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Alberta Sulphur Terminals Ltd.
Bruderheim Sulphur Forming and Shipping Facility

Application

for

Alberta Sulphur Terminals Ltd.

Bruderheim Sulphur Forming and Shipping Facility

(35-55-20 W4M)

Project Number 62720000
June 2007

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Introduction

Alberta Sulphur Terminals Ltd. (AST), a division of Hazco Environmental Services Ltd. (HAZCO) which, in turn, is a division of CCS Income Trust (CCS), hereby submits an application for Approval to construct and operate a Sulphur Forming and Shipping Facility (the Project). This application and supporting information provides Alberta Environment with the technical basis to issue an Approval under the *Environmental Protection and Enhancement Act* (EPEA). The application is made in accordance with EPEA Chapters E-13.3, Part 2, Division 2, Section 63 and Regulations 113/93 Section 3 (1) and 211/96.

The activities to be undertaken in relation to this Approval include construction, operation and monitoring of the Project, which in turn includes:

- rail and road access for receiving and shipping sulphur
- liquid sulphur unloading and transfer facilities
- sulphur forming facilities to produce sulphur pastilles
- liquid and formed sulphur storage facilities
- loading and shipping facilities for formed sulphur

All sulphur to be accepted by the Project will be degassed to contain no greater than 10 ppm hydrogen sulphide (H_2S) by weight. The proposed Project will be constructed and operated in accordance with the supporting Environmental Impact Assessment (EIA) as well as any terms and conditions imparted through the EIA review process and the associated Approval. The proposed Project will be designed and operated in general conformance with state of the art practices to minimize potential environmental impacts as well as impacts to area Stakeholders. The proposed facility reflects the application of 'Best Available Technology that is Practical to Implement' as well as technology and facilities that are proven effective and reliable in other parts of Alberta. Project operations and maintenance will be implemented in accordance with the following Project-specific plans, which are included as supporting documents to the EIA:

- Health and Safety Plan (refer to Volume I: Project Description – Appendix IV)
- Preliminary Emergency Response Plan (refer to Volume I: Project Description – Appendix V)

The EIA is prepared to support an application to construct and operate the Project in accordance with the requirements of the Approvals Procedure Regulation (113/93) of the EPEA. Sulphur processing is listed in the Activities Designation Regulation (211/96) of the EPEA, Schedule 1, Division 2, Section (b)(iii) as requiring formal approval under the EPEA and the final Terms of Reference (AENV 2007). Included with this submission are the Design Drawings (see Appendix 1) which describe the facility, an EIA Report, Plans and a Public Consultation Report which support the EIA.

Each of the above are referenced where appropriate within this Application.

Application

3(1) An application must be made to the Director and must be accompanied by the following information relative to the activity, the change in the activity or the proposed amendment, addition or deletion of the term or condition.

(a) The name and address of the applicant.

1. General

1.1 **Corporately Registered Company Name.**

Alberta Sulphur Terminals Ltd.

1.2 **Mailing Address of Head Office (in Alberta).**

10501 Barlow Trail SE
Calgary, Alberta T2C 4M5

1.3 **Mailing Address of Applicable Plant or Regional Office.**

Box 1090
Lamont, Alberta T0B 2R0

1.4 **Phone, Fax and Email.**

Phone: (403) 297-0444
Fax: (403) 253-3188

1.5 **Date:**

May 7, 2007

1.6 **Name(s) of contact(s) for this application.**

Mr. Rob Mann
Project Manager, Alberta Sulphur Terminals Ltd.

1.7 **Signature of Owner/Operator**

Mr. Rob Mann
Project Manager, Alberta Sulphur Terminals Ltd.

(b) The location, capacity and size of the activity to which the application relates.

2. Location

2.1 Legal Land Description.

The proposed Project will be located within a portion of Section 35, Township 55, Range 20, West of the 4th Meridian (35-55-20 W4M (the Site)), approximately 2.2 km east of Bruderheim, Alberta (Figure 1). The sulphur forming activities will occur over a small area located within the central portion of the Site, as illustrated in Figure 2. The surrounding land uses are illustrated in Figure 3. The specific site layout is illustrated in Figure 4. The precise locations of the proposed sulphur forming and shipping facilities are shown in Figure 5.

2.2 Relation to Nearest Town, City or Village.

The proposed Project falls within Lamont County and the closest communities are:

- Bruderheim, approximately 2.2 km west, population 1,200
- Lamont, approximately 4 km southeast, population 1,600
- Fort Saskatchewan, approximately 17 km west-southwest, population 15,000

2.3 Geographical description.

The Site is located on agricultural lands that are regularly cultivated, interspersed with small seasonal creeks and some marshy areas. The major drainage feature in the area is the North Saskatchewan River, located approximately 12 km to the northwest of the Site. A topographic map of the area is shown in Figure 1. The Site is located in a heavy industrial land use zone, Alberta's Industrial Heartland, with sodium chlorate plants located to the southwest and northwest. Land to the north, east and south of the Site is currently used for agriculture. Highway 15 is located approximately 1.5 km to the south of the Site, Highway 45 is located immediately to the northwest of the Site and R.R. 202 borders the Site to the west (Figure 2).

The main lines of both Canadian Pacific Railway (CPR) and Canadian National (CN) truncate the Site (Figure 2). The CPR line is the northernmost line and runs in an east-northeast direction. The CNR line is the southernmost line and runs in an east-southeast direction. The lines converge into a single line and right-of-way, approximately 1 km west of the Site.

3. Capacity.

3.1 Raw Material Processing Capacity, By-product Processing Capacity, Finished Product Capacity (Stated Design and Nominal)

The facilities will be constructed in phases to meet the demand of the target markets (Table 1). This application is for the 'initial' facilities; whereas, the EIA was completed to evaluate the potential impacts associated with the ultimate capacity of the project. An amending application will be submitted to AENV if and when the initial facilities are to be expanded to provide additional capacity.

Table 1: Principle Design Capacities

Component	Initial Capacity
Liquid storage	9,000 t
Sulphur forming	3,000 t/d
Pastilles stockpile	45,000 t
Water consumption	3.8×10^{-4} m^3/s
Principle development area	20.09 ha

Facilities associated with the Project development are described in the underlying text. Each component of the Project will be constructed and operated as part of initial development. The ultimate development, which is the basis of the EIA, will consist of the approximate doubling of initial capacity.

Utilization of these facilities and the amount of sulphur that will be processed, is market driven. Notwithstanding this qualification, it is anticipated that the amount of new sulphur generated in the Industrial Heartland and oil sands areas of Alberta will be on the order of 6,000 tonnes per day.

3.2 Other Appropriate Capacity Measurements

Not applicable.

4. Size

4.1 Size of the Affected Area, Leased Area, and/or Plant Site (e.g., hectares)

The proposed developments of the sulphur processing and shipping areas are shown in Figure 4. This development layout results in a 400 m development set-back from the property boundaries to the sulphur forming facilities. The following approximate sizes of development are associated with each of the components:

- general sulphur forming and storage facilities (6 ha)
- rail loop and siding (3 km)
- access roadway (600 m)

The remaining areas of the Site will continue to be used for agricultural purposes. Additional land development should not be required for the sulphur forming operations. Any additional industrial developments that may occur on the Site would be subject to application, review and approval under the EPEA, if and as required by the Act.

4.2 Physical dimensions of the plant site including a plant site map (i.e., plot plan).

The general site layout of the Project is shown in Figure 5.

4.3 Number of employees working at the facility.

During facility construction, the local regional economy will benefit as a result of the work force. Construction activities over the proposed nine month period are expected to employ approximately 36,000 man-hours. Project operations are expected to add approximately 40,500 man-hours annually to the regional economy (22 full-time positions).

(c) The nature of the activity, the change to the activity or the amendment, addition or deletion, as the case may be.

5. New Plants

5.1 **Provide Classification of this Facility Under the Environmental Protection and Enhancement Act Activities Designation Regulation 211/96.**

The Project will consist of four main components, as follows:

- infrastructure for the reception of liquid sulphur and the shipment of formed sulphur
- storage facilities for liquid and formed sulphur
- sulphur forming facilities
- sulphur transfer and loading infrastructure

The proposed Project is classified as a "sulphur processing facility" according to the Alberta Activities Designation Regulation Class Code (211/96) of the EPEA, Schedule 1, Division 2, Section (b)(iii).

The lands in question are currently used for agricultural purposes but are zoned for heavy industrial use. An application for a development permit will be submitted to the County of Lamont in conjunction with this application and supporting EIA.

5.2 **Describe the general purpose, raw materials, products, by-products (e.g., chemical manufacturing plant, brine pond, waste storage facility, etc.). Include quantities used/produced per unit time.**

5.2.1 Purpose

The Project will service oil and gas production and refining operations located in the Fort Saskatchewan area as well as northeastern Alberta. With increased applications, approvals and operation of bitumen upgraders and ongoing sulphur recovery initiatives, a shortage of sulphur forming facilities in Alberta has become apparent. AST will provide the oil and gas producers in the area with a state of the art sulphur forming, pastille storage and shipping facility that will include design elements and monitoring programs that focus on environmental protection.

