A1/A2/B1/B2/C1/C2, DILUENT/GLYCOL EXCHANGERS

V-4400 — V-4420 — V-4460

E-4430 A/B — E-4435 A/B — E-4470 A/B — E-4475 A/B — E-4445 A-F — E-4450 A/B/C/D/E/F — E-4480

PRODUCED GAS 42-PFD-04-141-01 TO AC-4085 A/B/C/D, INLET VAPOR AIR COOLERS

OFF-SPEC OIL 42-PFD-06-141-01 TO OFF-SPEC OIL HEADER

SALES OIL 42-PFD-06-141-01 TO T-6515/6525/6535, SALES OIL TANKS

PRODUCED WATER 42-PFD-01-141-01 TO T-0122, SKIM TANK

SLOP OIL (RAG LAYER) 42-PFD-06-141-01 TO SLOP TANKS

NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. A NEW UNIT TO BE INSTALLED IN CL1H SCOPE.
4. REFER TO PFD CL1H-42-PFD-07-149-01 FOR BLOWDOWN CLEANING SYSTEM DETAILS.
5. DESIGN DUTY IS THE TOTAL DUTY FOR ALL SHELLS.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA — RICHARD GARRETT — 19830

PERMIT TO PRACTICE VISTA PROJECTS LIMITED
Signature
Date Jun 12, 2019
PERMIT NUMBER: P 4559
The Association of Professional Engineers and Geoscientists of Alberta

2019-06-11

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION - REISSUED FOR REGULATORY APPROVAL	2012/07/25	RY	APC	LY	KUL	BZS
4.A.0	PHASE 1H EXPANSION - ISSUED FOR DESIGN	2019/04/05	EMJ	RVG	ZGA	KUL	JEG
4.A.1	PHASE 1H EXPANSION - REISSUED FOR DESIGN	2019/06/11	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO: Vista Projects

REVISION DESCRIPTION: REISSUED FOR DESIGN

PROJECT NO.: CL1H

LSD: S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE: 2019/06/11

SCALE: NONE

cenovus ENERGY

TITLE

CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
OIL TREATING SYSTEM
PHASE 1F/1G/1H

DRAWING NO.: CL1-42-PFD-04-0140-001

REVISION NO.: 4.A.1

V-4075
CASING GAS SLUG CATCHER
SIZE: 2438 mm O.D. x 7315 mm S/S

E-4080
SLUG CATCHER LIQUID COOLER
DESIGN DUTY: 13.3 GJ/h

AC-4085 A/B/C/D
INLET VAPOUR AIR COOLERS
DESIGN DUTY: 215.3 GJ/h
NOTE 3

V-4087
PRODUCED GAS SEPARATOR
SIZE: 1829 I.D. x 7315 mm S/S

PRODUCED GAS
42-PFD-04-160-01
FROM V-4615/4600/4620/4660, INLET DEGASSER, FWKO DRUM AND TREATERS
64 02
PHASE 1H
PHASE 1G

PRODUCED GAS
42-PFD-04-150-01
FROM V-4515/4500/4520/4560, INLET DEGASSER, FWKO DRUM AND TREATERS
54 02
PHASE 1G
PHASE 1F

PRODUCED GAS
42-PFD-04-140-01
FROM V-4415/4400/4420/4460, INLET DEGASSER, FWKO DRUMS AND TREATERS
44 02

CASING GAS FROM PIPELINE
PLANT LIMIT
44 19
MP NG 07-141-01
TOLUENE
TOLUENE
44 20
44 30
FI
PC
V-4075
LC
TC
AC-4085 A/B/C/D
HGL 07-142-02
44 23
PC
V-4087
LC
LC
FLARE 07-146-01
MARP
FI
44 24
PRODUCED GAS
42-PFD-08-140-01
TO H_2S SCAVENGER
FI
44 25
44 28
RECOVERED DILUENT
42-PFD-06-141-01
TO RECYCLE SLOP OIL HEADER
TC
F-4080
CGL 07-142-01
44 21
44 22
44 29
PRODUCED WATER
42-PFD-01-141-01
TO SKIM TANKS
V-4XXX
(FUTURE SLUG CATCHER)

NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAGE NUMBERS TO BE PREFIXED BY "CL1-".
3. DESIGN DUTY IS THE TOTAL DUTY FOR ALL BAYS.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD G. ARNOTT 58010

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION – REISSUED FOR REGULATORY APPROVAL	2012/07/25	RY	APC	LY	KUL	BZS
3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	EMJ	DVC	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
PRODUCED GAS HANDLING
PHASE 1F/1G/1H

DRAWING NO.
CL1-42-PFD-04-0141-001

REVISION NO.
3.A.0

T-4455
CLARIFIER STORAGE TANK
NOMINAL CAPACITY: 40.6 m3

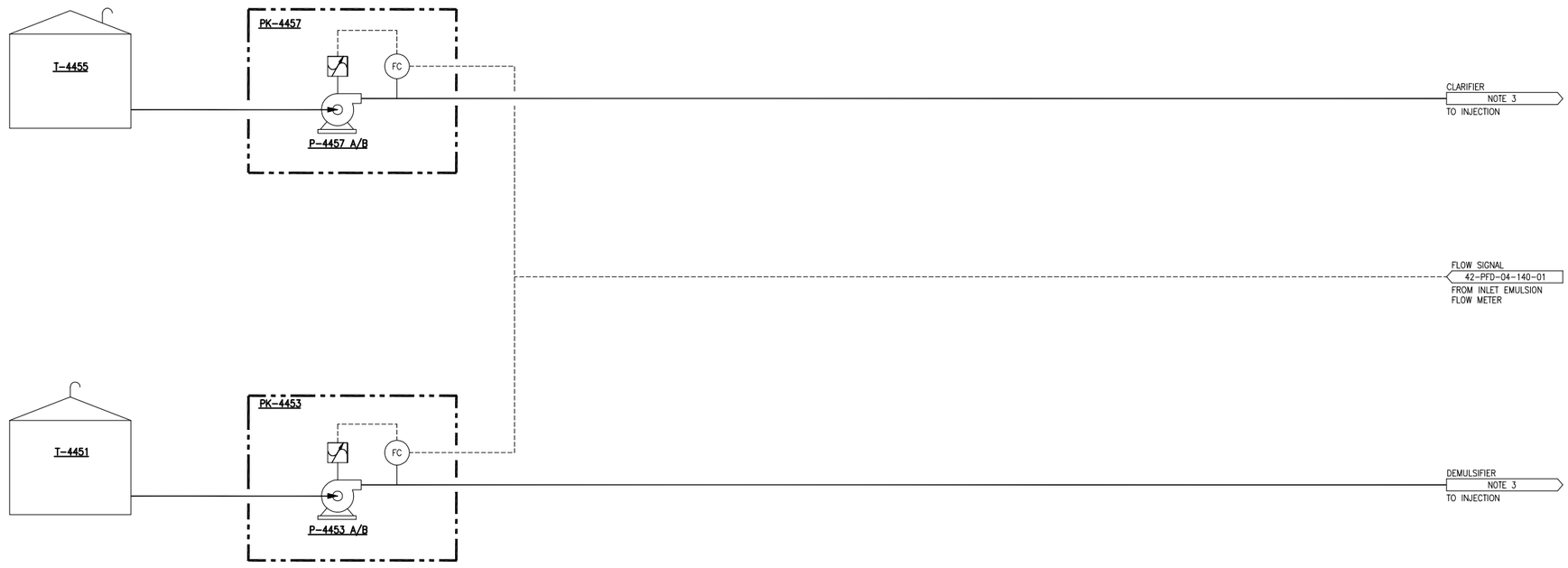
T-4451
DEMULSIFIER STORAGE TANK
NOMINAL CAPACITY: 64.1 m3

PK-4457
CLARIFIER INJECTION PACKAGE

PK-4453
DEMULSIFIER INJECTION PACKAGE

P-4457 A/B
CLARIFIER INJECTION PUMPS
RATED FLOW: 0.1 Am3/h

P-4453 A/B
DEMULSIFIER INJECTION PUMPS
RATED FLOW: 0.15 Am3/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. INJECTION POINT LOCATED ON DWG. CL1G-42-PFD-04-140-01.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEERS ASSOCIATION PROVINCE OF ALBERTA RICHARD GARRETT

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	MB	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	RZ	RVG	LY	RVG	FY
3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	EMJ		ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
CHEMICAL INJECTION – AREA 04
PHASE 1F

DRAWING NO.
CL1-42-PFD-04-0142-001

REVISION NO.
3.A.0

P- 4444/4544/4644
DESAND JET WATER PUMP
RATED FLOW: 56.8 Am³/h
NOTE 3 4

T-4040
DESAND TANK
NOMINAL CAPACITY: 318 m³

P-4042 A/B
DESAND TANK DECANT PUMPS
RATED FLOW: 10 Am³/h

DESAND JET WATER
42-PFD-01-141-01
FROM T-0155, DEOILED WATER TANK

41 22

FC

44 26

P-4444

MINIMUM FLOW
42-PFD-01-141-01
TO T-0155, DEOILED WATER TANK

DESAND JET WATER
42-PFD-01-151-01
FROM T-0355, DEOILED WATER TANK

51 22

FC

54 26

P-4544

MINIMUM FLOW
42-PFD-01-151-01
TO T-0355, DEOILED WATER TANK

DESAND JET WATER
42-PFD-01-161-01
FROM T-0555, DEOILED WATER TANK

61 22

FC

64 26

P-4644

MINIMUM FLOW
42-PFD-01-161-01
TO T-0555, DEOILED WATER TANK

DESAND JET WATER → V-4415 INLET DEGASSER 04-140-01 → DESAND SLURRY
DESAND JET WATER → V-4400 FWKO DRUM 04-140-01 → DESAND SLURRY
DESAND JET WATER → V-4420 TREATER 04-140-01 → DESAND SLURRY
DESAND JET WATER → V-4460 TREATER 04-140-01 → DESAND SLURRY

DESAND JET WATER → V-4515 INLET DEGASSER 04-150-01 → DESAND SLURRY
DESAND JET WATER → V-4500 FWKO DRUM 04-150-01 → DESAND SLURRY
DESAND JET WATER → V-4520 TREATER 04-150-01 → DESAND SLURRY
DESAND JET WATER → V-4560 TREATER 04-150-01 → DESAND SLURRY

DESAND JET WATER → V-4615 INLET DEGASSER 04-160-01 → DESAND SLURRY
DESAND JET WATER → V-4600 FWKO DRUM 04-160-01 → DESAND SLURRY
DESAND JET WATER → V-4620 TREATER 04-160-01 → DESAND SLURRY
DESAND JET WATER → V-4660 TREATER 04-160-01 → DESAND SLURRY

PHASE 1F
PHASE 1G

PHASE 1G
PHASE 1H

TC

LLP NG
07-141-01

VC
07-140-01

SKIMMER
T-4040

TC

SAND TO TRUCKS

US
02-141-01

RO

P-4042 A/B

47 43
DESAND QUENCH
42-PFD-07-143-01
FROM P-7452 A/B/C, PROCESS WATER SUPPLY PUMPS

44 27
PRODUCED WATER
42-PFD-01-141-01
TO SKIM TANKS

NNF
PRODUCED WATER
42-PFD-06-141-01
TO T-6715/6725/6735/6745, SLOP TANKS

NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F. EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. P-4544 IS INSTALLED AS PART OF PHASE 1G.
4. P-4644 IS INSTALLED AS PART OF PHASE 1H.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD GARRETT ALBERTA

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION – REISSUED FOR REGULATORY APPROVAL	2012/07/25	DS	APC	LY	KUL	BZS
3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	EMJ	RV	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
DESAND SYSTEM
PHASE 1F/1G/1H