5.2.2 Raw Materials

The produced sulphur will be delivered to the AST facility at a temperature slightly above its melting point of 115°C, generally between 130°C and 140°C. Its specific gravity, both as a liquid and as a solid, is roughly 2, indicating that 1 m^3 of sulphur weighs approximately 2 tonnes. The vapour is relatively dense (8.8 times that of air). However, sulphur is not volatile at the delivery, forming and solidification temperatures that are expected. Strengths in excess of 200 kPa are typical when liquid sulphur is allowed to cool and solidify.

From a precautionary labelling point of view, hazards for health, fire and contact are considered slight (1 on a rating scale of 0–4 where 0 is no hazard and 4 is an extreme hazard, based on the Workplace Hazardous Materials Information System, WHMIS). Elemental sulphur oxidizes by combustion, requiring vigilant fire protection and monitoring procedures wherever sulphur is stored or formed. Notwithstanding these precautions, sulphur burns as a slow smoldering process; hence, there is generally ample time to respond to a fire

once it is detected. Toxic fumes (SO_2) are generated by combustion and must be accounted for in any procedures associated with emergency response. Solid and liquid sulphur is essentially insoluble in water.

AST has chosen to utilize a third generation drop forming sulphur solidification technology from Sandvik Process Systems named Rotoform HS®. Each unit has a minimum guaranteed capacity of 12.0 t/h. Eleven units will be commissioned at initial construction providing an initial forming capacity of approximately 3,000 t/d.

5.2.3 Products and By-products

Dust suppression agents will be utilized as part of the air emissions management process. Agents currently selected for the Project include a proprietary dust suppression agent, Dustbind S5, and a proprietary sulphur release aid, IPAC SRB Plus. Dustbind S5 and IPAC SRB Plus usage rates are estimated to be less than 100 kg/d (respectively) during initial operations. The actual amounts used will depend on the size of the trains being loaded and the conveyor size. Dustbind S5 will be applied at the transfer points and IPAC SRB Plus will be applied at each individual Rotoformer.

5.3 Describe the Major Unit Operations (e.g., Cooling Towers, Steam Boilers, Compression, Sulphur Prilling, etc.).

Each primary component of the Project is described in a sub-section of this Application. The underlying text provides a summary of each of the components of the Project.

5.3.1 Sulphur Reception

Liquid sulphur will be received at the facility by either rail car or truck. Future delivery may possibly occur by pipeline. Only liquid sulphur that has been degassed to a maximum of 10 parts per million (ppm) H_2S will be accepted. Upon arrival at the facility, the pipeline or tankers will unload via a pumping station into insulated and heated tanks, each having a holding capacity of 3,000 t of liquid sulphur. All liquid sulphur storage tanks will be vented to the atmosphere following treatment to reduced entrained H_2S. Liquid sulphur will then be pumped from the receiving tanks to a feed tank. The sulphur will then be filtered and temperature conditioned prior to being formed.

5.3.2 Sulphur Storage

Storage facilities will be provided for sulphur in its liquid form, prior to being formed, as well as in its pastille form, prior to being shipped. The sole purpose of the storage facilities will be to allow efficient operation of the forming facilities, while accommodating the inconsistent nature of sulphur delivery and shipping. Liquid sulphur will be stored in 3,000 t, insulated and clad, steel tanks that are designed to comply with the requirements of Alberta Energy and Utilities Board (EUB) Directive 55 (EUB 2007, Internet site) and API 650 modified (API 1998). Three tanks will be constructed as part of the initial development. Formed sulphur pastilles will be transferred outside of the production building to a radial stacking conveyor and onto a double-lined asphalt bulk sulphur storage pad. The storage pad specified as part of this application is designed to store up to 45,000 t of formed pastilles. The sulphur pastille storage area has the following environmental protection measures incorporated into its design:

- run-on and runoff controls
- 150 mm thick asphalt surface for primary containment and working
- 300 mm clay liner for secondary containment

- prepared sub-grade

Sulphur pad design details are provided in the Figure 6.

5.3.3 Sulphur Forming

The forming process will first involve pumping the sulphur from receiving tanks to a feed tank. The sulphur will then be pumped from the feed tank through a duplex filter and a conditioning unit which cools the sulphur to an optimal forming temperature of 125°C. The sulphur will then enter a recirculation loop which feeds the Rotoform HS® drop forming equipment. The feed to the Rotoformer will use metering equipment and nozzles specifically designed to provide a continuous sulphur feed across a rotating stainless steel belt. The belt will be cooled by cold water jets sprayed against the underside of the rotating belt, causing the pastilles to cool and solidify above. The initial Project development will consist of 11 Rotoform HS® Drop units having a processing capacity of approximately 3,000 t/d.

The solid pastilles will be gathered into a collection hopper, conveyed to a radial stacking conveyor and transferred to the asphalt bulk sulphur storage pad. Initially, a front end loader will transfer the stockpiled sulphur to a surge bin that is equipped with a dust suppression package. The dust treated product will then be deposited on a load out conveyor equipped with weight measurements and totalizer and onto rail or trucks for shipment.

The water utilized by the Rotoform HS® will be sent through a closed loop cooling tower which will provide filtration and temperature reduction. Makeup water for the cooling tower will be supplied from the runoff collection pond which is designed to collect and treat surface water from the Site and also serve as the source of fire protection water (Figure 7). Additional make-up water will be provided by a groundwater supply well.

5.4 **Describe the duration of the project, construction commencement date, completion date and commissioning dates of unit(s), production facilities and environmental protection and control systems/procedures. Include an estimated project cost as well as costs of environmental protection and control systems**

5.4.1 Project Timeline

The proposed facilities will be developed in stages to accommodate the rate of sulphur production generated by existing and proposed oil sands development programs as well as market conditions. The initial stage will include the development of all project components with sufficient capacity to process approximately 3,000 t/d sulphur. The anticipated timing for the initial stage of development is summarized in the underlying table and is dependent on the pace and outcome of the regulatory process.

Table 2: Initial Development Timing

Task	Anticipated Timeframe
Project disclosure	2005
EIA scoping	Early 2006
EIA implementation	2006
Application submission	Mid 2007
Detailed design	Late 2007
Construction	Early 2008
First operations	Mid 2008
Project lifespan	25 years

5.4.2 Production Facilities and Environmental Protection and Control Systems/Procedures

Production facilities were described above in Section 5.3 and in detail in Volume I: Project Description. Environmental Protection and Control Systems/Procedures are described in Sections 5.13.1 to 5.13.5 of the Application and in detail in Volume I: Project Description.

5.4.3 Estimated Project Cost

Preliminary cost estimates suggest Project capital spending of over CDN $37.5 million.

5.4.4 Environmental Protection and Control System Cost

Costs of environmental project and control system are estimated to be CDN $5 million.

5.5 Provide Scale Diagrams of the Plant, Plant Site and the Surrounding Area

Refer to the following Table 3 for the location of the diagrams and descriptions required.

Table 3: Location of Diagrams and Descriptions

	Item	Location or Details
a.	Topography of the Area	Figure 1
b.	Property Boundary Land Use of Area	Figures 2 and 3. Lands in question are currently used for agricultural purposes but are zoned for heavy industrial use. An application for a Development Permit will be submitted to the County of Lamont in conjunction with this application and supporting EIA.
c.	Site Location	Figures 1 to 3
d.	Building Location and Type	Figure 4
e.	Equipment Location and Name	Figure 5
f.	Liquid Effluent Outfall Air Emission Point Sources Sampling/Monitoring Equipment	Not applicable See Figure 5 and Attachments D, D-A1, D-A2, and D-A3
g.	Equipment Used for Waste Management	See Attachments B and C
h.	Sewer Line Locations	Not Applicable
i.	Industrial Runoff Drainage Information	See Attachment B
j.	Air Emission Discharge Points	See Air Quality Modelling Report (DML and Jacques Whitford 2005) and Volume IIA, Section 2: Air Quality Modeling – Appendix I
k.	Topsoil Stockpiles	See Section 34.2. (b) of this Application

5.6 Provide a flow diagram of the manufacturing process(es) or operation(s) involved, the industrial wastewater, air and waste treatment facilities and a general narrative description, including equipment and unit capacities

5.6.1 General

For the purpose of this Project, AST has chosen to utilize a third generation drop forming sulphur solidification technology from Sandvik Process Systems named Rotoform HS®. Each unit has a minimum guaranteed capacity of 12.0 t/h. Eleven units will be commissioned at full scale operation, providing a sulphur forming capacity of approximately 3,000 t/d.

The equipment is modular in design and flexible in that any number of machines can be used at any given time. The process is exceptionally clean without any sulphur contact with water, steam or air surges during the forming process. The elimination of direct contact with water, steam or air currents effectively minimizes major environmental concerns, namely dust emissions as well as water contamination through sulphur acidification. The process does not require specialized personal protective equipment, including artificial breathing air or confined space entry. A detailed process flow diagram is provided in Figure 8. Principal Project components are described in the following subsections.

5.6.2 Sulphur Reception and Preparation

Liquid sulphur will be received at the facility by either rail car or truck. Future delivery may possibly occur by pipeline. Only liquid sulphur that has been degassed to a maximum of 10 ppm H_2S will be accepted. Upon arrival, the pipeline or tankers will unload via a pumping station into insulated and heated tanks (T-101–T-106), each having a holding capacity of 3,000 t of liquid sulphur. All liquid sulphur storage tanks will be vented to atmosphere following treatment to reduce entrained H_2S.

5.6.3 Sulphur Forming

The forming process will first involve pumping sulphur from receiving tanks to a feed tank. It will next be pumped from the feed tank through a duplex filter and conditioning unit which cools the sulphur to an optimal forming temperature of 125°C. The sulphur will then enter a recirculation loop which feeds the Rotoform HS® drop forming equipment. The feed to the Rotoformer will use metering equipment and nozzles specifically designed to provide a continuous sulphur feed across a rotating stainless steel belt. The belt will be cooled by cold water jets sprayed against the underside of the rotating belt, causing the pastilles to cool and solidify above.

The solid pastilles will gather into a collection hopper and be conveyed to a radial stacking conveyor, as described in Volume I: Project Description – Section 2.3.4. The water utilized by the Rotoform HS® will be sent through a closed loop cooling tower to provide filtration and temperature reduction. Makeup water for the cooling tower will be supplied from the runoff collection pond which will be designed to collect surface water from the Site and provide fire protection water. Additional make-up water will be provided by a groundwater supply well or from a municipal water supply. Figure 9 is a schematic illustration of the Sandvik process.

5.6.4 Sulphur Transfer and Shipping

The solid pastilles will fall onto a collection conveyor (CV101), be transferred outside to a radial stacking conveyor (CV102) and onto an asphalt bulk sulphur storage pad.

Initially, a front end loader will transfer stockpiled sulphur to a surge bin equipped with a dust suppression package. The dust treated product will be deposited on a load out conveyor (CV103) equipped with weight measurements and totalizer and onto rail or trucks for shipment. An automated loading system may be introduced as part of future expansion to transfer formed sulphur into vertical holding bins used to directly load rail cars.

5.6.5 Product Storage

Liquid sulphur storage will occur at two locations within the Site and process, as follows:

- initial sulphur load-out and transfer tank
- liquid sulphur storage tanks

Liquid sulphur will be stored in 3,000 t, insulated and clad, steel tanks that are designed to comply with the requirements of EUB Directive 55 (EUB 2007, Internet site) and API 650 modified (API 1998). The initial development will include three 3,000 t tanks.

Formed sulphur will be stored on a double-lined asphalt bulk sulphur storage pad. The storage pad specified as part of this application is designed to store up to 45,000 t of formed pastilles. The sulphur pastille storage area has the following environmental protection measures incorporated into its design:

- run-on and runoff controls
- 150 mm thick asphalt surface for primary containment and working
- 300 mm clay liner for secondary containment
- prepared sub-grade

Sulphur pad design details are provided in the Figure 6.

5.6.6 Sulphur Handling

Sulphur handling procedures are described in Volume 1: Project Description – Section 3.2: Process Description. Additional products that will require storage include dust suppression agents, as described in Volume I: Project Description – Section 3.6: Air Emissions Management and lime, which may be required to neutralize acidic surface water runoff. Volumes of these compounds will be small relative to the volume of liquid and formed sulphur that may be stored on site. Up to 50 t of each product could be stored on-site at any given point in time. Products will be stored in containers provided by the respective suppliers and all storage areas will comply with AENV requirements for storage of potentially hazardous materials. Handling of these materials will also be in accordance with manufacturers' recommendations and any requirements of the applicable Material Safety Data Sheets (MSDS).

5.6.7 Industrial Wastewater, Air and Waste Treatment Facilities

The Project will recycle cooling water used in the Rotoform HS® process. Surface water management plans are described in Volume I: Project Description – Section 3.5.2: Surface Water Management.

Emission control systems are described in Volume IIA, Section 2: Climate and Air Quality. Briefly, H_2S vented from liquid sulphur tanks and transfer points will be absorbed using the SULFATREAT® process. The Rotoform HS® process minimizes emissions and dust suppression agents will be applied to the sulphur pastilles.

Chemical waste is expected to be minimal as the Project is designed to be a 'zero-discharge' facility. Any chemical waste generated will be disposed off site as described in Volume I: Project Description – Section 3.7.2: Waste Management.

5.7 **Provide a list of unit products resulting from the processing or activity operations, specifying the production unit, typical and maximum design capacities. Include a material balance flow sheet (block diagram) for the entire plant operation.**

The Project will produce sulphur pastilles. Figure 8 illustrates the process flow of the facility. As the Rotoform HS® process does not include chemical reactions, only the phase change of sulphur, a mass balance flow sheet has not been submitted.

5.8 **For Industrial Wastewater Discharges and Air Emission Streams Identify**

(a) the release substance volume(s) generated per unit time

(b) concentration of substance(s) and physical or biological characteristics of substance(s)

(c) discharge rate per unit time as well as per unit of production

(d) whether the discharge or emission is continuous or intermittent and the frequency (if intermittent)

5.8.1 Industrial Wastewater

The sulphur forming and shipping operations will not generate wastewater that requires release to the environment. If necessary, excess water contained in the surface water runoff collection pond that is not utilized in the cooling process will be neutralized and monitored prior to being released to the surrounding watershed.

5.8.2 Air

Potential air emissions include H_2S vented from liquid sulphur and SO_2, produced as a result of H_2S oxidation. Elemental sulphur dust will be the only potential acidifying emission. Please refer to Volume IIA, Section 2: Climate and Air Quality for more detailed information.

5.9 **Identify any component streams which contribute to those streams identified in 5.8 above.**

Air emissions will be associated with vents at liquid sulphur tanks and transfer points, the boiler stack and Rotoform stacks. Please refer to Volume IIA, Section 2: Climate and Air Quality for more detailed information.

5.10 **Describe any cooling system to be used. Include flow rates, intake and discharge temperatures, blowdown rate and dissipation rate in receiving water (kilojoules/hour).**

The water utilized by the Rotoform HS® process will be sent through a closed loop cooling tower which will provide filtration and temperature reduction. Make up water for the cooling tower will be supplied from a surface water runoff collection pond which is designed to collect and treat surface water from the Site and will also serve as the source of fire protection water (Figure 7). Additional make-up water will be provided by a groundwater supply well or from a municipal water supply.

(a) Identify any additives (i.e., corrosion inhibitors, biocides), the frequency of application.

The only chemicals that will be added to the process are those used for dust suppression as well as lime that may be used, if and as required, for acid water neutralization. All chemicals will be stored in accordance with provincial standards for containment of potentially hazardous materials which will include double containment and leak detection.

Dust suppression on the sulphur pastille storage pad, transfer points and rail load-out area will use a proprietary dust suppression agent and release aid, as well as water from the surface runoff collection pond or groundwater. Dust suppression agents will be applied at the load-out hopper at the rail load-out. The agents will be stored in make-up tanks and delivered via pump.

Dust suppression agents currently selected for the Project include a proprietary dust suppression agent, Dustbind S5 and a proprietary sulphur release aid, IPAC SRB Plus. The Dustbind S5 and IPAC SRB Plus usage rates are estimated to be less than 100 kg/d (respectively) during initial operations, increasing to less than 200 kg/d for full-scale operations. The actual amounts used will depend on the size of the trains being loaded and the conveyor size. Dustbind S5 will be applied at the transfer points and IPAC SRB Plus will be applied at each individual Rotoformer.

(b) Calculate additive concentration in the final discharge effluent stream.

Not applicable.

5.11 **Describe all raw water treatment processes, chemicals used, amounts and quality of wastes to be disposed and the frequency of disposal**

The cooling water will not be treated prior to use. The water contained within the double-lined surface water runoff collection pond will be used as cooling water within the sulphur forming process. Excess water will be neutralized with lime and monitored prior to being released to the surrounding watershed, as necessary.

5.12 **For sanitary wastes, describe the facilities treatment system (if any) and disposal method**

(a) number of people on the system

Not applicable.

(b) volume discharged per unit time

Sanitary waste generated at the site will be collected into a septic tank and hauled off site for disposal.

(c) whether or not approval was required or obtained from the Plumbing Inspections Branch of Alberta Labour; and

Not applicable.

(d) final disposal of sludge (if any) and location

Not applicable.

5.13 **Describe major environmental control operations including size and location of any ponds, pond contents, pond liners, landfills or other waste management facilities (i.e. sludge ponds), air or water pollution control or treatment facilities, discharge details, engineering drawings for these structures (e.g. industrial runoff control, deepwell disposal). (See ATTACHMENT C). As-built plans and liner details for ponds, landfills, and other waste management facilities will also be required.**

Environmental control operations are documented in Volume I: Project Description – Section 3.8: Environmental Management Systems and Contingency Plans and are briefly described below. See also Attachment C.

5.13.1 Surface Water

All surface water that comes in contact with the sulphur handling and pastille storage areas will be collected and stored in a surface water runoff collection pond (Figure 7). This pond will be double-lined and equipped with leak detection monitoring to ensure that potentially acidic

water is not released to the surrounding ground or surface watershed. The water contained within the double-lined pond will be used as cooling water within the sulphur forming process. Excess water will be neutralized and monitored prior to being released to the surrounding watershed, as necessary. Design details for the surface water runoff collection pond and ditching details are illustrated in Figure 7.

Design features are described in Volume I: Project Description – Section 3.5.2: Surface Water Management and are included to mitigate the risk of contaminating surface and groundwater as a result of operating the proposed facilities.

Freshwater consumption will be minimized by utilizing surface water in the process and by recycling water used in the cooling process. The water diversions will be limited to the area of sulphur handling and will be temporary. All plans are consistent with standard design and operating practices for sulphur forming facilities.