DRAWING NO.
CL1-42-PFD-04-0143-001

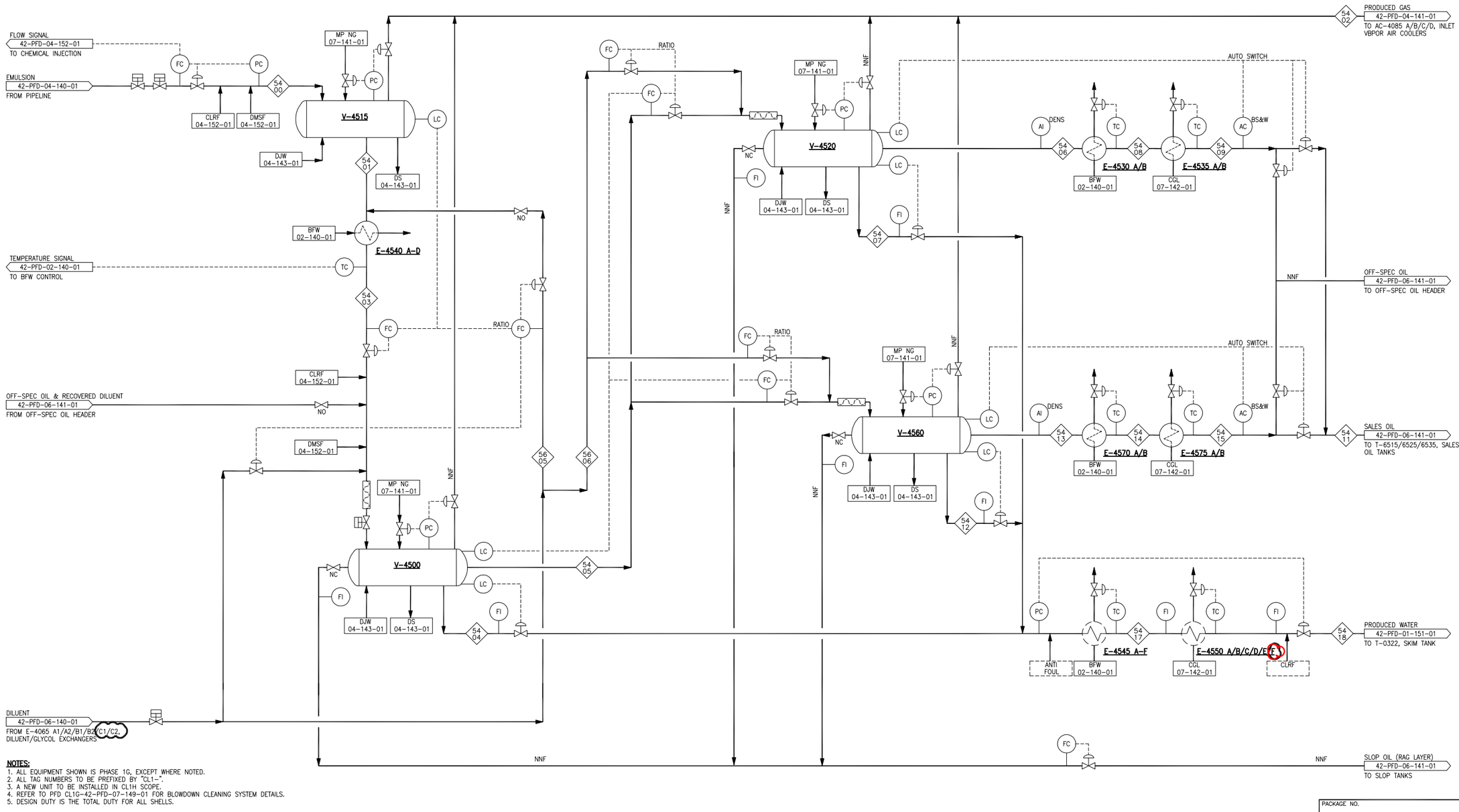
REVISION NO.
3.A.0

CL1-42-PFD-04-0143-001_3.A.0

K:\Projects\Cenovus\2195\Piping\Drafting\PFD\01 - IFR - (IN PROGRESS)\CL1-42-PFD-04-0143-001_3.A.0.dwg Ken Sorensen 4/3/2019 11:22 AM

CL1-42-PFD-04-0150-001_0.B.0

V-4515 INLET DEGASSER	E-4540 A/B/C/D(4PX2S) EMULSION/BFW EXCHANGERS	V-4500 FWKO DRUM	V-4520/4560 TREATERS	E-4530 A/B(1PX2S) SALES OIL/BFW EXCHANGERS	E-4570 A/B(1PX2S) SALES OIL/BFW EXCHANGERS	E-4535 A/B(2PX4S) SALES OIL/GLYCOL EXCHANGERS	E-4575 A/B(2PX4S) SALES OIL/GLYCOL EXCHANGERS	E-4545 A-F PRODUCED WATER/BFW EXCHANGERS	E-4550 A/B/C/D/E/F PRODUCED WATER/GLYCOL EXCHANGERS
SIZE: 4267 mm I.D. x 21336 mm S/S	DESIGN DUTY: 223.1 GJ/h NOTE 5	SIZE: 4267 mm O.D. X 28956 mm S/S	SIZE: 4267 mm O.D. X 33528 mm S/S	DESIGN DUTY: 11.56 GJ/h NOTE 5	DESIGN DUTY: 11.56 GJ/h NOTE 5	DESIGN DUTY: 28.85 GJ/h NOTE 5	DESIGN DUTY: 28.85 GJ/h NOTE 5	DESIGN DUTY: 70.13 GJ/h NOTES 4, 5	DESIGN DUTY: 87.3 GJ/h NOTES 3, 4, 5



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1G, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. A NEW UNIT TO BE INSTALLED IN CL1H SCOPE.
4. REFER TO PFD CL1G-42-PFD-07-149-01 FOR BLOWDOWN CLEANING SYSTEM DETAILS.
5. DESIGN DUTY IS THE TOTAL DUTY FOR ALL SHELLS.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GARRETT 56136

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	MB	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	RZ	RVG	LY	RVG	FY
0.B.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	EMJ	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO: Vista Projects

REVISION DESCRIPTION: ISSUED FOR DESIGN

PROJECT NO.: CL1H

LSD: S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE: 2019/04/05

SCALE: NONE

cenovus ENERGY

TITLE: CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
OIL TREATING SYSTEM
PHASE 1G

DRAWING NO.: CL1-42-PFD-04-0150-001

REVISION NO.: 0.B.0

K:\Projects\Cenovus\2195\Piping\Drafting\PFD\01 - IFR - (IN PROGRESS)\CL1-42-PFD-04-0150-001_0.B.0.dwg Ken Sorensen 4/3/2019 11:22 AM

CL1-42-PFD-04-0152-001_0.B.0

T-4555
CLARIFIER STORAGE TANK
NOMINAL CAPACITY: 40.6 m3

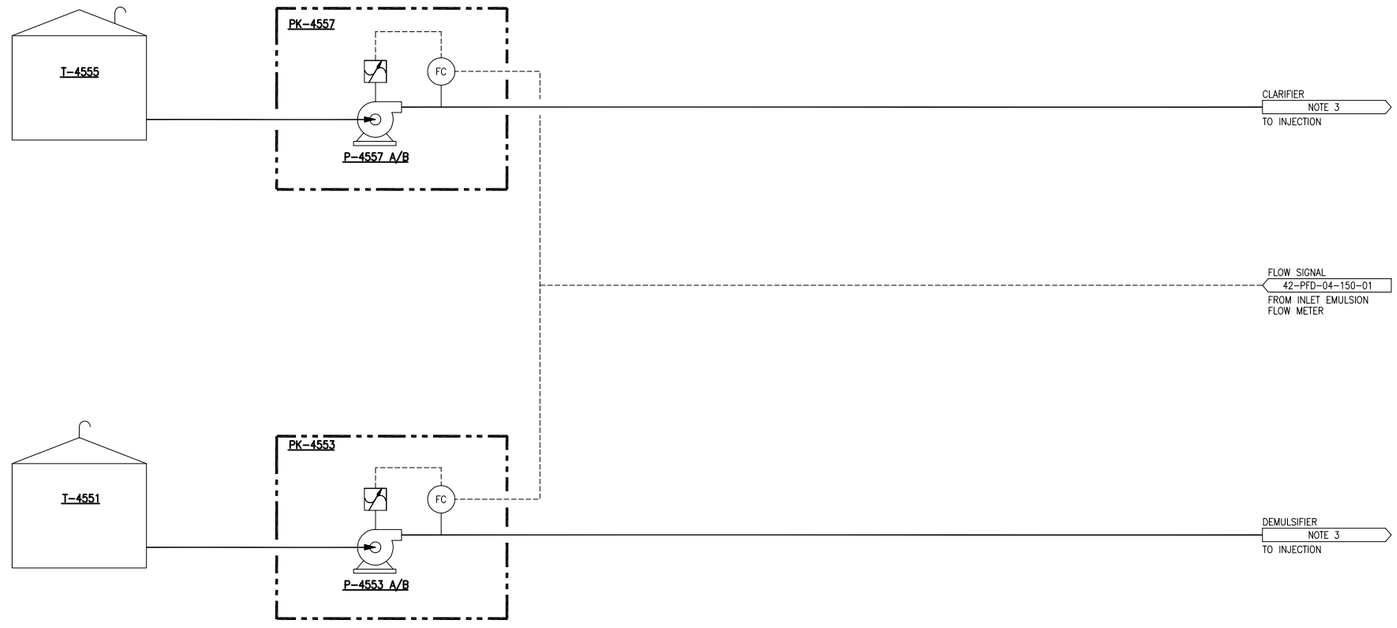
T-4551
DEMULSIFIER STORAGE TANK
NOMINAL CAPACITY: 64.1 m3

PK-4557
CLARIFIER INJECTION PACKAGE

PK-4553
DEMULSIFIER INJECTION PACKAGE

P-4557 A/B
CLARIFIER INJECTION PUMPS
RATED FLOW: 0.1 Am3/h

P-4553 A/B
DEMULSIFIER INJECTION PUMPS
RATED FLOW: 0.15 Am3/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1G, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. INJECTION POINT LOCATED ON DWG. CL1G-42-PFD-04-150-01.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GARDNER 04/04/2019

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	MB	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	RZ	RVG	LY	RVG	FY
0.B.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	EMJ	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
CHEMICAL INJECTION – AREA 04
PHASE 1G

DRAWING NO.
CL1-42-PFD-04-0152-001

REVISION NO.
0.B.0

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CL1-42-PFD-04-0160-001_0.A.1

V-4615
INLET DEGASSER
SIZE: 4267 mm I.D. x 21336 mm S/S

E-4640 A/B/C/D(4PX2S)
EMULSION/BFW EXCHANGERS
DESIGN DUTY: 223.1 GJ/h
NOTE 5

V-4600
FWKO DRUM
SIZE: 4267 mm O.D. X 28956 mm S/S

V-4620/4660
TREATERS
SIZE: 4267 mm O.D. X 33528 mm S/S

E-4630 A/B(1PX2S)
SALES OIL/BFW EXCHANGERS
DESIGN DUTY: 11.56 GJ/h
NOTE 5

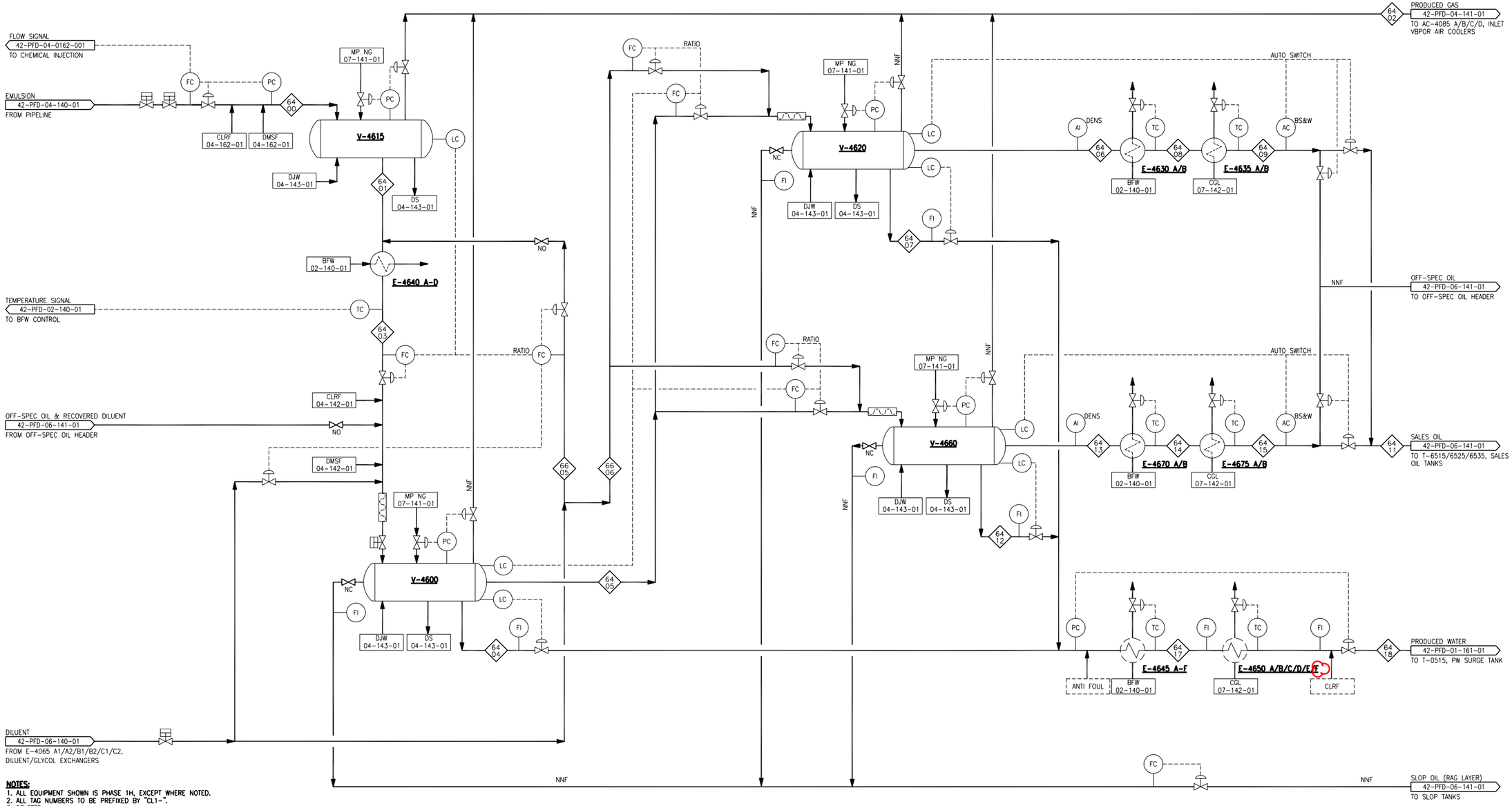
E-4670 A/B(1PX2S)
SALES OIL/BFW EXCHANGERS
DESIGN DUTY: 11.56 GJ/h
NOTE 5