Monitoring of surface water quality will be implemented to preclude accidental release of acidic water from the surface water runoff collection pond. Discharge limits for specific contaminants (if and when suspected) will be determined in accordance with the Water Quality Based Effluent Limits Procedures Manual (AEP 1995, as amended).

5.13.2 Air

$PM_{2.5}$ and PM_{10} are the only air emissions expected to be of sufficient quantity to be reportable under National Pollutant Release Inventory (NPRI) requirements.

Project emissions with respect to criteria air pollutants (CO, H_2S, NO_2, $PM_{2.5}$, SO_2), acid deposition and O_3 creation were predicted for the application and cumulative effects cases in Volume IIA, Section 2: Climate and Air Quality. No exceedances of air quality objectives or standards were predicted.

Technologies for the reduction or minimization of ozone precursors are not applicable to the Project given the very low levels of NO_x and SO_x that are anticipated. Air quality monitoring that is incorporated into the development plan is summarized below.

The proposed air monitoring program consists of three primary components, as follows:

- H_2S and SO_2 monitoring in the work area as a health and safety precaution for workers
- Compliance Source Emissions Testing on Rotoform emissions
- ambient air monitoring once per year to evaluate potential fugitive emissions of elemental sulphur

The monitoring program for hydrogen sulphide and sulphur dioxide includes:

- personal monitors on all personnel working in the sulphur forming and processing areas
- continuous monitors in the vicinity of the liquid sulphur storage tanks, sulphur reception area and inside of the forming building

The H_2S monitors will be set to alarm at a measured concentration exceeding 8 ppm. The SO_2 monitors will be set to alarm at a measured concentration of 4 ppm. Personal monitors will alarm at a level audible to the individual; whereas, continuous monitors will alarm at the monitoring location and within the control room.

Annual ambient air and compliance source monitoring programs will be designed and implemented as a condition of the EPEA operating approval to be issued by AENV.

5.13.3 Soil Monitoring

The emission and subsequent deposition of fugitive sulphur dust may present a risk to soil quality in and around the development area associated with the facility. Soil monitoring around the facility will be completed a minimum of once every three years, allowing identification and characterization of any impacts to surrounding surface soils. Soil monitoring will be completed in accordance with the requirements of the Soil Monitoring Directive (AENV 2000), as well as a soil monitoring proposal which will be submitted to AENV for formal approval.

Soil monitoring will also be implemented in any one of the following instances:

- if there are any spills or accidental releases from the sulphur forming and shipping activities
- if there is significant impact to groundwater quality as determined by the groundwater monitoring program (see Section 5.13.4)
- when portions of the Project development area are decommissioned and reclaimed
- at the time the facilities are decommissioned, in order to identify any potential adverse effects from the facility operations

Analytes for soil monitoring will include elemental sulphur, calcium carbonate equivalency, total sulphur and soluble main ions.

5.13.4 Groundwater Monitoring

Groundwater monitoring wells completed in the uppermost groundwater bearing formations, around the perimeter of the sulphur forming and storage facilities will be monitored twice annually to evaluate potential impacts to groundwater quality. Piezometer nests have been installed at selected locations to evaluate the vertical groundwater flow direction and monitor potential impacts to deeper water-bearing formations. Groundwater samples will be collected using standard methodologies, preservation, containment and transport techniques. The analytical schedule for ongoing monitoring of the sulphur facility is expected to include the following parameters:

- temperature, pH and electrical conductivity
- routine potability parameters (alkalinity, bicarbonate, calcium, carbonate, chloride, conductivity, hardness, hydroxide, ion balance, iron, magnesium, manganese, pH, potassium, sodium, total dissolved solids (TDS) and sulphate)

The leak detection systems for the surface water runoff collection pond and the pastille storage pad, as well as, the wetlands on the Site will be sampled and analyzed for the same parameters and at the same time as the groundwater monitoring wells.

Monitoring for the effects of groundwater withdrawal will be completed twice per year, at the same time as quality monitoring.

5.13.5 Leak Detection Monitoring

Leak detection monitoring will be implemented for the surface water runoff collection pond and asphalt stockpile pad to assess potential leakage relative to an action leakage rate (ALR), which is defined as the leakage expected to occur through a synthetic impermeable liner having 2 holes of 2 mm diameter over every 1 ha of area.

The potential for leakage will be determined by considering relative water levels in the leak detection and primary containment systems, water chemistry and potential flow into the leak detection layer. Leak detection monitoring will be implemented monthly until the integrity of the primary liners is confirmed, after which the monitoring frequency will be reduced to twice yearly.

5.14 Details on underground and aboveground tanks

See Attachment D-A4.

Underground Tanks

The initial sulphur load-out and transfer tank will consist of an underground concrete tank surrounded by a permeable leak detection system and a secondary compacted clay soil liner. The tank will be fitted with steam-coils to maintain the sulphur in its liquid state, and will be vented to atmosphere through an H_2S removal system. The concrete walls of the tank provide primary containment, and the secondary clay soil liner will provide secondary containment. Because any liquid sulphur that may potentially permeate the concrete will quickly solidify, the primary containment system is self-annealing. The vent stack will be situated above the breathing zone to protect workers from any potential H_2S vapours that may accumulate in the tank.

Aboveground Tanks

Liquid sulphur will be stored in sulphur feed tanks that are 1,667 m^3 (3,000 t) in volume, insulated and clad, steel tanks designed to comply with the requirements of EUB Directive 55 (EUB 2007, Internet site) and API 650 modified (API 1998). The initial development will include three 3,000 t tanks. The location of the tanks is shown on Figure 5.

Two molten sulphur tanks located near the boiler stacks will store filtered and temperature regulated sulphur prior to entering the Rotoform building.

5.15 **For underground storage tanks, please specify:**

(a) Measures incorporated to prevent overfilling of tanks (e.g. Automatic shut-off devices, high level dams).

To prevent overfilling of underground storage tanks the following measures will be implemented:

- Direct inspection of off loading operations
- Ultrasonic level indicators
- Warning alarms at filling location
- Sealed Camlock connections
- Filling over sealed contained surfaces.

(b) Summarize results of integrity testing and inspections.

Not applicable.

5.16 **Describe the source and amount of potable water, how it will be used and any water treatment system used (i.e., chlorination, filtration, softening, etc.). Refer to Potable Water Regulation 122/93 with amendments up to and including Alberta Regulation 214/96.**

Potable water will be brought in from an outside source. Water will be treated prior to delivery to the Project.

5.17 **Provide details on any reciprocating or turbine engines.**

There will be no reciprocating or turbine engines used at the facility. This section is not applicable.

5.18 **Provide a copy of the plot plan showing any stack and exhaust stack locations and distance between each stack**

Figure 5 illustrates the location of the boiler stacks and the Rotoform exhaust stacks. The initial construction consists of one boiler stack and two Rotoform exhaust stacks.

5.19 **Provide the peak height of the compressor building in metres.**

There will be no compressor buildings located at the facility. This section is not applicable.

5.20 **Provide details on all natural gas fired heaters (including space heaters), treaters and boilers (a table may be used to list all the information).**

Table 4: Boiler and Rotoform Information

Parameter		Boiler (150 HP)	Rotoform
Power rated (kW)		112.0	
Stack height (m)		16.76	18.30
Stack diameter (m)		0.406	0.390
Exit temperature (°C)		228.0	36.0
Exit velocity (m/s)		7.5	16.7
Actual exhaust volume flow rate (m^3/h)		3,523.0	7,170.0
Exhaust mass flow rate (kg/s)		0.69	2.10
Emission rates (g/s)	CO	0.123	-
	H_2S	-	0.012
	NO_x	0.101	-
	$PM_{2.5}$	0.011	0.105
	SO_2	0.001	-

5.21 **Provide details on any auxiliary or standby process equipment or other sources of emissions to air, soils or water.**

Not applicable.

5.22 **Provide details on flare stacks.**

There will be no flare stacks at the facility, therefore, this section is not applicable to this application.

5.23 **Provide the following details on any active flare pit on-site**

There will be no flare pits at the facility, therefore, this section is not applicable to this application.

5.24 **Details on any inactive or former flare pits on-site.**

This section is not applicable to this application.

5.25 **Describe emergency flaring scenarios: provide rates and composition of flared streams (i.e., inlet stream, acid gas before sulphur recovery unit, acid gas after sulphur recovery unit, etc.) and to provide a dispersion modeling run to show the maximum ground level concentration.**

The facility will not use flaring, therefore, this section is not applicable to this application.

5.26 **Describe any on-site incineration of solid waste and any approvals received for the disposal practice.**

All wastes will be shipped off site, therefore, this section is not applicable to this application.

5.27 **Determine the maximum ground level concentration of SO_2, NO_2, or any air contaminant that is significant. Provide a computer output for NO_2 and SO_2 dispersion**

modelling. Background ambient concentrations must be taken into account, as well as nearby sources up to 5 km.

Air monitoring data indicate that the impacts of regional emissions with respect to criteria air contaminants such as H_2S, NO_2 and SO_2 will be small. Maximum observed ground-level concentrations are predicted to be much less than the ambient air quality objectives. The final estimated ground-level concentrations of criteria pollutants for the Project area as based on observational data and plume dispersion calculations are presented in the following table.

Table 5: Maximum Ground-level Concentrations of Criteria Pollutants Predicted for the Study Area (Baseline Case)

Species	Averaging Period	Ambient Background Concentration (µg m^{-3})	Maximum Predicted Ground-level Concentration (µg m^{-3})	Total Ground-level Concentration, Including Background (µg m^{-3})	AAAQO (µg m^{-3})
CO	One-hour	5,800	19.5	5,820	15,000
	8-hour	3,300	16.9	3,317	6,000
H_2S	One-hour	8.0	-	8.0	14
	24-hour	2.3	-	2.3	4
NO_2	One-hour	102	23.2	125.2	400
	24-hour	42	14.4	56.4	200
	Annual	4	1.1	5.1	60
$PM_{2.5}$	24-hour	20.5[1]	1.5[1]	22.0[1]	30[2]
SO_2	One-hour	120	–	120	450
	24-hour	28	–	28	150
	Annual	3	–	3	30

Notes:
[1] 98th percentile value.
[2] The CWS applies to representative regional locations and not to maximum predicted impacts.
– Not associated with emissions from Canexus Sodium Chlorate Plant.
AAAQO = Alberta's Ambient Air Quality Objectives.

Emissions associated with trucks, locomotive, trackmobile, storage tanks and front end loader comprise area sources. Four trucks will be simultaneously unloading liquid sulphur with motors running about 10% of the time. The trackmobile, locomotive and front end loaders were assumed to act as area sources because they will be in motion over defined spaces. Emissions due to resuspension of dust from the asphalt pavement transversed by the front end loader will occur within the area of loading activity.

Volume IIA, Section 2: Climate and Air Quality – Table 2.5-2 presents emission parameters associated with area sources. Emissions from the trucks, locomotives, trackmobile and front end loader were based on exhaust specifications. Sulphur content for the diesel fuel consumed by the locomotive engine was assumed to be 500 ppm while that consumed by trucks and front end loader was assumed to be only 15 ppm. Emissions from the asphalt pavement were obtained from estimation methods recommended by the United States Environmental Protection Agency (USEPA 2006, Internet site) with the assumption that the silt covering the asphalt would be similar to that found in areas of sand and gravel operations. This is a conservative assumption because it does not allow for AST's commitment to sweep the area on a daily basis.

6. Renewal Applications

Not applicable.

7. Applications for Activity Change or an Amendment

Not applicable.

(d) Where the application requires an approval from the Alberta Energy and Utilities Board or the Natural Resources Conservation Board in relation to the activity, the date of the written decision in respect of the application.

8. New/Renewal/Change

Provide:

8.1 **Date of Alberta Energy and Utilities Board (EUB) Approval (if applicable).**

An approval is not required from the EUB, but is required from the Natural Resources Conservation Board (NRCB). Application for approval from the NRCB will be made simultaneously with this application.

8.2 **EUB Approval Number (if applicable).**

Not applicable.

8.3 **Comments on any environmental related terms and conditions of the approval.**

Application under separate cover has also been made to the NRCB with respect to this Application for Approval.

(e) An indication of whether an environmental impact assessment (EIA) report has been required.

9. Environmental Impact Assessment

9.1 **Was an EIA required?**

Construction and operation of a sulphur processing facility is not listed as a 'mandatory' or 'exempt' activity according to the Environmental Assessment (mandatory and exempt activities) Regulation. A public consultation process was initiated in 2005 as part of an initial Application. Based on Stakeholder concerns raised during this process, AST was directed to complete an EIA to support this Application, which is submitted under separate cover.

9.2 **If required, the date of submission of the EIA report to Alberta Environment accepted by the Director.**

Not applicable.

(f) Copies of existing approvals that were issued to the applicant in respect of the activity under this Act or a predecessor of this Act.

10. Existing Approvals

10.1 **Attach copies of applicable existing approvals (e.g., if this is a renewal application, please attach a copy of the previous approval that is due to expire, including any amendments).**

This is a new application and there have not been any previous approvals or registrations issued for the proposed Project. The lands in question are currently used for agricultural purposes and are zoned for heavy industrial use. An application for a Development Permit will be submitted to the County of Lamont in conjunction with this Provincial application. An Application for Approval to Divert Groundwater and Surface Water under the jurisdiction of the *Water Act* (AENV 1999a) is provided as Appendix 1.

(g) The proposed or actual dates for construction commencement, construction completion and commencement of operation.

11. New Plants

11.1 **Provide dates for the above.**

The proposed facilities will be developed in stages to accommodate the rate of sulphur production generated by existing and proposed oil sands development programs as well as market conditions. The initial stage will include the development of all project components with sufficient capacity to process approximately 3,000 t/d sulphur. The anticipated timing for the initial stage of development is summarized in the underlying table and is dependent on the pace and outcome of the regulatory process. Only the initial development is being applied for at this time.

Table 6: Initial Development Timing

Task	Anticipated Timeframe
Project disclosure	2005
EIA scoping	Early 2006
EIA implementation	2006
Application submission	Mid 2007
Detailed design	Late 2007
Construction	Early 2008
First operations	Mid 2008
Project lifespan	25 years

The receipt, forming, temporary storage and shipping of formed sulphur will occur continuously over the lifespan of the facility (estimated to be 25 years). Operations of the Project are contingent on the continuance of oil sands upgrading operations and the viability of international markets for the sulphur produced in Alberta.

Failure to meet the proposed project timeline, or to approve the Project in general, will result in the blocking of incremental volumes of sulphur produced by oil sands upgrading facilities, either in new locations or at existing facilities. For example, sulphur being produced by

Syncrude is currently being stored in above ground blocks and Suncor is considering this option for sulphur generated by its Voyageur upgrader. Sulphur forming facilities are currently not available to the independent upgraders that are scheduled to come online in the Fort Saskatchewan area over the next few years.

Future expansion of the sulphur processing facilities may occur, subject to market conditions. The maximum potential rate of sulphur processing is 6,000 t/d as is reflected by the EIA.

12. Renewal Applications

12.1 **Provide actual date for original commencement of operation, if known.**

Not applicable.

13. Applications for Activity Change or an Amendment

Not applicable.

(h) A list of substances, the sources of the substances and the amount of each substance that will be released into the environment as a result of the activity, the change to the activity or the amendment, addition or deletion, as the case may be, the method by which the substances will be released and the steps taken to reduce the amount of the substances released.

14. New Plants

14.1 **Provide a list and quantity of substances used in the production process in terms of a typical operating day.**

Substances used in the production process include:

- sulphur
- dust suppression agents
- lime
- water

14.1.1 Sulphur

AST has chosen to utilize a third generation drop forming sulphur solidification technology from Sandvik Process Systems named Rotoform HS®. Each unit has a minimum guaranteed capacity of 12.0 t/h. Initial construction will include 11 units, providing an initial forming capacity of approximately 3,000 t/d.

14.1.2 Dust Suppression

Dust suppression agents currently selected for the Project include a proprietary dust suppression agent, Dustbind S5 and a proprietary sulphur release aid, IPAC SRB Plus. The Dustbind S5 and IPAC SRB Plus usage rates are estimated to be less than 100 kg per day (respectively) during initial operations. The actual amounts used will depend on the size of the trains being loaded and the conveyor size. Dustbind S5 will be applied at the transfer points and IPAC SRB Plus will be applied at each individual Rotoformer.

14.1.3 Lime

Lime may be used, if and as required, in the surface runoff collection pond for acid water neutralization.

14.1.4 Water

Water utilized by the Rotoform HS® process will be sent through a closed loop cooling tower which will provide filtration and temperature reduction. Makeup water for the cooling tower will be supplied from the runoff collection pond, which is designed to collect and treat surface water from the Site and also serve as the source of fire protection water (Figure 7).

14.2 **Describe the water or air demands in terms of the sources, purpose (specific operation) and quantities.**

A water supply source is required for sulphur cooling. Groundwater will be used whenever there is insufficient water available from the surface runoff collection pond (Figure 7). The total water supply requirements for the initial development are estimated to be 12,000 m^3 per year.

14.3 **Describe the sources of the substances to be released to the environment.**

Based on the facility design and operation, AST is striving to be a “zero discharge” facility with respect to facility operations and wastes. This design includes the containment of potentially impacted run-off water and re-use of this water as cooling water in the sulphur forming process.

The Project is designed to minimize wastes and by-products. All dust that is collected in the process will be recycled and placed back in the sulphur feed tanks to be formed. During operations, there may potentially be some waste or contaminated sulphur (sulphur that does not meet saleable product specifications) collected as part of equipment maintenance and on-going operations. Any waste sulphur that is collected will be stored on the pastille storage pad until sufficient volumes are present to allow for efficient disposal. Disposal will occur at an approved Class II waste disposal facility and will be managed and neutralized in accordance with that facility’s operational requirements.

Neutralization sludge may also be generated by the surface water neutralization facility. This sludge will be solidified and stockpiled pursuant to disposal at an approved Class II waste disposal facility. Appropriate testing of representative samples of the sludge will be completed to verify that these materials are solid and non-hazardous in accordance with provincial regulations. Removal of accumulated sediments from the pond is expected to occur very infrequently given the pond’s size and the controls that will be put in place to minimize potential acidification of runoff water.

The volumes of industrial wastes, as described above, are anticipated to be below 10 t/y for each waste stream. Each waste stream would be classified as non-hazardous in accordance with the Waste Control Regulation of the EPEA.