E-4635 A/B(2PX4S)
SALES OIL/GLYCOL EXCHANGERS
DESIGN DUTY: 28.72 GJ/h
NOTE 5

E-4675 A/B(2PX4S)
SALES OIL/GLYCOL EXCHANGERS
DESIGN DUTY: 28.72 GJ/h
NOTE 5

E-4645 A-F
PRODUCED WATER/BFW EXCHANGER
DESIGN DUTY: 70.13 GJ/h
NOTE 3,4,5

E-4650 A/B/C/D/E/F
PRODUCED WATER/GLYCOL EXCHANGER
DESIGN DUTY: 87.3 GJ/h
NOTE 3,4,5



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1H, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. DELETED.
4. REFER TO PFD CL1H-42-PFD-07-149-01 FOR BLOWDOWN CLEANING SYSTEM DETAILS.
5. DESIGN DUTY IS THE TOTAL DUTY FOR ALL SHELLS.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEERS ASSOCIATION OF ALBERTA — REGINALD GARNETT

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
Signature
Date Jan 15, 2019
PERMIT NUMBER: P 4559
The Association of Professional Engineers and Geoscientists of Alberta

2019-06-11

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION - REISSUED FOR REGULATORY APPROVAL	2012/07/25	DS	APC	LY	KUL	BZS
0.A.0	PHASE 1H EXPANSION - ISSUED FOR DESIGN	2019/04/05	EMJ	RVG	ZGA	KUL	JEG
0.A.1	PHASE 1H EXPANSION - REISSUED FOR DESIGN	2019/06/11	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
REISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/06/11

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
OIL TREATING SYSTEM
PHASE 1H

DRAWING NO.
CL1-42-PFD-04-0160-001

REVISION NO.
0.A.1

CL1-42-PFD-04-0162-001_0.A.0

T-4655
CLARIFIER STORAGE TANK
NOMINAL CAPACITY: 40.6 m³

T-4651
DEMULSIFIER STORAGE TANK
NOMINAL CAPACITY: 64.1 m³

PK-4657
CLARIFIER INJECTION PACKAGE

PK-4653
DEMULSIFIER INJECTION PACKAGE

P-4657 A/B
CLARIFIER INJECTION PUMPS
RATED FLOW: 0.1 Am³/h

P-4653 A/B
DEMULSIFIER INJECTION PUMPS
RATED FLOW: 0.15 Am³/h

NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1H, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. INJECTION POINT LOCATED ON DWG. CL1-42-PFD-04-0160-001.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD GARRETT ALBERTA

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION - REISSUED FOR REGULATORY APPROVAL	2012/07/25	DS	APC	LY	KUL	BZS
0.A.0	PHASE 1H EXPANSION - ISSUED FOR DESIGN	2019/04/05	EMJ	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
CHEMICAL INJECTION - AREA 04
PHASE 1H

DRAWING NO.
CL1-42-PFD-04-0162-001

REVISION NO.
0.A.0

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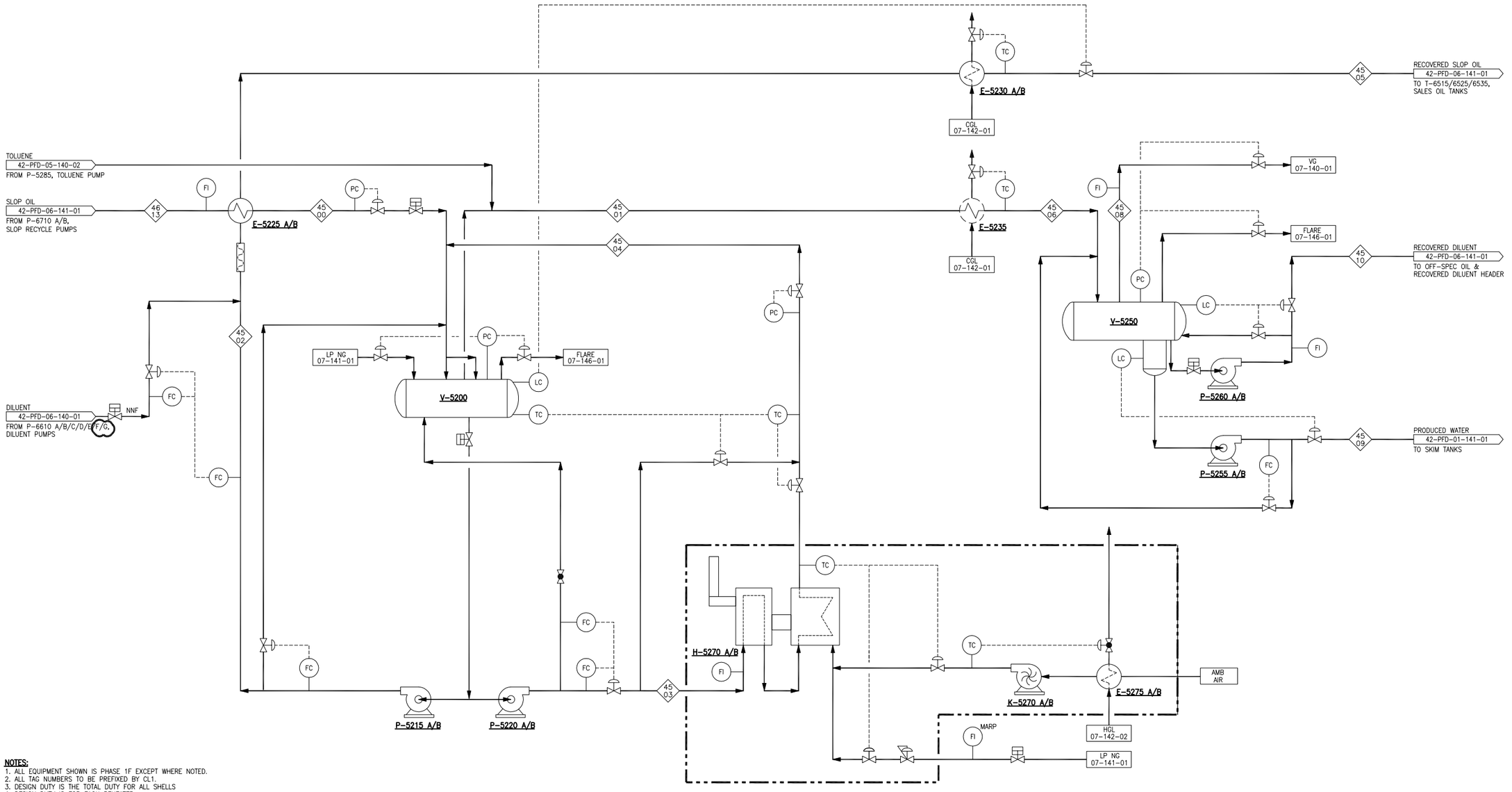
E-5225 A/B(1PX2S) CRUDE FLASH DRUM FEED/EFFLUENT EXCHANGERS	V-5200 CRUDE FLASH DRUM	P-5215 A/B CRUDE FLASH DRUM OIL PUMPS	P-5220 A/B CRUDE FLASH DRUM OIL RECYCLE PUMPS	H-5270 A/B CRUDE FLASH DRUM REHEATERS	K-5270 A/B CRUDE FLASH DRUM REHEATER BLOWERS	E-5235 CRUDE FLASH DRUM OVERHEAD/GLYCOL EXCHANGER	E-5275 A/B CRUDE FLASH DRUM REHEATER AIR PREHEATERS	E-5230 A/B(1PX2S) CRUDE FLASH DRUM EFFLUENT/GLYCOL EXCHANGERS	V-5250 CRUDE FLASH DRUM OVERHEAD SEPARATOR	P-5260 A/B CRUDE FLASH RECYCLE DILUENT PUMPS	P-5255 A/B CRUDE FLASH RECYCLE WATER PUMPS
DESIGN DUTY: 6.17 GJ/h NOTE 3	SIZE: 4267 mm O.D. x 12192 mm S/S	RATED FLOW: 79.5 Am3/h	RATED FLOW: 262.1 Am3/h	DESIGN DUTY: 9.35 GJ/h NOTE 4	MOTOR POWER: 22.4 kW	DESIGN DUTY: 15.12 GJ/h	DESIGN DUTY: 0.78 GJ/h NOTE 3	DESIGN DUTY: 7.34 GJ/h NOTE 3	SIZE: 1067 mm O.D x 3658 mm S/S	RATED FLOW: 8.4 Am3/h	RATED FLOW: 4.3 Am3/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY CL1.
3. DESIGN DUTY IS THE TOTAL DUTY FOR ALL SHELLS
4. DESIGN DUTY IS FOR EACH REHEATER

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GARNER 66153

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	MB	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	RZ	RVG	LY	RVG	FY
3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	HYY	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
OIL SLOPS TREATING SYSTEM
PHASE 1F

DRAWING NO.
CL1–42–PFD–05–0140–001

REVISION NO.
3.A.0

CL1-42-PFD-05-0140-001_3.A.0

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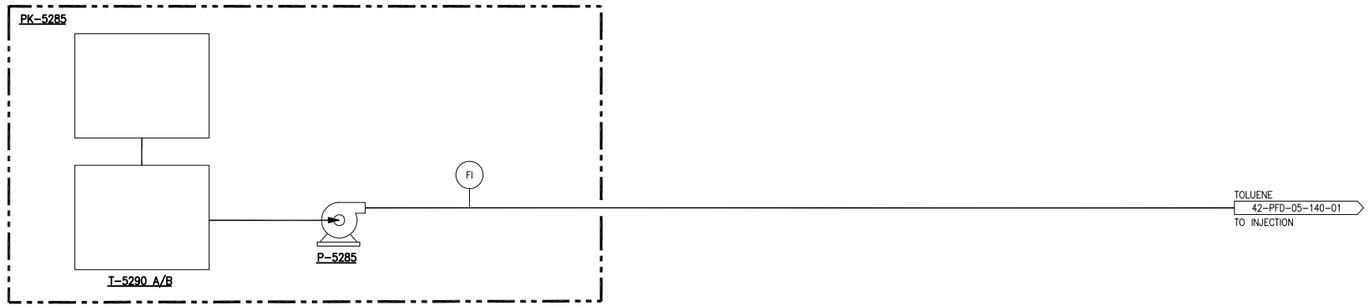
T-5290 A/B
TOLUENE TANKS
CAPACITY: 0.159 m3

PK-5285
TOLUENE INJECTION PACKAGE

P-5285
TOLUENE PUMP
RATED FLOW: 0.005 Am3/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD BARRETT

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	MB	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	RZ	RVG	LY	RVG	FY
2.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	HYY	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
CHEMICAL INJECTION – AREA 05
PHASE 1F

DRAWING NO.
CL1-42-PFD-05-0140-002

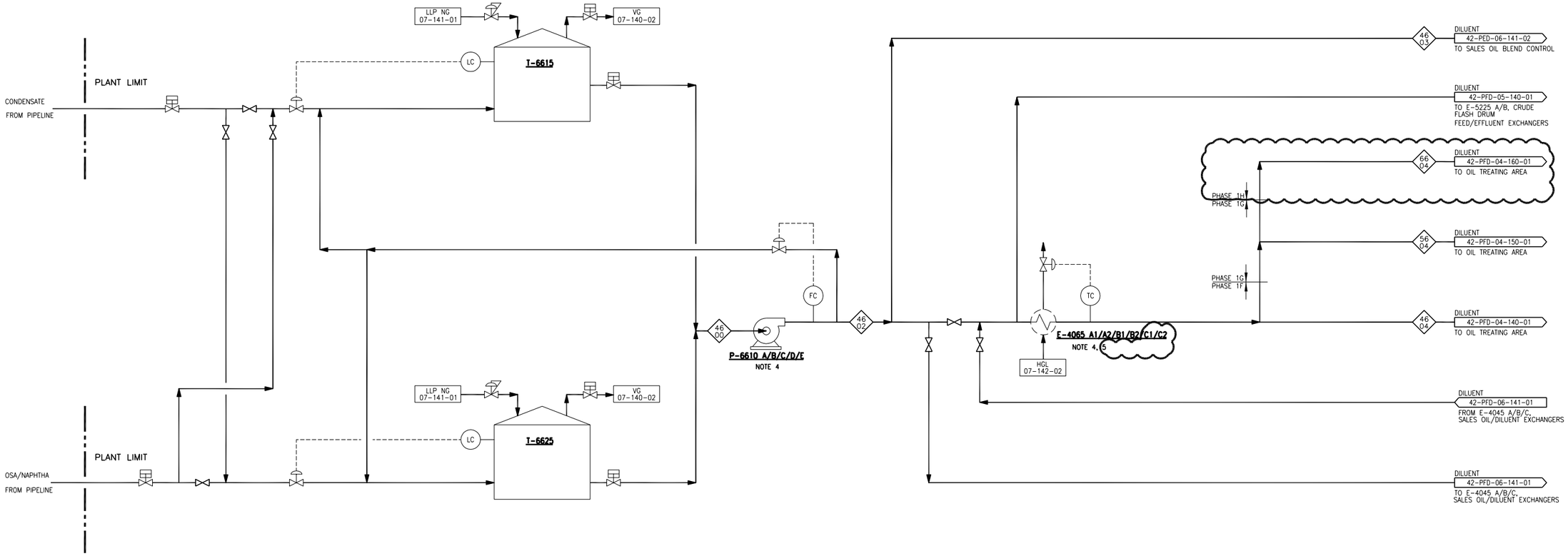
REVISION NO.
2.A.0

CL1-42-PFD-06-0140-001_5.A.1

T-6615/6625
DILUENT TANKS
NOMINAL CAPACITY: 4754 m³

P-6610 A/B/C/D/E
DILUENT PUMPS
RATED FLOW: 182 Am³/h
NOTE 4

E-4065 A1/A2/B1/B2/C1/C2(1PX2S)
DILUENT/GLYCOL EXCHANGERS
DESIGN DUTY: 23.1 GJ/h
NOTE 3,4,5



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. DESIGN DUTY IS FOR THE TOTAL DUTY FOR ALL SHELLS.
4. PUMPS P-6610 D/E AND EXCHANGERS E-4065 B1/B2 ARE INSTALLED AS PART OF PHASE 1G.
5. EXCHANGERS E-4065 C1/C2 ARE INSTALLED AS PART OF PHASE 1H.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GARRATT