Emissions associated with trucks, locomotives, trackmobiles, storage tanks and front end loaders comprise area sources. Four trucks will be simultaneously unloading liquid sulphur with motors running about 10% of the time. The trackmobile, locomotive and front end loaders were assumed to act as area sources because they will be in motion over defined spaces. Emissions due to resuspension of dust from the asphalt pavement transversed by the front end loader will occur within the area of loading activity.

14.4 **Describe the amount of the substance to be released to the environment.**

Industrial waste generated by the Project will be collected and disposed of at an approved Class II waste disposal facility. Discharge limits for specific contaminants (if and when suspected) will be determined in accordance with the Water Quality Based Effluent Limits Procedures Manual (AEP 1995, as amended).

Volume IIA, Section 2: Climate and Air Quality – Table 2.5-2 presents emission parameters associated with area sources. Emissions from the trucks, locomotives, trackmobile and front end loader were based on exhaust specifications. Sulphur content for the diesel fuel consumed by the locomotive engine was assumed to be 500 ppm while that consumed by trucks and front end loader was assumed to be only 15 ppm. Emissions from the asphalt pavement were obtained from estimation methods recommended by the United States Environmental Protection Agency (USEPA 2006) with the assumption that the silt covering the asphalt would be similar to that found in areas of sand and gravel operations. This is a conservative assumption because it does not allow for AST's commitment to sweep the area on a daily basis.

Expected Rotoform and boiler stack emission rates are listed in Table 5, Section 5.20 of this Application. Two Rotoform stacks and one boiler stack will be in operation when the Project is initially constructed.

14.5 **Describe the methods of release.**

Air emissions will be released to the atmosphere via the boiler and Rotoform stacks, which range in height from 16.76–18.30 m, respectively. Exhaust emissions from the trucks, locomotives, trackmobile and front end loader will be released relatively close to ground level.

Surface water will be released from the surface runoff collection pond in accordance with approval requirements on an as-needed basis.

14.6 **Describe the minimization controls implemented.**

14.6.1 Water Emissions

All surface water that comes in contact with the sulphur handling and pastille storage areas will be collected and stored in a surface water runoff collection pond (Figure 7). Water contained within the pond will be used in the sulphur cooling process in order to minimize surface water release to the surrounding watershed.

14.6.2 Air Emissions Management

Dust suppression on the sulphur pastille storage pad, transfer points and rail load-out area will be achieved with the use of a proprietary dust suppression agent and release aid, as well as water. Dust suppression agents will be applied at the load-out hopper at the rail load-out. The dust suppression agents will be stored in make-up tanks and delivered via pump. The actual amounts used will depend on the size of the trains being loaded and the conveyor size. Dustbind S5 will be applied at the transfer points and IPAC SRB Plus will be applied at each individual Rotoformer.

Hydrogen sulphide vented from liquid sulphur and transfer points will be adsorbed using the SULPHATREAT® process.

Project emissions with respect to criteria air pollutants (CO, H_2S, NO_2, $PM_{2.5}$, SO_2), acid deposition and O_3 creation were predicted for the application and cumulative effects cases in

Volume IIA, Section 2: Climate and Air Quality. No exceedances of air quality objectives or standards were predicted.

Technologies for the reduction or minimization of ozone precursors are not applicable to the Project given the very low levels of NO_x and SO_x that are anticipated. Air quality monitoring that is incorporated into the development plan is summarized in Section 5.13 of this Application.

14.7 **For all plants, the industrial runoff volume for the plant developed area shall be determined. Refer to ATTACHMENT B for the determination of industrial runoff drainage system design.**

See Attachment B.

15. For Renewal Applications

Not applicable.

16. For Applications for Activity Change or an Amendment

Not applicable.

(i) A summary of the environmental monitoring information gathered during the previous approval period.

17. New Plants

17.1 **Provide any baseline environmental data that has been collected at the site (for air, water, soils, etc.).**

Baseline environmental data collected for the Site is presented and explained in detail in Volume IIA, IIB and IIC of the EIA.

17.2 **Provide any baseline hydrogeologic characteristics and groundwater monitoring data (information requirements outlined in Attachment G).**

Baseline hydrogeologic characteristics and groundwater monitoring data are explained in detail in Volume IIB, Section 2: Groundwater Quantity and Quality of the EIA.

18. Renewal Applications

Not applicable.

19. Applications for Activity Change or an Amendment

Not applicable.

(j) A summary of the performance of substance release control systems used for the activity during the previous approval period.

20. New Plants

Not applicable.

21. Renewal Applications

Not applicable.

22. Applications for Activity Change or an Amendment

Not applicable.

(k) The justification for the release of substances into the environment as a result of the activity, the change to the activity or the amendment, addition or deletion, as the case may be.

23. New Plants

23.1 **Describe the application of the process technology, management practices and current environmental control systems towards minimizing the release of substances to the environment using pollution prevention approaches and pollution control technologies by:**

(a) evaluating and identifying alternate process and technologies;

The need for adaptive planning is somewhat limited in the case of the proposed Project because the facilities are intended to process only one material (degassed, liquid elemental sulphur) and only one output (solid elemental sulphur pastilles). Further, the forming technology that has been selected represents a modern, environmentally responsible and proven technology that is readily available to AST. Modifications may be implemented in one of the following circumstances:

- if improved forming technology becomes available
- if and when the forming process is expanded
- when improved dust control and emission control technologies become available

Critical evaluations of emerging technologies will be completed whenever these technologies are developed. A similar review will be completed if the processing facilities are expanded, as part of the amending application to allow expansion of the forming facilities. Finally, a review of dust management and mitigation measures will be completed at a minimum of every three years, in conjunction with the soil monitoring program. This review will be based on the results of both the soil monitoring and air monitoring programs.

(b) input (raw materials, feedstocks, fuel, etc) substitution;

Liquid sulphur is the only feedstock for this process therefore, this section is not applicable to the Project.

(c) applying industry guidelines and standards;

See Volume I: Project Description – Section 2.4: Regulatory and Planning Framework

See Volume I: Project Description – Section 3.8.3: Health and Safety Plans

(d) referencing similar typical environmental approvals (either locally or in other jurisdictions);

There are no stand-alone sulphur forming facilities in the province, hence, it is not possible to directly compare emissions intensity. Because the proposed facilities are modern and include state-of-the-art technology, the emissions intensity is expected to be low relative to existing forming systems. This proposed Project is most similar to Shell's Shantz facility.

(e) considering potential environmental impacts;

The following contingency measures consider potential environmental impacts for each of the following circumstances:

- surface water quality exceedances
  - treatment of impacted water to comply with release criteria
  - utilization of impacted water in the water cooling system
  - off-site disposal at an approved facility
- groundwater quality issues
  - modify operating practices to address potential release
  - detailed review of containment systems for sulphur
  - additional soil and/or groundwater quality monitoring
  - implementation of groundwater remediation measures
- soil quality issues
  - lime or calcium carbonate treatment of impacted soils
  - excavation and disposal of impacted soils
  - additional soil monitoring
- air quality issues – elemental sulphur
  - modify forming operations and controls to reduce sulphur emissions
  - modify sulphur handling operations and dust controls to reduce fugitive sulphur emissions
  - modify or reduce forming operations to reduce sulphur emissions
- air quality issues – H_2S or SO_2
  - stop operations until the source of hydrogen sulphide is identified
  - evaluate sulphur sources and suppliers for potential hydrogen sulphide exceedances
  - evaluate liquid sulphur in storage to identify hydrogen sulphide exceedances
- leak detection monitoring
  - inspect and repair primary containment systems
  - automated extraction of water from the leak detection layer(s)

- repair or re-design containment systems

(f) considering unique situations due to plant location, size or capacity; and

See Volume IIA, Section 4: Public Health and Safety

See Volume 1: Project Description – Appendix V, Preliminary Emergency Response Plan

(g) application of ambient guidelines or standards.

Alberta Ambient Air Quality Objectives (AENV 2006, Internet Site)

23.2 **What alternatives to releasing substances to the environment have been considered/evaluated, e.g., by-product synergy.**

The following alternatives to releasing substances to the environment have been considered and implemented in the design of the Project:

- Collection and use of surface water
- Collection and recycling of spilled sulphur and sulphur dust
- Treatment of tank vent gases to minimize H_2S emissions

24. Renewal Applications

Not Applicable.

25. Applications for Activity Change or an Amendment

Not applicable.

(l) The measures that will be implemented to minimize the amount of waste produced, including a list of the wastes that will or may be produced, the quantities and the method of final disposition.

26. New Plants

26.1 **Complete ATTACHMENT A.**

See Attachment A.

26.2 **Describe any waste minimization measures to be implemented.**

Based on the Project design and operation, AST is striving to be a “zero discharge” facility with respect to facility operations and potentially impacted run-off water. This design includes the containment of potentially impacted run-off water and re-use of this water as cooling water in the sulphur forming process.

The Project is designed to minimize wastes and by-products. All dust that is collected in the process will be recycled and placed back in the sulphur feed tanks to be formed. During operations, there may potentially be some waste or contaminated sulphur (sulphur that does not meet saleable product specifications) collected as part of equipment maintenance and on-going operations. Any waste sulphur that is collected will be stored on the pastille storage

pad until sufficient volumes are present to allow for efficient disposal. Disposal will occur at an approved Class II waste disposal facility and will be managed and neutralized in accordance with that facility's operational requirements.

Neutralization sludge may also be generated by the surface water neutralization facility. This sludge will be solidified and stockpiled pursuant to disposal at an approved Class II waste disposal facility. Appropriate testing of representative samples of the sludge will be completed to verify that these materials are solid and non-hazardous in accordance with provincial regulations. Removal of accumulated sediments from the pond is expected to occur very infrequently given the pond's size and the controls that will be put in place to minimize the potential for acidification of run-off water.

The volumes of industrial wastes, as described above, are anticipated to be below 10 t/y for each waste stream. Each waste stream would be classified as non-hazardous in accordance with the Waste Control Regulation of the EPEA.

All domestic garbage will be disposed at an authorized municipal solid waste landfill. To minimize domestic wastes generated at the site, a recycling program will be employed at the facility to collect and recycle plastics, cardboard and beverage containers.

26.3 **Describe any liquid effluent/process wastewater or air emissions treatment facilities (see ATTACHMENT C).**

27. Renewal Applications

Not applicable.

28. Applications for Activity Change or an Amendment

Not applicable.

(m) Any impact, including surface disturbance, that may or will result from the activity, the change to the activity or the amendment, addition or deletion, as the case may be.

29. New Plants

29.1 **Limit discussion to the extent and nature of the surface disturbance that will result from the activity. Include both temporary and permanent disturbances. Other impacts should be identified in the other relevant areas of this application form such as section (k).**

The development of the Project will initially result in the temporary surface disturbance of up to approximately 20.09 ha of lands in total. The area of sulphur forming is estimated to be approximately 6 ha. Initial development of the facility will require the stripping and conservation of soils in the development area, for ultimate reuse in the reclamation program once the Project is decommissioned. Once the facility is closed and reclaimed, the area will be reclaimed as agricultural lands. Hence, the impact of the facility is temporary.

Some increase in truck and rail traffic can be expected on the side roads leading to the facility. While this traffic increase will be noticeable, it will not affect the ability for others to use the roadways and will not adversely affect the safety of those roadways. Truck traffic on Highways 15 and 45 that is associated with the Project will be low relative to the capacity and existing traffic levels on these major highways.

A detailed account of the anticipated impacts and mitigating measures is included in the EIA report.

30. Renewal Applications

Not applicable.

31. Applications for Activity Change or an Amendment

Not applicable.

(n) Confirmation that any emergency response plans that are required to be filed with the local authority of the municipality in which the activity is or is to be carried on or with Alberta Public Safety Services have been so filed.

32. Emergency Response Plans

Provide emergency response plans related to the disaster plans prepared in accordance with the requirements of the EUB and Municipal Affairs (MA).

32.1 **Provide the following information:**

(a) statement of confirmation that the plans had been filed;

(b) date of initial preparation and subsequent amendments to or replacements of the plan; and,

(c) agencies to which the plan has been submitted (e.g., Municipalities, EUB, MA).

Scenarios for emergency response are described in a Preliminary Emergency Response Plan which is included in Volume 1: Project Description – Appendix V. A copy of emergency contact numbers will be kept clearly visible in the office trailer. Local authorities (ambulance, police, fire fighting and paramedics) will be kept appraised of the facility operations and emergency response procedures that are in place.

From a precautionary labelling point of view, hazards for health, fire and contact are considered slight (1 on a rating scale of 0–4 where 0 is no hazard and 4 is an extreme hazard, based on the Workplace Hazardous Materials Information System, WHMIS).

(o) Confirmation that there are contingency plans in place to deal with any unexpected sudden or gradual releases of substances to the environment.

33. Contingency Plans

33.1 **Provide environmental contingency plans to deal with abnormal occurrences which have the potential of adversely affecting the environment. These occurrences need not be environmental emergencies resulting in adverse impacts or even result in contravention of approval limits; but could be occurrences which may result in variations to environmental expectations described in the application.**

General contingency planning is incorporated into the Operations Plan for the proposed Sulphur Forming and Shipping Facility that is included in Volume I: Project Description. Contingency measures will be implemented if Project emissions are occurring to the extent that soil, groundwater or surface water quality is being adversely affected. Because the nature of the potential emissions is not known, it is not practical to specify the precise nature

of the response plan at this time. Rather, generalized response steps would be implemented as described in the Operations Plan and as summarized in Volume I: Project Description – Section 3.8.1: Contingency Plans.

The dual containment and leak detection systems associated with sulphur storage will minimize the potential for leakage to the surrounding environment by providing low permeability barriers. Potential for leakage will also be reduced by minimizing the accumulation of fluid pressure head through regular removal of the collected runoff water. The lower clay liner provides contingency protection against failure of the upper synthetic liner.

Beneath the sulphur forming and shipping facilities, the low rates of groundwater flow and the naturally low hydraulic conductivity of the soils provide further protection against potential impacts associated with the Site. The Site also possesses naturally high alkalinity, which will tend to buffer any acidic emissions associated with the release of elemental sulphur to the environment. The surface water and groundwater monitoring network and monitoring program will allow detection of any facility-related releases to the surface and/or shallow groundwater.

(p) The conservation and reclamation plan for the activity.

34. New Plants

34.1 **Provide pre-construction site and soil assessments to evaluate and document soil, landscape and vegetation conditions, including pre-development land and soil inventories, as well as current land use. Identify any environmental risks or constraints for conservation and reclamation of the project, including constraints due to landscape or soil conditions.**

Pre-construction soil, terrain and vegetation characterization of the Project area has been conducted and is detailed in Volume IIC, Section 2: Soil and Volume IIC, Section 3: Vegetation. These sections include reclamation suitability classification of soil materials in the PDA, as well as baseline soil physical and chemical data and vegetation classifications.

34.2 **Using the pre-site assessments, develop and discuss the procedures that will be used to return the site to equivalent land capability (this may involve returning the site to conditions and land uses that are similar to the pre-development setting or, in some instances, to alternate land use(s) that are different than before). Present the procedures in the form of a Conservation and Reclamation Plan that addresses:**

A detailed conservation and reclamation plan can be found in Volume IID, Section 2: Land Use and Reclamation – Appendix I.

(a) facility planning

- **site dimension requirements (including discussion of minimizing surface disturbance)**
- **facility layout (buildings, infrastructure, etc.)**
- **grading requirements**
- **potential impact of the project on landscape aesthetics and plans to minimize such impacts**

See Volume I: Project Description – Section 2.3: Project Components and Development Timing.

(b) land conservation planning (focusing on soil salvage and materials handling)

- ***location and separation of topsoil, subsoil and spoil stockpiles***

Soil stockpiles will be placed in areas that are level and provide stable foundations for long-term soil storage. They will be placed at least 30 m from water bodies and at least 250 m from any portion of the Project which may be a source of acidifying emissions. Separate stockpiles will be constructed for topsoil originating from solonetzic soils and chernozemic soils as well as for subsoil. Each soil stockpile will have setbacks to ensure that admixing of materials does not occur. The approximate area in which the stockpiles will be constructed is shown in Figure 10. The final locations of stockpiles may change, however, they will meet the guidelines outlined above and accurate stockpile locations and soil types will be recorded on as-built drawings.

In general, the soil stockpiles will be constructed with side slopes not exceeding a 3:1 ratio of length to height and with an average height of 2 m.

- ***topsoil quality, depth and suitability for reclamation***

Please refer to the EIA, Volume IIC, Section 2: Soil.

- ***areas where topsoil is to be salvaged along with general total volumes***

Please refer to the EIA, Volume IID, Section 2: Land Use and Reclamation – Appendix I.

- ***volumes of topsoil to be used for current uses such as landscaping or for future use in final site reclamation***

Topsoil will be stockpiled until reclamation commences. It is anticipated that all stockpiled soil will be used when reclaiming the Project area.

- ***subsoil and spoil volumes and suitability for reclamation (if excavations are required for below grade structures)***

The majority of subsoils in the Project area are classified as “unsuitable” for reclamation. Therefore, stripping of subsoil should be avoided as much as possible and should be limited only to areas where excavation is required. There are several locations which may require subsoil stripping including the surface water runoff collection pond (Figure 4). The area of the proposed surface water runoff pond is approximately 7,800 m^2 or 0.78 ha (Figure 4). Soils salvaged from these areas will require separate stockpiling and handling from topsoil. Subsoil exposed by topsoil stripping will be protected from erosion. Excessive subsoil compaction will need to be prevented by limiting traffic to established roadways.

- ***procedures and equipment to remove soil materials***

To ensure proper topsoil salvage, a qualified soil inspector (i.e., a soil scientist) will be present during salvage of all topsoil, to provide support to construction personnel and to document that the appropriate salvage procedures have been followed.

- ***problem soil handling (if problem soils are identified)***
- ***protocols for suspending and recommencing topsoil salvage when field conditions will result in the mixing, loss, degradation or compaction of topsoil***

Care will be taken to avoid overstripping and admixing of topsoil and subsoil materials. However, should field conditions result in the mixing, loss, degradation or compaction of topsoil (i.e., high winds, heavy rains, etc.); salvage activities will be suspended until conditions improve.

- ***spill control and clean-up procedures, including measures to prevent, remove or treat areas of contamination to meet established guidelines***

Soil contamination may occur during the construction and operational phases of the Project. All phases of the Project will operate with spill control and waste management procedures in place. These procedures are discussed in Volume I: Project Description. In the case of accidental releases of sulphur, the sulphur will be collected and either recycled or legally disposed off site.