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
Signature
Date Jan 12, 2019
PERMIT NUMBER: P 4559
The Association of Professional Engineers and Geoscientists of Alberta

2019-06-11

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VA	PHASE 1H EXPANSION - ISSUED FOR REGULATORY APPROVAL	2012/07/25	DS	APC	LY	KUL	BZS
5.A.0	PHASE 1H EXPANSION - ISSUED FOR DESIGN	2019/04/05	HYY	RVG	ZGA	KUL	JEG
5.A.1	PHASE 1H EXPANSION - REISSUED FOR DESIGN	2019/06/11	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
REISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/06/11

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
DILUENT STORAGE/TRANSFER
PHASE 1F/1G/1H

DRAWING NO.
CL1-42-PFD-06-0140-001

REVISION NO.
5.A.1

CL1-42-PFD-06-0141-001_5.B.0

OFF-SPEC OIL 42-PFD-04-0160-001 NNF — FROM E-4635 A/B & E-4675 A/B, SALES OIL/GLYCOL EXCHANGERS — PHASE 1H / PHASE 1G
OFF-SPEC OIL 42-PFD-04-150-01 NNF — FROM E-4535 A/B & E-4575 A/B, SALES OIL/GLYCOL EXCHANGERS — PHASE 1G / PHASE 1F
OFF-SPEC OIL 42-PFD-04-140-01 NNF — FROM E-4435 A/B & E-4475 A/B, SALES OIL/GLYCOL EXCHANGERS
SALES OIL 42-PFD-04-140-01 (44 11) — FROM E-4435 A/B & E-4475 A/B, SALES OIL/GLYCOL EXCHANGERS — PHASE 1F / PHASE 1G
SALES OIL 42-PFD-04-150-01 (54 11) — FROM E-4535 A/B & E-4575 A/B, SALES OIL/GLYCOL EXCHANGERS — PHASE 1G / PHASE 1H
SALES OIL 42-PFD-04-0160-001 (64 11) — FROM E-4635 A/B & E-4675 A/B, SALES OIL/GLYCOL EXCHANGERS
RECOVERED SLOP OIL 42-PFD-05-140-01 (45 05) — FROM E-5230 A/B, FLASH TREATER EFFLUENT/GLYCOL EXCHANGER
SLOP OIL (RAG LAYER) 42-PFD-04-140-01 NNF — FROM AREA 04 — PHASE 1F / PHASE 1G
SLOP OIL (RAG LAYER) 42-PFD-04-150-01 NNF — FROM AREA 04 — PHASE 1G / PHASE 1H
SLOP OIL (RAG LAYER) 42-PFD-04-0160-001 NNF — FROM AREA 04
BLOWDOWN CLEANING FLUIDS 42-PFD-07-149-01 — FROM P-7405 A/B, BLOWDOWN CLEANING RECYCLE PUMPS
CONDENSED LIQUIDS 42-PFD-08-140-01 — FROM V-8000, SCAVENGER UNIT INLET SEPARATOR
CONDENSED LIQUIDS 42-PFD-07-140-01 — FROM V-7635/7685/7695, EJECTOR SUCTION SCRUBBERS
PRODUCED WATER 42-PFD-07-141-01 NNF — FROM V-7040, FUEL GAS MIX DRUM
PRODUCED WATER 42-PFD-04-143-01 NNF — FROM P-4042 A/B, DESAND TANK DECANT PUMPS
RECOVERED DILUENT 42-PFD-04-141-01 (44 28) — FROM V-4087, PRODUCED GAS SEPARATOR
RECOVERED WATER/OIL 42-PFD-07-140-02 — FROM VRU COMPRESSOR
LIQUIDS 42-PFD-07-146-01 NNF — FROM P-7590 A/B, FLARE KNOCK-OUT DRUM PUMPS
RECYCLE OIL 42-PFD-01-141-01 NNF — FROM P-0148 A/B, OIL RECYCLE PUMPS — PHASE 1F / PHASE 1G
RECYCLE OIL 42-PFD-01-151-01 NNF — FORM P-0348 A/B, OIL RECYCLE PUMPS — PHASE 1G / PHASE 1H
RECYCLE OIL 42-PFD-01-0161-001 — FORM P-0548 A/B, OIL RECYCLE PUMPS

T-6515/6525/6535 SALES OIL TANKS — NOMINAL CAPACITY: 6333 m3
T-6715/6725/6735/6745 SLOP TANKS — NOMINAL CAPACITY: 800 m3
E-6720 A/B(2PX2S) SLOP OIL/GLYCOL EXHANGERS — DESIGN DUTY: 5.48 GJ/h, NOTE 6
P-6510 A/B/C/D LACT BOOSTER PUMPS — RATED FLOW: 568 Am3/h, NOTE 7, 8
P-6710 A/B SLOP RECYCLE PUMPS — RATED FLOW: 45 Am3/h
P-6740 A/B SLOP WATER PUMPS — RATED FLOW: 25 Am3/h
P-6730 SLOP SYSTEM PUMP — RATED FLOW: 5 Am3/h
E-4045A/B/C SALES OIL/DILUENT EXCHANGERS — DESIGN DUTY: 2.52 GJ/h (EACH), NOTE 7

OFF-SPEC OIL HEADER
SALES OIL HEADER
SALES OIL MINIMUM FLOW
SALES OIL HEADER
OFF-SPEC OIL HEADER
SLOP WATER HEADER
RECYCLE EMULSION HEADER
SLOP OIL HEADER
TRUCK-OUT HEADER
SLOP OIL INLET HEADER
RECYCLED SLOP OIL
RECYCLED EMULSION
RECYCLED OFF-SPEC/TANK HEATING HEADER

LLP NG 07-141-01 — VG 07-140-02 — T-6515 — TC — HGL 07-142-02
LLP NG 07-141-01 — VG 07-140-02 — T-6525 — TC — HGL 07-142-02
LLP NG 07-141-01 — VG 07-140-02 — T-6535 — TC — HGL 07-142-02
LLP NG 07-141-01 — VG 07-140-02 — T-6715 — TC — HGL 07-142-02
LLP NG 07-141-01 — VG 07-140-02 — T-6725 — TC — HGL 07-142-02
LLP NG 07-141-01 — VG 07-140-02 — T-6735 — TC — HGL 07-142-02
LLP NG 07-141-01 — VG 07-140-02 — T-6745 — TC — HGL 07-142-02

TC — E-4045A/B/C (NOTE 7) — DILUENT 42-PFD-06-140-01 TO OIL TREATING AREA
DILUENT 42-PFD-06-140-01 FROM DILUENT PUMPS
FC — P-6510 A/B/C/D (NOTE 7, 8)
46 08 — SALES OIL 42-PFD-06-141-02 TO SALES OIL BLEND COOLERS
46 07
FI — P-6740 A/B — 46 10 — 46 11 — RECYCLED PRODUCED WATER 42-PFD-01-141-01 TO SKIM TANKS
SC — P-6730 — FC — P-6710 A/B
OFF-SPEC OIL & RECYCLE OIL 42-PFD-04-0160-001 TO PHASE 1H, OIL TREATING AREA — PHASE 1H / PHASE 1G
OFF-SPEC OIL & RECYCLE OIL 42-PFD-04-150-01 TO OIL TREATING AREA — PHASE 1G / PHASE 1F
OFF-SPEC OIL & RECYCLE OIL 42-PFD-04-140-01 TO OIL TREATING AREA
RECOVERED DILUENT 42-PFD-05-140-01 FROM AREA 05
SLOP OIL 42-PFD-05-140-01 (46 13) TO E-5225 A/B, CRUDE FLASH DRUM FEED/EFFLUENT EXCHANGER
RECYCLE OIL 42-PFD-01-141-01 (41 23) FROM P-0148 A/B, OIL RECYCLE PUMPS — PHASE 1F / PHASE 1G
RECYCLE OIL 42-PFD-01-151-01 (51 23) FROM P-0348 A/B, OIL RECYCLE PUMPS — PHASE 1G / PHASE 1H
RECYCLE OIL 42-PFD-01-0161-001 (61 23) FROM P-0548 A/B, OIL RECYCLE PUMPS
TC — FC — PC — E-6720 A/B — HGL 07-142-02

NOTES:
1. EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. THE STORAGE TANKS ARE DESIGNED TO HANDLE PRODUCTION FROM CL1F/G/H.
4. THE HEADERS ARE SIZED FOR ALL PHASES CL1F/G/H.
5. HEATED GLYCOL JACKET REQUIRED FOR CANNED PUMPS.
6. DESIGN DUTY IS THE TOTAL DUTY FOR ALL SHELLS.
7. PUMP P-6510C AND EXCHANGER E-4045C ARE INSTALLED AS PART OF PHASE 1G.
8. PUMP P-6510D IS INSTALLED AS PART OF PHASE 1H.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA — 04/04/2019

PERMIT TO PRACTICE VISTA PROJECTS LIMITED
APEGA PERMIT No. P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	MB	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	RZ	RVG	LY	RVG	FY
5.B.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	HYY	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO: Vista Projects

REVISION DESCRIPTION: ISSUED FOR DESIGN
PROJECT NO.: CL1H
LSD: S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M
ISSUE DATE: 2019/04/05
SCALE: NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
SALES OIL & SLOP OIL STORAGE/TRANSFER
PHASE 1F/1G/1H

DRAWING NO.: CL1-42-PFD-06-0141-001
REVISION NO.: 5.B.0

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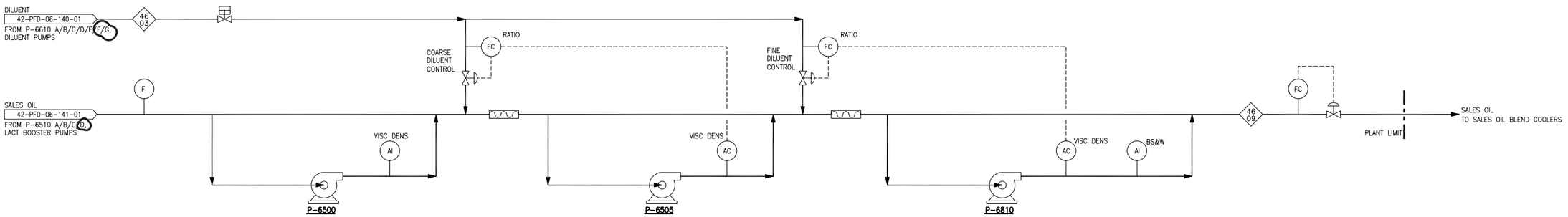
CL1-42-PFD-06-0141-002_3.B.0

P-6500
SALES OIL SAMPLE PUMP #1
RATED FLOW: 3.38 Am^3/h

P-6505
SALES OIL SAMPLE PUMP #2
RATED FLOW: 3.38 Am^3/h

P-6810
SALES OIL SAMPLE PUMP #3
RATED FLOW: 3.38 Am^3/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY CL1-.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEERS ASSOCIATION OF ALBERTA — RICHARD GARDNER

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION – REISSUED FOR REGULATORY APPROVAL	2012/07/25	JM	APC	LY	KUL	BZS
3.B.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	HYY	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
SALES OIL BLEND CONTROL
PHASE 1F/1G/1H

DRAWING NO.
CL1-42-PFD-06-0141-002

REVISION NO.
3.B.0

K:\Projects\Cenovus\2195\Piping\Drafting\PFD\01 - IFR - (IN PROGRESS)\CL1-42-PFD-06-0141-002_3.B.0.dwg Ken Sorensen 4/3/2019 11:21 AM

CL1-42-PFD-07-0140-001_4.A.1

M-7681/M-7683/M-7684/ M-7686/M7687 VENT GAS EJECTORS

V-7685 EJECTOR SUCTION SCRUBBER SIZE: 1219 mm I.D. X 3048 mm S/S

M-7632/M-7633/M-7634/ M-7636/M-7637 VENT GAS EJECTORS

V-7635 EJECTOR SUCTION SCRUBBER SIZE: 1219 mm I.D. X 3048 mm S/S

M-7691/M-7693/M-7694/ M-7696/M-7697 VENT GAS EJECTORS

V-7695 EJECTOR SUCTION SCRUBBER SIZE: 1219 mm I.D. X 3048 mm S/S

CFU REJECT GAS
42-PFD-01-0161-001
FROM V-0527, REJECT VESSEL

EJECTOR DRIVE GAS
42-PFD-07-141-01
FROM E-7030, NATURAL GAS/GLYCOL EXCHANGER

47 00

PI

M-7681/M-7683/M-7684/ M-7686/M-7687

M-7632/M-7633/M-7634/ M-7636/M-7637

M-7691/M-7693/M-7694/ M-7696/M-7697

47 01

BLENDED FUEL GAS
42-PFD-07-141-01
TO V-7040, FUEL GAS MIX DRUM

T-0515 PW SURGE TANK 01-0161-001
T-0555 DEOILED WATER TANK 01-0161-001
T-0545 A/B OIL RECYCLE TANKS 01-0161-001
PHASE 1H
PHASE 1G
T-0355 DEOILED WATER TANK 01-151-01
T-0322 SKIM TANK 01-151-01
V-0325 IGF VESSEL 01-151-01
T-0345 OIL RECYCLE TANK 01-151-01
PHASE 1G
PHASE 1F
T-0155 DEOILED WATER TANK 01-141-01
T-0122 SKIM TANK 01-141-01
V-0125 IGF VESSEL 01-141-01
T-0145 OIL RECYCLE TANK 01-141-01

T-0570 CLEAR WELL 01-162-01
T-0560 WLS 01-162-01
PHASE 1H
PHASE 1G
T-0370 CLEAR WELL 01-152-01
T-0360 WLS 01-152-01
PHASE 1G
PHASE 1F
T-7450 PROCESS WATER TANK 07-143-01
T-0900 RAW BRACK. WATER TANK 01-140-01
T-0160 WLS 01-142-01
T-0170 CLEAR WELL 01-142-01
T-0845 A/B REGENERATION WASTE WATER TANK 01-145-01
T-0242 PW DISPOSAL WATER TANK 01-145-02

T-3000 BFW TANK 02-140-01
T-4040 DESAND TANK 04-143-01
V-5250 CFD OH SEP 05-140-01

NC
NO
LC
LP NG 07-141-01

V-7685
V-7635
V-7695

CONDENSED LIQUIDS
42-PFD-06-141-01
TO T-6715/6725/6735/6745, SLOP TANKS

NOTES:
1. ALL EQUIPMENT SHOWN IS PHASES 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY CL1-.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GARRETT

2019-06-11

PERMIT TO PRACTICE VISTA PROJECTS LIMITED
Signature
Date Jun 12, 2019
PERMIT NUMBER: P 4559
The Association of Professional Engineers and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION - REISSUED FOR REGULATORY APPROVAL	2012/07/25	JM	APC	LY	KUL	BZS
4.A.0	PHASE 1H EXPANSION - ISSUED FOR DESIGN	2019/04/05	HYY	RVG	ZGA	KUL	JEG
4.A.1	PHASE 1H EXPANSION - REISSUED FOR DESIGN	2019/06/11	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO: Vista Projects

REVISION DESCRIPTION: REISSUED FOR DESIGN

PROJECT NO.: CL1H

LSD: S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE: 2019/06/11

SCALE: NONE

cenovus ENERGY

TITLE: CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
VAPOUR RECOVERY SYSTEM (EJECTOR)
PHASE 1F/1G/1H

DRAWING NO.: CL1-42-PFD-07-0140-001

REVISION NO.: 4.A.1

PK-7605/7475/7670
VRU COMPRESSOR PACKAGE
NOTE 3

K-7605/7475/7665
1ST STAGE VRU COMPRESSOR

E-7612/7482/7677
VRU COMPRESSOR INTERSTAGE COOLER

K-7610/7480/7670
2ND STAGE VRU COMPRESSOR

E-7627/7497/7679
VRU COMPRESSOR DISCHARGE COOLER

V-7605/7475/7663
VRU COMPRESSOR SUCTION SCRUBBER

V-7610/7480/7678
VRU COMPRESSOR INTERSTAGE SEPARATOR

V-7615/7485/7680
VRU COMPRESSOR DISCHARGE SEPARATOR

T-6515/6525/6535
SALES OIL TANKS
06-141-01

T-6615/6625
DILUENT TANKS
06-140-01

T-6715/6725/6735/6745
SLOP TANKS
06-141-01

SPILLBACK

PC

TC

LC

V-7605

E-7612

CGL
07-142-01

V-7610

E-7627

V-7615

K-7605

K-7610

TO
DRAIN TANK

PK-7605

RECOVERED GAS
42-PFD-07-141-01
TO V-7040,
FUEL GAS MIX DRUM

47
39

RECOVERED WATER/OIL
42-PFD-06-141-01
TO T-6715/6725/6735/6745,
SLOP TANKS

47
41

V-7475

E-7482

V-7480

E-7497

V-7485

K-7475

K-7480

PK-7475

PHASE 1X
PHASE 1H

PHASE 1F
PHASE 1H

V-7663

E-7677

V-7678

E-7679

V-7680

K-7665

K-7670

PK-7670

NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-"
3. PK-7670 IS INSTALLED AS PART OF PHASE H.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GARRETT 04/04/2019

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	MB	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	VW	RVG	LY	RVG	FY
4.C.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	HYY	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
VAPOUR RECOVERY SYSTEM (COMPRESSOR)
PHASE 1F/1G/1H

DRAWING NO.
CL1-42-PFD-07-0140-002

REVISION NO.
4.C.0

CL1-42-PFD-07-0140-002_4.C.0

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CL1-42-PFD-07-0141-001_3.B.1

EH-7560
FLARE PURGE GAS ELECTRIC HEATER
DESIGN DUTY: 40 kW

V-7050
NATURAL GAS KNOCK-OUT DRUM
SIZE: 1676 mm I.D. x 2743 mm S/S

E-7030
NATURAL GAS/GLYCOL EXCHANGER
DESIGN DUTY: 19 GJ/h

V-7040
FUEL GAS MIX DRUM
SIZE: 2438 mm I.D. x 3658 mm S/S

EJECTOR DRIVE GAS
42-PFD-07-140-01
TO VENT GAS EJECTORS

FLARE PURGE GAS/PILOT GAS
42-PFD-07-146-01
TO FLARE PURGE/PILOT GAS HEADER

NATURAL GAS
FROM PIPELINE

LIFT GAS
TO WELL HEAD

PIPELINE LIQUIDS
42-PFD-07-146-01
TO V-7570,
FLARE KNOCK-OUT DRUM

SWEETENED PRODUCED GAS
42-PFD-08-140-01
FROM H2S SCAVENGER UNIT

BLENDED FUEL GAS
42-PFD-07-140-01
FROM VENT GAS EJECTORS

RECOVERED GAS
42-PFD-07-140-02
FROM VAPOUR RECOVERY COMPRESSOR

HP NATURAL GAS
42-PFD-02-141-02
TO GT-2900/2950, GTGS

HP NATURAL GAS
42-PFD-02-0161-004
TO GT-5500/5550, GTGS

PLANT LIMIT

ELECTRIC HEATER

H-7300A/B GLYCOL HEATERS 07-142-02

HGL 07-142-02

NNF

PRODUCED WATER
42-PFD-06-141-01
TO T-6715/6725/6735/6745, SLOP TANKS

V-4075 CASING GAS SLUG CATCHER 04-141-01
V-4400 FWKO DRUM 04-140-01
V-4515 INLET DEGASSER 04-150-01
V-4520/4560 TREATERS 04-150-01
V-4600 FWKO DRUM 04-160-01
V-0522A/B/C/0525A/B/C CFU 01-0161-001
V-4415 INLET DEGASSER 04-140-01
V-4420/4460 TREATERS 04-140-01
V-4500 FWKO DRUM 04-150-01
V-4615 INLET DEGASSER 04-160-01
V-4620/4660 TREATERS 04-160-01

H-5270 A/B CRUDE FLASH DRUM REHEATER 05-140-01
V-7340 GLYCOL EXPANSION DRUM 07-142-02
V-7635/7685/7695 EJECTOR SUCTION SCRUBBERS 07-140-01
V-5200 CRUDE FLASH DRUM 05-140-01

T-0900 RAW BRACKISH WATER TANK 01-140-01
T-0845A/B REGEN WASTE WATER TANKS 01-145-01
T-0122 SKIM TANK 01-141-01
T-0145 OIL RECYCLE TANK 01-141-01
T-7450 PROCESS WATER TANK 07-143-01
V-0125 IGF VESSEL 01-141-01
T-0155 DEOILED WATER TANK 01-141-01

T-0252 PW DISPOSAL TANK 01-145-02
T-0160 WLS 01-142-01
T-0280 NEUTRALIZATION TANK 01-144-01
T-4040 DESAND TANK 04-143-01
T-6515/6525/6535 SALES OIL TANKS 06-141-01

T-0170 CLEAR WELL 01-142-01
T-3000 BFW TANK 02-140-01
T-6615/6625 DILUENT TANKS 06-140-01
T-6715/6725/6735/6745 SLOP TANKS 06-141-01

T-0555 DEOILED WATER TANK 01-161-01
T-0545A/B OIL RECYCLE TANKS 01-161-01
T-0570 CLEAR WELL 01-162-01
V-0325 IGF VESSEL 01-151-01
T-0370 CLEAR WELL 01-152-01

T-0515 PW SURGE TANK 01-0161-001
T-0680 NEUTRALIZATION TANK 01-164-01
T-0560 WLS 01-162-01
T-0355 DEOILED WATER TANK 01-151-01
T-0322 SKIM TANK 01-151-01
T-0360 WLS 01-152-01
T-0345 OIL RECYCLE TANK 01-151-01
T-0480 NEUTRALIZATION TANK 01-154-01

B-3360/3460 HRSGs 02-141-02
B-3160/3260 OTSGs 02-141-01
B-3500/3550/3600/3650 OTSGs 02-151-01
B-3700 2ND STAGE OTSG 02-0151-002
B-3750/3800/3850/3900 OTSGs 02-0161-001
B-3950 2ND STAGE OTSG 02-0161-002
B-5600/5650 HRSGs 02-0161-004

PHASE 1F
PHASE 1G
PHASE 1H

HIGH PRESSURE
MEDIUM PRESSURE
LOW PRESSURE
LOW-LOW PRESSURE

NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PERMIT TO PRACTICE VISTA PROJECTS LIMITED
Signature
Date Jun 12, 2019
PERMIT NUMBER: P 4559
The Association of Professional Engineers and Geoscientists of Alberta

2019-06-11

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION - REISSUED FOR REGULATORY APPROVAL	2012/07/25	JM	APC	LY	KUL	BZS
3.B.0	PHASE 1H EXPANSION - ISSUED FOR DESIGN	2019/04/05	HYY	RVG	ZGA	KUL	JEG
3.B.1	PHASE 1H EXPANSION - REISSUED FOR DESIGN	2019/06/11	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
REISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/06/11

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
NATURAL GAS & FUEL GAS SYSTEM
PHASE 1F/1G/1H

DRAWING NO.
CL1-42-PFD-07-0141-001

REVISION NO.
3.B.1

CL1-42-PFD-07-0142-001_3.A.1

E-3035/3055/3075/5710
BLOWDOWN/GLYCOL EXCHANGER
DESIGN DUTY: 86.5 GJ/h
NOTE 6, 7

E-2885/2895
2ND STAGE BLOWDOWN/GLYCOL COOLER
DESIGN DUTY: 22.9 GJ/h
NOTE 6, 7

E-4435 A/B(2PX4S)
E-4535 A/B(2PX4S)
E-4635 A/B(2PX4S)
SALES OIL/GLYCOL EXCHANGERS
DESIGN DUTY: 28.85 GJ/h
NOTES 4, 6, 7

E-4475 A/B(2PX4S)
E-4575 A/B(2PX4S)
E-4675 A/B(2PX4S)
SALES OIL/GLYCOL EXCHANGERS
DESIGN DUTY: 28.85 GJ/h
NOTES 4, 6, 7

E-4480
OIL SLOPS COOLER
DUTY: 2.57 GJ/h

E-4450 A-F
E-4550 A-F
E-4650 A-F
PRODUCED WATER/GLYCOL EXCHANGERS
DESIGN DUTY: 87.3 GJ/h
NOTE 6, 7

STEAM SAMPLE COOLERS
DESIGN DUTY: 4.6 GJ/h
NOTE 6, 7

E-5230 A/B(1PX2S)
CRUDE FLASH DRUM
EFFLUENT/GLYCOL EXCHANGERS
DESIGN DUTY: 7.34 GJ/h
NOTE 4

E-7595
FLARE KOD LIQ.
COOLER
DESIGN DUTY: 4.0 GJ/h

E-5235
CRUDE FLASH DRUM
OVERHEAD/GLYCOL EXCHANGER
DESIGN DUTY: 15.12 GJ/h

E-7445
PROCESS WATER
MAKE-UP COOLER
DESIGN DUTY: 25.48 GJ/h

E-4080
SLUG CATCHER
LIQUID COOLER
DESIGN DUTY: 13.3 GJ/h

E-0241
PRODUCED WATER
DISPOSAL COOLER
RATED DUTY: 26.2 GJ/h

AC-7350 A-R
AC-7351 A-J
GLYCOL AIR COOLERS
DESIGN DUTY: 481.6 GJ/h
NOTE 5, 6, 7

E-7627/7497/7679
VRU COMPRESSOR DISCHARGE COOLER
NOTE 7

E-7612/7482/7677
VRU COMPRESSOR INTERSTAGE COOLER
NOTE 7

PHASE 1H | PHASE 1G | PHASE 1G | PHASE 1F

GLYCOL
42-PFD-07-142-02
TO HEATING GLYCOL SYSTEM

GTG LUBE OIL COOLING
E-7627/7497/7679
VRU INTERSTAGE VAP. 07-140-02
E-7612/7482/7677
VRU INTERSTAGE VAP. 07-140-02
E-0241
PW DISPOSAL 01-145-02
NNF
E-4480
OIL SLOPS (RAG LAYER) 04-140-01
NNF
E-7595
FLARE KOD LIQ. 07-146-01
NNF
E-7445
PROCESS MAKE-UP WATER 07-143-01
E-5235
FTO 05-140-01
E-5230 A/B
RSO 05-140-01
E-4435 A/B
SO 04-140-01
E-4475 A/B
SO 04-140-01
STEAM SAMPLE COOLERS
E-3035
BD 02-141-01
E-4450 A-F
PW 04-140-01
E-4080
SLUG CATCHER LIQUIDS 04-141-01

E-4675 A/B NOTE 7 — SO 04-0160-001
E-4635 A/B NOTE 7 — SO 04-0160-001
STEAM SAMPLE COOLERS NOTE 7
E-3075 NOTE 7 — BD 02-0161-001
E-4650 A-F NOTE 7 — PW 04-0160-001
E-2895 NOTE 7 — BD 02-0161-002
E-5710 NOTE 7 — BD 02-0161-005

E-4575 A/B NOTE 6 — SO 04-150-01
E-4535 A/B NOTE 6 — SO 04-150-01
STEAM SAMPLE COOLERS NOTE 6
E-3055 NOTE 6 — BD 02-0151-001
E-4550 A-F NOTE 6 — PW 04-150-01
E-2885 NOTE 6 — BD 02-0151-002

NC
COOLING GLYCOL BYPASS
42-PFD-07-142-02
TO HEADER
DPC

GLYCOL
42-PFD-07-142-02
FROM HEATING GLYCOL SYSTEM

AC-7350 A-R NOTE 6
AC-7351 A-J NOTE 7

NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. THE HEAT MEDIUM IS 60/40 WT% TEG/H_2O.
4. DESIGN DUTY IS THE TOTAL DUTY FOR ALL SHELLS.
5. DESIGN DUTY IS THE TOTAL DUTY FOR ALL BAYS.
6. EXCHANGERS E-2885 E-4550 A-F, E-3055, E-4535 A/B, E-4575 A/B, STEAM SAMPLE COOLERS FOR CL1G, AND AC-7350 J-R ARE INSTALLED AS PART OF PHASE 1G.
7. EXCHANGERS E-4650 A-F, E-4450F, E-4550F, E-3075, E-4635 A/B, E-4675 A/B, E-7679, E-7677, E-2895, E-5710, STEAM SAMPLE COOLERS FOR CL1H, AND AC-7351 A-J ARE INSTALLED AS PART OF PHASE 1H.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA — RICHARD GARRETT

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
Signature
Date Jun 12, 2019
PERMIT NUMBER: P 4559
The Association of Professional Engineers and Geoscientists of Alberta

2019-06-11

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	MB	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	VW	RVG	LY	RVG	FY
3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	HYY	RVG	ZGA	KUL	JEG
3.A.1	PHASE 1H EXPANSION – REISSUED FOR DESIGN	2019/06/11	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO: Vista Projects

REVISION DESCRIPTION: REISSUED FOR DESIGN

PROJECT NO.: CL1H

LSD: S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE: 2019/06/11

SCALE: NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
COOLING GLYCOL SYSTEM
PHASE 1F/1G/1H

DRAWING NO.: CL1-42-PFD-07-0142-001

REVISION NO.: 3.A.1

CL1-42-PFD-07-0142-002_0.B.1

F-7335
GLYCOL FILTER
SIZE: 610 mm O.D. x 1080 mm S/S

P-7380
GLYCOL FILL PUMP
RATED DUTY: 25.9 Am3/h

T-7390
GLYCOL STORAGE TANK
NOMINAL CAPACITY: 85 m3

V-7340
GLYCOL EXPANSION DRUM
SIZE: 3353 mm I.D. x 8534 mm S/S

E-7030
NATURAL GAS/GLYCOL EXCHANGER
RATED DUTY: 19 GJ/h

P-7330 A/B/C/D/E/F/G
GLYCOL CIRCULATION PUMPS
RATED FLOW: 750 Am3/h
NOTE 6, 7

H-7300 A/B/C
GLYCOL HEATERS
DESIGN DUTY: 33 GJ/h
NOTE 5, 7

E-5275 A/B
CRUDE FLASH DRUM
REHEATER AIR PREHEATER
DESIGN DUTY: 0.78 GJ/h
NOTE 4

E-4065A1/A2/B1/B2/C1/C2 (1Px2S)
DILUENT/GLYCOL EXCHANGER
DESIGN DUTY: 23.1 GJ/h
NOTES 4, 6, 7

E-3785/3835/3885/3935/3985
E-3185/3285/3535/3585/3635/3685/3735
COMBUSTION AIR PREHEATERS
(OTSCs)
DESIGN DUTY: 26.14 GJ/h
NOTES 4, 6, 7

E-6720
SLOP OIL/GLYCOL EXCHANGER
DESIGN DUTY: 5.48 GJ/h

GLYCOL
42-PFD-07-142-01
FROM COOLING GLYCOL SYSTEM

47 25

FC

HEATER BYPASS

H-7300A/B/C NOTE 7

FI

MARP

LP NAT. GAS
07-141-01

TC

47 26

E-3185/3285

AMB AIR
02-141-01

47 27

E-7030

NAT. GAS
07-141-01

47 30

E-3985
NOTE 7

AMB AIR
02-0161-002

67 28

E-6720

SLO
06-141-01

47 31

E-3785/3835/3885/3935
NOTE 7

AMB AIR
02-0161-001

67 27

T-7390

PC

LP NG
07-141-01

NNF

P-7380

FLARE
07-146-01

E-3735
NOTE 6

AMB AIR
02-0151-002

57 28

TANK
HEATERS

47 32

V-7340

E-3535/3585/3635/3685
NOTE 6

AMB AIR
02-0151-001

57 27

AIR COOLER
PLENUMS

F-7335

UNIT
HEATERS

47 35

COOLING GLYCOL BYPASS
42-PFD-07-142-01
FROM HEADER

E-5275 A/B

AMB AIR
05-140-01

47 28

HEAT
TRACING

47 36

DPC

E-4065A1/A2/B1/B2/C1/C2
NOTE 6, 7

DIL
06-140-01

47 29

GLYCOL
42-PFD-07-142-01
TO COOLING GLYCOL SYSTEM

47 16

47 15

P-7330 A/B/C/D/E/F/G
NOTE 6, 7

NOTES:

1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. THE HEAT MEDIUM IS 60/40 WT% TEG/H2O.
4. DESIGN DUTY IS THE TOTAL DUTY FOR ALL SHELLS.
5. DESIGN DUTY IS FOR EACH GLYCOL HEATER.
6. EXCHANGERS E-3535/3585/3635/3685, E-3735, E-4065 B1/B2, AND PUMPS P-7330 D/E ARE INSTALLED AS PART OF PHASE 1G.
7. EXCHANGERS E-3785/3835/3885/3935, E-3985, E-4065 C1/C2, GLYCOL HEATER H-7300C, AND PUMPS P-7330 F/G ARE INSTALLED AS PART OF PHASE 1H.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

ASSOCIATION OF PROFESSIONAL ENGINEERS AND GEOSCIENTISTS OF ALBERTA

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
Signature
Date Jun 13, 2019
PERMIT NUMBER: P 4559
The Association of Professional Engineers and Geoscientists of Alberta

2019-06-11

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	MB	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	RZ	RVG	LY	RVG	FY
0.B.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	HYY	RVG	ZGA	KUL	JEG
0.B.1	PHASE 1H EXPANSION – REISSUED FOR DESIGN	2019/06/11	KSO	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO

Vista Projects

REVISION DESCRIPTION
REISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/06/11

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
HEATING GLYCOL SYSTEM
PHASE 1F/1G/1H

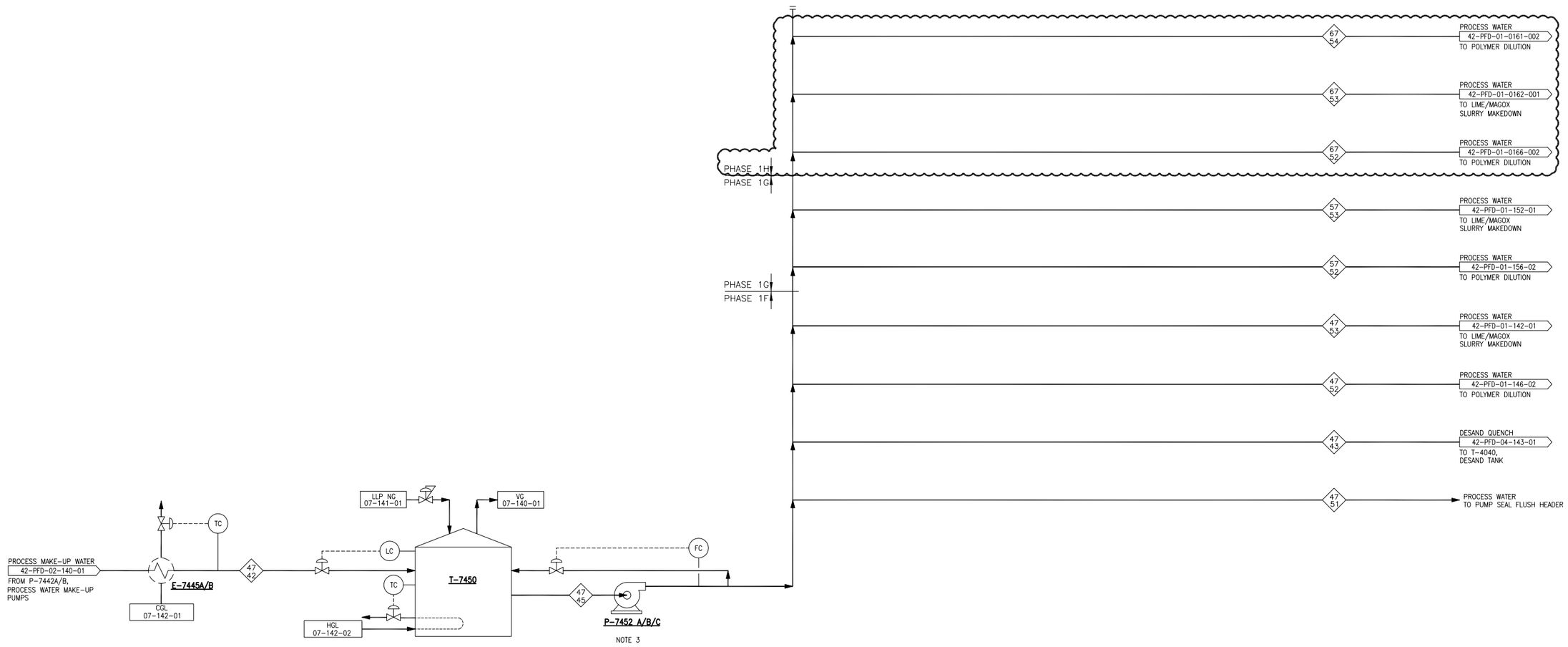
DRAWING NO.
CL1-42-PFD-07-0142-002

REVISION NO.
0.B.1

E-7445A/B
PROCESS WATER MAKE-UP COOLERS
DESIGN DUTY: 25.48 GJ/h

T-7450
PROCESS WATER TANK
NOMINAL CAPACITY: 323 m3

P-7452 A/B/C
PROCESS WATER SUPPLY PUMPS
RATED FLOW: 110 Am3/h
NOTE 3



NOTES:

1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".
3. P-7452C IS INSTALLED AS PART OF PHASE 1G.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	MB	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	RZ	RVG	LY	RVG	FY
3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	HYY	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
PROCESS WATER SYSTEM
PHASE 1F/1G/1H

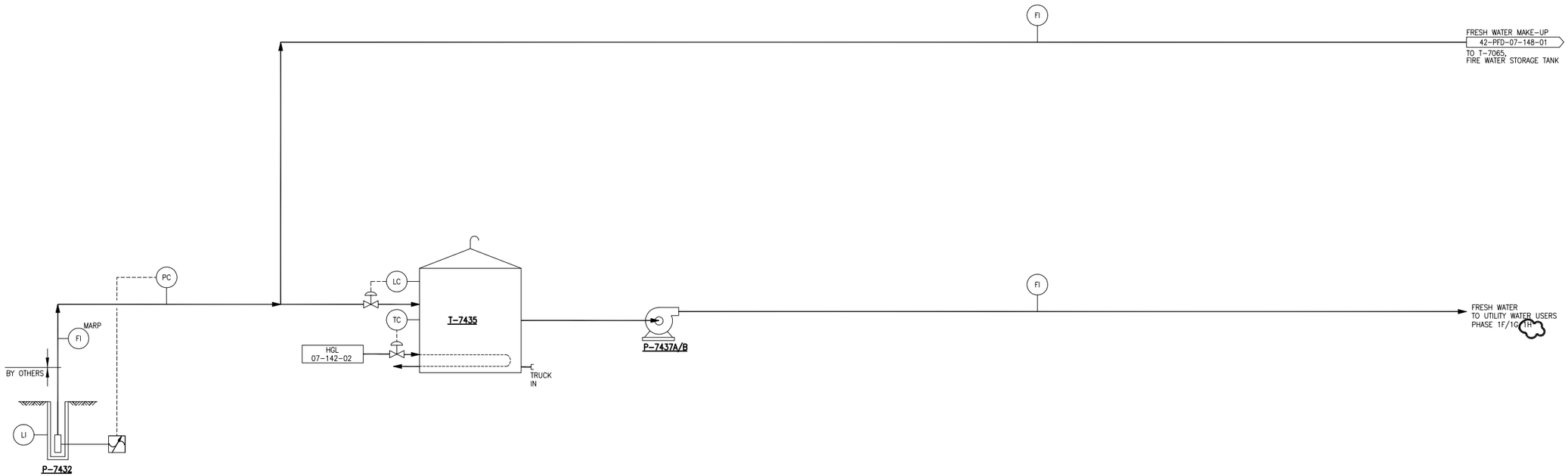
DRAWING NO.
CL1-42-PFD-07-0143-001

REVISION NO.
3.A.0

P-7432
FRESH WATER WELL PUMP
RATED FLOW: 34 m3/h

T-7435
FRESH WATER TANK
NOMINAL CAPACITY: 76.9 m3

P-7437A/B
FRESH WATER PUMPS
RATED FLOW: 23 Am3/h



NOTES:
1. ALL EQUIPMENT SHOWN IS PHASE 1F EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GRANDY

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	MB	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	RZ	RVG	LY	RVG	FY
4.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	HYY	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
FRESH WATER SYSTEM
PHASE 1F/1G/1H

DRAWING NO.
CL1-42-PFD-07-0144-001

REVISION NO.
4.A.0

PK-7230/7235/7225
INSTRUMENT AIR PACKAGE

K-7230/7235/7225
INSTRUMENT AIR COMPRESSOR

V-7230/7235/7225
INSTRUMENT AIR
OIL RECEIVER
SIZE: mm O.D. x mm S/S

F-7230/7235/7225
INSTRUMENT AIR
OIL SEPARATOR ELEMENT

F-7231/7236/7226
INSTRUMENT AIR
OIL FILTER

AC-7230/7235/7225
INSTRUMENT AIR
AFTER COOLER

V-7245/7247/7249
INSTRUMENT AIR
WET AIR RECEIVER
SIZE: mm I.D. x mm S/S

F-7255/7257/7259
INSTRUMENT AIR
PRE-FILTER

D-7265 A/B & D-7267 A/B & D-7269 A/B
INSTRUMENT AIR DRYER

EH-7265/7267/7269
INSTRUMENT AIR
ELECTRIC HEATER

V-7275/7277/7279
INSTRUMENT AIR
DRY AIR RECEIVER
SIZE: 1829 mm O.D. x 6096 mm S/S
NOTE 3

AIR IN
INLET AIR FILTER
PC
K-7230/7235/7225
V-7230/7235/7225
LG
TI
AC-7230/7235/7225
F-7230/7235/7225
AFTER COOLER
PC
F-7231/7236/7226

DRYER CONTROL PANEL

AI
MOISTURE
FC
TC
EH-7265/7267/7269

ADSORPTION
D-7265 A/B
D-7267 A/B
D-7269 A/B
REGENERATION

ATM
FO

PT
INSTRUMENT AIR
TO INSTRUMENT AIR HEADER

F-7255/7257/7259

V-7245/7247/7249

V-7275/7277/7279 NOTE 3

WATER
TO BUILDING SUMP

PK-7230/7235/7225 NOTE 3

NOTES:

1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-"
3. PK-7225 AND V-7279 ARE INSTALLED AS PART OF PHASE 1H.

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD GARRETT ALBERTA 98070

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VB	PHASE 1H EXPANSION – REISSUED FOR REGULATORY APPROVAL	2012/07/25	PC	APC	LY	KUL	BZS
3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	HYY	RVC	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

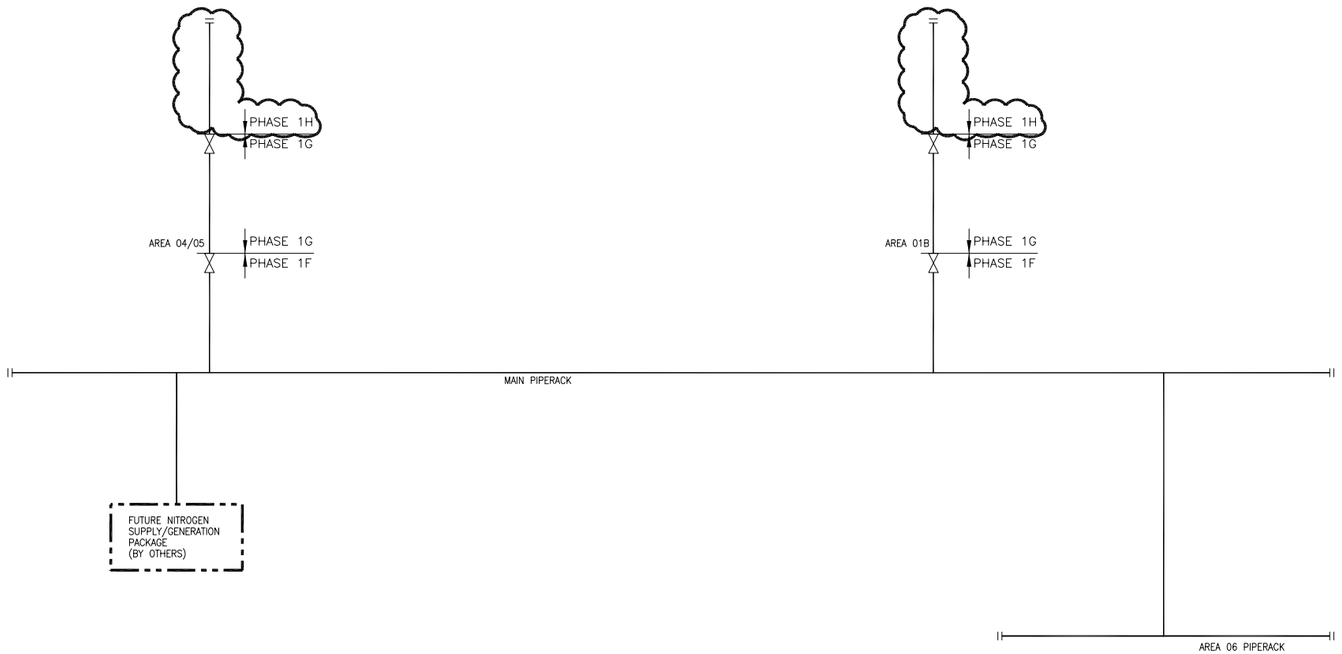
SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
INSTRUMENT AIR SYSTEM
PHASE 1F/1G/1H

DRAWING NO.
CL1-42-PFD-07-0145-001

REVISION NO.
3.A.0



NOTES:

1. ALL EQUIPMENT SHOWN IS PHASE 1F, EXCEPT WHERE NOTED.
2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED

APEGA PERMIT No.
P 04559

The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	MB	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	RZ	RVG	LY	RVG	FY
3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	HYY	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO

Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
NITROGEN SYSTEM
PHASE 1F/1G/1H

DRAWING NO.
CL1-42-PFD-07-0145-003

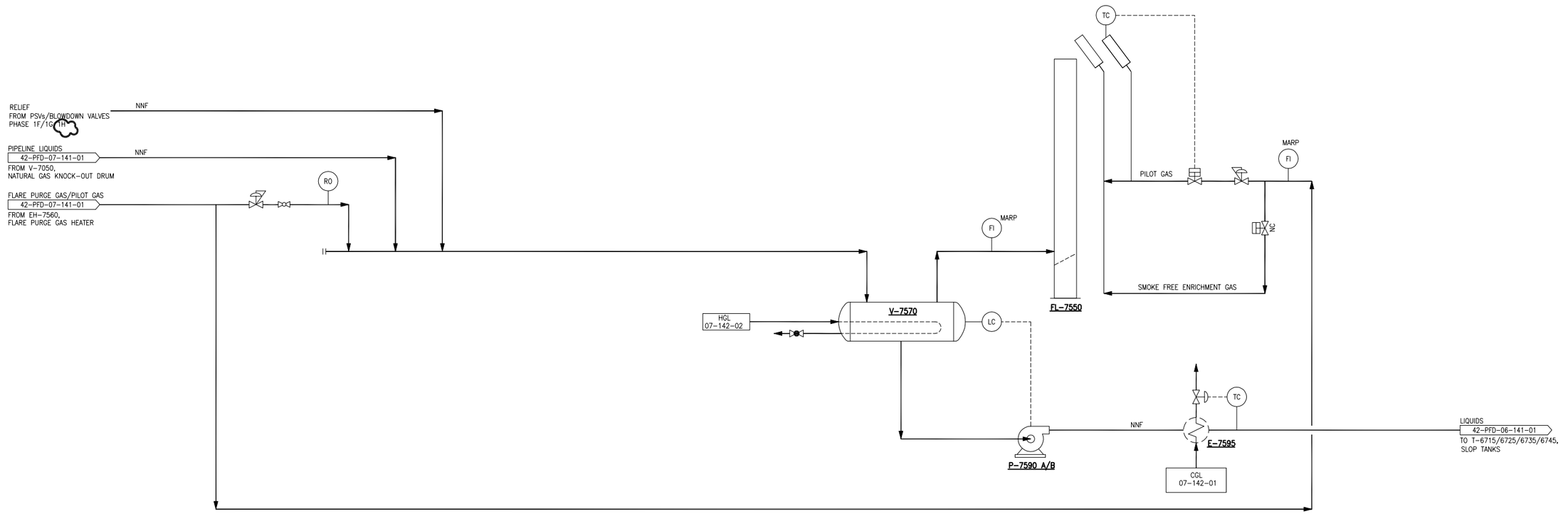
REVISION NO.
3.A.0

V-7570
FLARE KNOCK-OUT DRUM
SIZE: 4268 mm I.D. x 18290 mm S/S

P-7590 A/B
FLARE KNOCK-OUT DRUM PUMPS
RATED FLOW: 58 Am³/h

FL-7550
FLARE STACK
SIZE: 590.55 mm ID x 50000 mm HIGH

E-7595
FLARE KNOCK-OUT DRUM LIQUIDS COOLER
DESIGN DUTY: 5.37 GJ/h



NOTES:
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2. ALL TAG NUMBERS TO BE PREFIXED BY "CL1-".

PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD BARRETT

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
VC	PHASE 1H EXPANSION - REISSUED FOR REGULATORY APPROVAL	2012/08/22	IS	APC	LY	KUL	BZS
3.A.0	PHASE 1H EXPANSION - ISSUED FOR DESIGN	2019/04/05	HYY	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
FLARE SYSTEM
PHASE 1F/1G/1H

DRAWING NO.
CL1-42-PFD-07-0146-001

REVISION NO.
3.A.0

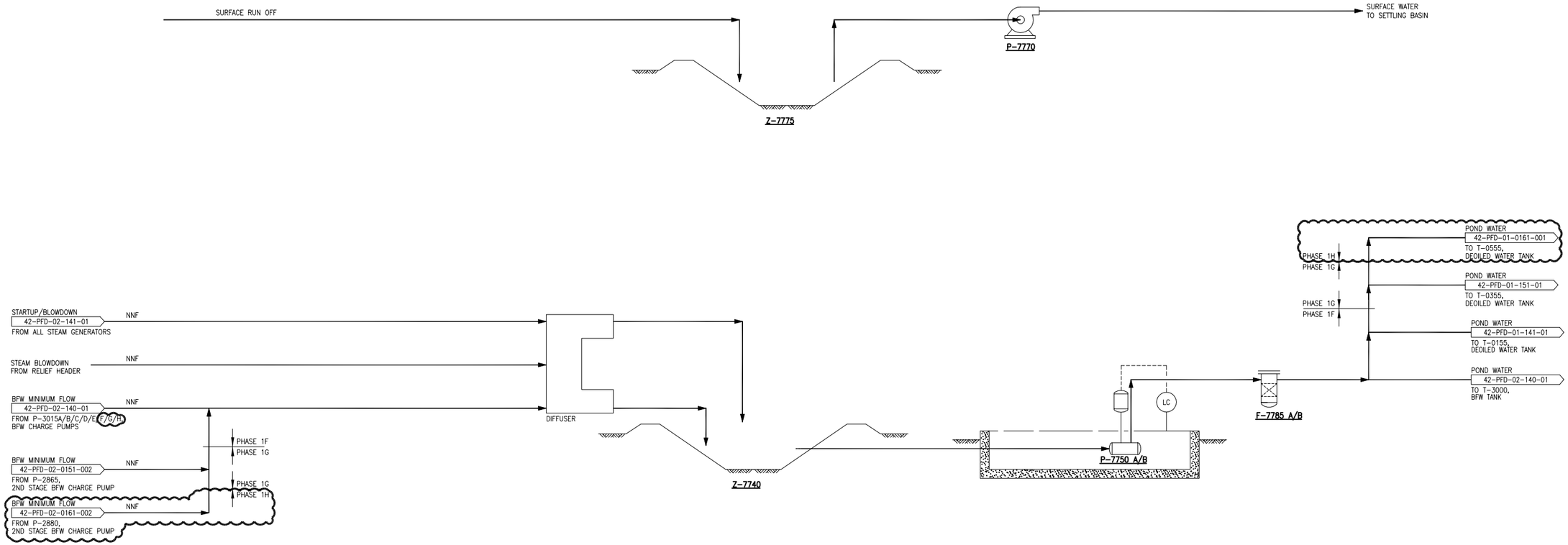
Z-7740
STEAM BLOWDOWN POND
CAPACITY: XXXX m³

Z-7775
STORM WATER POND
CAPACITY: XXXX m³

P-7770
STORM WATER POND PUMP
RATED FLOW: 25.0 Am3/h

P-7750A/B
STEAM BLOWDOWN POND PUMPS
RATED FLOW: 80 Am3/h

F-7785 A/B
BLOWDOWN POND RETURN FILTERS
SIZE: 324 mm I.D. X 1029 mm S/FF



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PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER RICHARD GARRETT 04/04/2019

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	RZ	RVG	LY	RVG	FY
4.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	HYY	RVG	ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
STORM WATER/STEAM BLOWDOWN PONDS
PHASE 1F/1G/1H

DRAWING NO.
CL1-42-PFD-07-0147-001

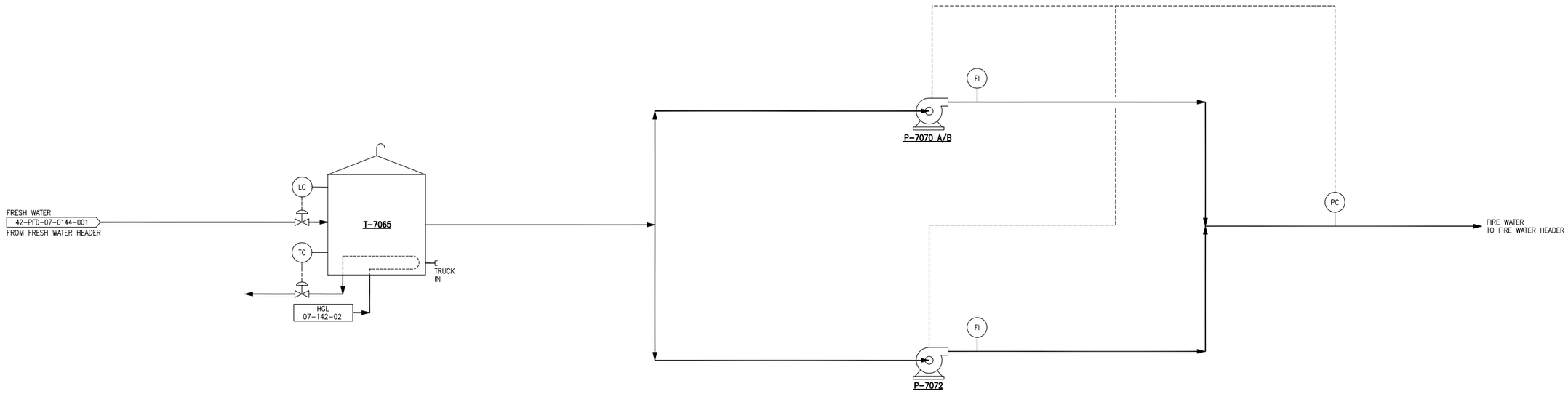
REVISION NO.
4.A.0

CL1-42-PFD-07-0148-001_3.A.0

T-7065
FIRE WATER STORAGE TANK
NOMINAL CAPACITY: 4316 m3

P-7070 A/B
FIRE WATER PUMPS
RATED FLOW: 909.0 Am3/h

P-7072
FIRE WATER JOCKEY PUMP
RATED FLOW: 22.7 Am3/h



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PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD BARRETT

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED

APEGA PERMIT No.
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The Association of Professional Engineers, and Geoscientists of Alberta

REV NO	REVISION	DATE	DRN	CKD	DES	LDE	PE
0V	PHASE 1G EXPANSION – ISSUED FOR DESIGN	2013/01/15	KJS	RVG	LY	KU	GP
1V	PHASE 1G EXPANSION – REISSUED FOR DESIGN	2013/07/23	JM	RVG	LY	KU	MC
2V	PHASE 1G EXPANSION – ISSUED FOR PROJECT TURNOVER	2015/06/08	RZ	RVG	LY	RVG	FY
3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	HYY	RVG	ZCA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
FIRE WATER SYSTEM
PHASE 1F

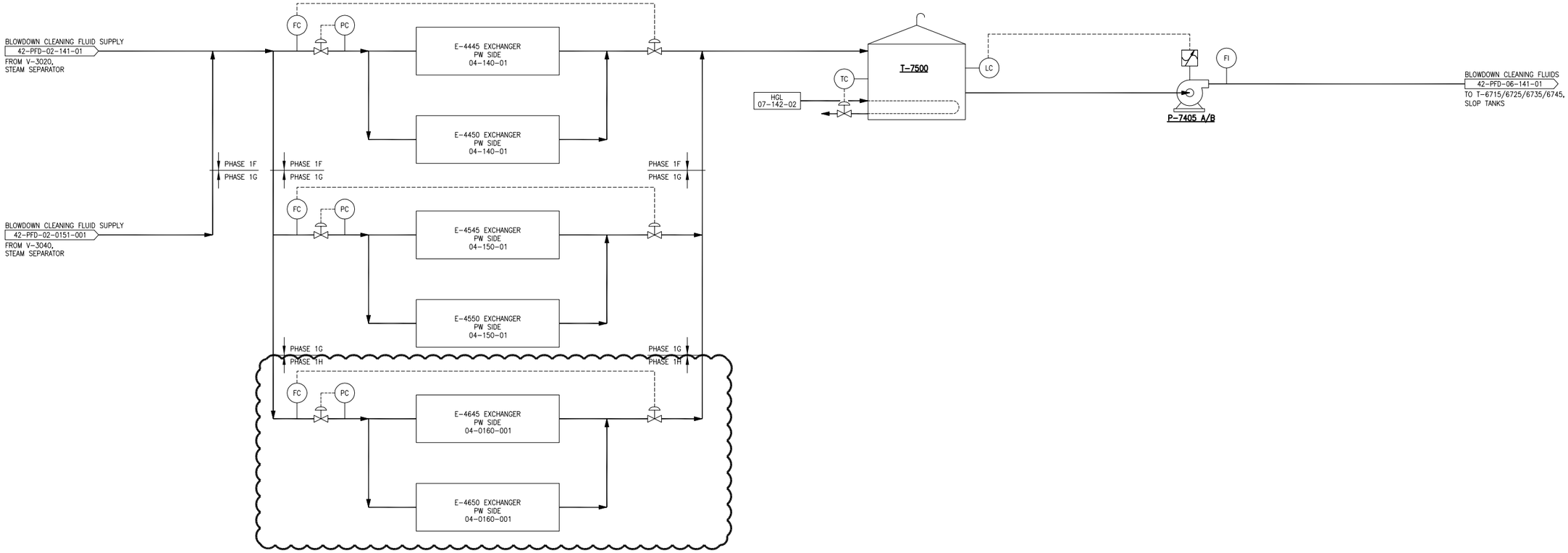
DRAWING NO.
CL1-42-PFD-07-0148-001

REVISION NO.
3.A.0

K:\Projects\Cenovus\2195\Piping\Drafting\PFD\01 - IFR - (IN PROGRESS)\CL1-42-PFD-07-0148-001_3.A.0.dwg Ken Sorensen 4/3/2019 11:20 AM

T-7500
BLOWDOWN
CLEANING TANK
NOMINAL CAPACITY: 230 m3

P-7405 A/B
BLOWDOWN CLEANING
RECYCLE PUMPS
RATED FLOW: 30 Am3/h



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PACKAGE NO.

REFERENCE NUMBER	REFERENCE TITLE

STAMPS

PROFESSIONAL ENGINEER ALBERTA RICHARD GARRETT

04/04/2019

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VISTA PROJECTS LIMITED
APEGA PERMIT No.
P 04559
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3.A.0	PHASE 1H EXPANSION – ISSUED FOR DESIGN	2019/04/05	HYY		ZGA	KUL	JEG

CONSULTANT NAME AND LOGO
Vista Projects

REVISION DESCRIPTION
ISSUED FOR DESIGN

PROJECT NO.
CL1H

LSD
S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
BLOWDOWN CLEANING SYSTEM
PHASE 1F/1G/1H

DRAWING NO.
CL1-42-PFD-07-0149-001

REVISION NO.
3.A.0

V-8000
INLET SEPARATOR

T-8005
FRESH CHEMICAL
STORAGE TANK

T-8010
METHANOL TANK

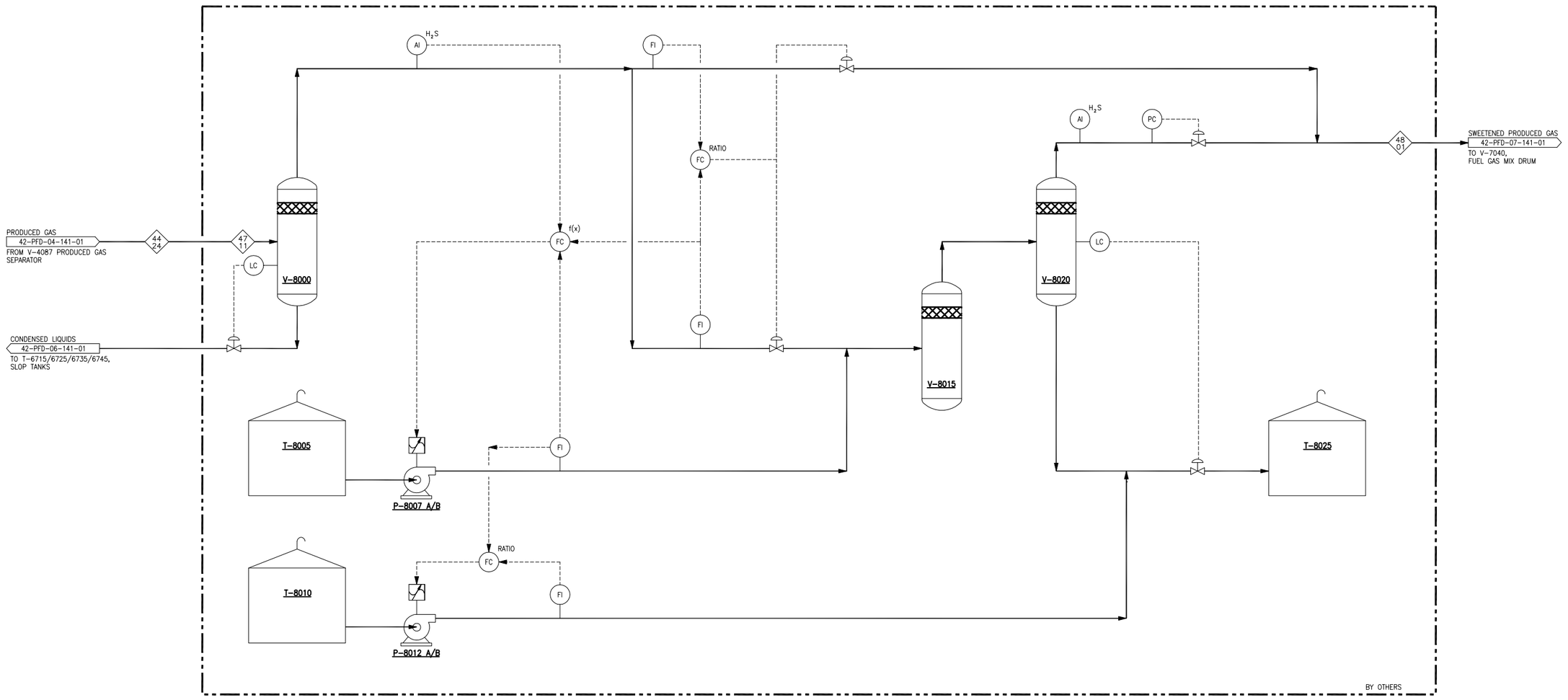
P-8007A/B
FRESH CHEMICAL PUMPS

P-8012A/B
METHANOL PUMPS

V-8015
CONTACTOR

V-8020
POST-CONTACTOR
SEPARATOR

T-8025
SPENT CHEMICAL
STORAGE TANK



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PACKAGE NO.

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STAMPS

PROFESSIONAL ENGINEER ALBERTA

04/04/2019

PERMIT TO PRACTICE
VISTA PROJECTS LIMITED

APEGA PERMIT No.
P 04559

The Association of Professional Engineers, and Geoscientists of Alberta

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CONSULTANT NAME AND LOGO

Vista Projects

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PROJECT NO.
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S.E. 1/4, Sec. 17, TWP 76, RG 6, W4M

ISSUE DATE
2019/04/05

SCALE
NONE

cenovus ENERGY

TITLE
CHRISTINA LAKE COMMERCIAL PLANT
PROCESS FLOW DIAGRAM
H2S SCAVENGER UNIT
PHASE 1F

DRAWING NO.
CL1-42-PFD-08-0140-001

REVISION NO.
4.A.0