(c) land reclamation planning (at a conceptual level in initial applications for new plants)

- ***end land use objectives for the reclaimed site and how equivalent land capability will be returned***

The objective of surface reclamation at the Site will be to achieve equivalent land capability to the pre-disturbance condition. Details of how equivalent land capability will be obtained are described below.

- ***removal of infrastructure***

At the end of the Project life (approximately 25 years), infrastructure, including buildings, foundations, paved areas, rail lines and roads will be removed from the Site. Concrete and pavement will be broken up and disposed of at approved facilities and graveled areas will be assessed for contaminants and separated into uncontaminated and chemically contaminated fractions. Uncontaminated gravel may be re-used locally.

- ***contouring and restoration of drainage***

The subsoil at the Site will be re-contoured to achieve a final grade similar to pre-disturbance conditions. It should be noted that pre-Project contours at the Site are largely a product of previous reclamation activities undertaken some time after 1981 across the Site. Surface contours should, as much as possible, allow for integration into the surrounding terrain and establish interconnectivity with surrounding landscapes and established drainage patterns. Pre-disturbance drainage patterns are described in Volume IIB, Section 3: Surface Water Quantity and topographic mapping of the area indicates that pre-disturbance slopes in the Project area are generally less than 10% (see Figure 4). These data may be used as a guideline to establish a final grade during reclamation. The Project area will be reclaimed by grading and re-vegetating to restore natural drainage patterns as soon as practical following decommissioning. All culverts will be removed to facilitate restoration of natural drainage patterns and runoff conditions.

- ***erosion control***

Measures for controlling soil erosion of stockpiles and disturbed areas of the Site may include, but are not limited to the following:

- avoiding construction during summer months (June–August) when storm activity is high
- spraying dry soil surfaces with water or tackifying agents to reduce potential for wind erosion loss
- installing water erosion control matting or geotextile fabrics
- applying crop residue matting such as straw or mulch

These measures are intended to temporarily limit erosion losses or are to be applied to vulnerable soils or areas. The measures will be implemented by the Soil Inspector and the Construction Supervisor based on their experience.

Baseline soil data indicates that approximately 0.4 ha of the soil in the Site is rated as having a high risk for wind erosion (Peace Hills soil series). Handling of this soil will require additional caution and should not be conducted during high winds. The remaining surface soils in the Site are rated as having low wind erosion risk. All soils in the Site have low water erosion risk on low slopes.

Longer-term erosion control measures will include vegetation of soil stockpiles and any areas which can be reclaimed immediately following construction. The soil stockpiles will be seeded with a mix that is salt and drought tolerant and contains short growth habit species to minimize requirements for watering and mowing but maximize erosion prevention. The pre-disturbance land use of the Project area is agricultural; therefore, it is recommended that the Drylands pasture mix blended by Pickseed be used on the soil stockpiles. The seed mix will be analyzed for weed content prior to seeding and the certificate of seed analysis will be kept on record at the facility and a copy will be provided to the Lamont County Agricultural Service Board.

- ***soil replacement***

Any residual compaction of the subsoil will be relieved by ripping and, if necessary, by adding calcium amendments. Since subsoils at the Site are mainly classified “unsuitable” for reclamation due to sodic conditions, relieving compaction in these subsoils will likely require multiple amendment, ripping and cultivation treatments, as well as a detailed evaluation by a qualified soil scientist prior to placement of topsoil and final grading.

Topsoil will be replaced to appropriate depths to achieve final elevation grades at the Site. Topsoil replacement will take place during appropriate times of the year when soil temperatures and moisture conditions allow for even topsoil placement and potential erosion losses of place topsoil are limited.

Soil quality will be assessed and if necessary, liming treatments will be applied to ensure the pH of the soil is suitable for plant growth and within acceptable limits. As noted above, lime and other calcium amendments are useful, not only in reversing depressed pH levels, but in alleviating soil sodicity issues. It is expected that naturally sodic subsoils will benefit from lime application and that this will result in improved reclamation suitability of these materials.

- ***revegetation and land management, including species list, seed source and quality, seeding rates and methods; fertilization rates and methods; and wildlife habitat plans where applicable***

Re-vegetation plans will be developed in consultation with the appropriate regulatory bodies and with reference to future land uses. It is predicted that the Site will return to agriculture land use. The applicable reclamation criteria will be applied to ensure the revegetation strategy meets the criteria and that a reclamation certificate will be issued. A forage mix or annual crop species will most likely be seeded, which will result in the establishment of a cover crop and prevent weed infestations. Weed management practices will continue throughout the revegetation phase until a reclamation certificate is issued.

35. Renewal Applications

Not applicable.

36. Applications for Activity Change or an Amendment

Not applicable.

(q) A description of the public consultation undertaken or proposed by the applicant.

37. New Plants

37.1 **Describe any proposed or conducted public involvement process.**

AST is committed to the implementation of an effective public consultation program both to support this Application and the EIA process and to complement ongoing operations of the facility. The fundamental objectives of the public consultation program are as follows:

- to engage area residents and stakeholders to identify those that may be affected by the proposed Project
- to communicate clearly and directly the Project and each of its significant components
- to develop an appreciation of the concerns of the area residents and stakeholders, to address those concerns within the context of this Application and supporting EIA and to communicate back to the concerned stakeholders the results of the EIA as they are relevant to their individual concerns
- to communicate the results of the public consultation program to the relevant regulators so that these concerns and mitigating strategies can be accounted for in the regulatory review process
- to establish a consultative approach that allows concerned stakeholders to provide meaningful input into the application process as well as the construction and operation of the facility if and when it is approved

37.2 **Briefly describe the target audiences, frequency, type and purpose for the public involvement and any environmental concerns identified in the review and how those concerns were addressed.**

Wherever possible, AST seeks to resolve stakeholder issues directly with those raising concerns. AST is committed to resolving issues wherever it is practical and possible to do so and is committed to preventing disagreements that are based on misunderstanding or the lack of appropriate information.

The Public Consultation program was initiated as part of a stand-alone application and has been continued to support the Environmental Assessment and NRCB application process. The principle elements of the public consultation program are as follows:

- regular scheduling of open house forums to describe the project, the application status and to obtain feedback from area residents and stakeholders
- direct meetings with individuals and groups that express concerns or require additional information regarding the Project
- feedback sessions with concerned stakeholders discussing how their concerns are being addressed in the application and assessment process

- posting of all application information on the HAZCO website, as this information comes available; distribution of information circulars at key times in the application process
- maintenance of a local office that is available to area residents during normal working hours

Documentation of the public consultation program is provided in Volume I: Project Description – Section 2.6.1.6: Public Consultation and Volume IID, Section 5: Public Consultation.

38. Renewal Applications

Not applicable.

39. Applications for Activity Change or an Amendment

Not applicable.

(r) Information required under any other regulation under the Act to be submitted as part of or in support of the application.

40. Information Requirements

40.1 **For example, describe the potable water supply for the plant. Indicate whether it requires approval under the Potable Water Regulation 122/93 with amendments up to and including Alberta Regulation 214/96.**

This section is not applicable as potable water will be brought in from an outside source. Potable water will be treated to comply with Potable Water Regulation 122/93 with amendments up to and including Alberta Regulation 214/96 prior to delivery to the Site.

(s) Any other information required by the Director, including information that is addressed in a standard or guideline in respect of the activity that is published or adopted by the Department.

3(2) The Director may waive any of the requirements of subsection (1)(a) to (q) if the Director is satisfied that a requirement is not relevant to a particular application or that it is appropriate for other reasons to waive the requirement.

41. Waiver of Requirements

41.1 **Although some of the information requirements outlined in section 3(1)(a) to (s) of the Act may be waived, the applicant should confirm with Alberta Environment that the information is needed.**

4(1) The Director shall not review an application for the purpose of making a decision until it is a complete application.

(2) Where the application is not complete, the Director shall notify the applicant in writing and request the information necessary to make the application complete.

(3) Where the information is not supplied by the applicant within a reasonable time, the Director may reject the application and shall forthwith advise the applicant in writing of that fact.

Authorization

This application is submitted in accordance with the *Environmental Protection and Enhancement Act*. This application has been reviewed and deemed complete by INEOS.

(Date)

(Signature)

(Title of Applicant)

Glossary of Terms and Abbreviations

Acronym	Definition
$(NH_4)_2SO_4$	ammonium sulphate
35-55-20-W4M	Section 35, Township 55, Range 20, West of the 4th Meridian (the Site)
A	symbol for hole area from the action leakage rate formula
A	cross-sectional area available for flow
A1	Agricultural Use Area 1
A2	Agricultural Use Area 2
AAAQO	Alberta Ambient Air Quality Objectives
AADT	average annual daily traffic
AAF	Alberta Agriculture and Food
AAFRD	Alberta Agriculture Food and Rural Development
abiotic	not biological; not involving or produced by organisms
ACD	Alberta Community Development
acid	molecule that is able to give up a proton (H^+) to, or accept electrons from, a base; gives a solution with a pH of less than 7
acidification	reduction of the pH of soil, waterways and lakes
adaptive planning	flexibility built into design and layout to accommodate future modifications required by changed standards, limits and guidelines
AENV	Alberta Environment
aerobic bacteria	bacteria that require oxygen to survive and grow
AET	areal evapotranspiration
AFSC	Agricultural Financial Services Corporation
AIH	Alberta Industrial Heartland: a large industrial centre in central Alberta including Edmonton, Fort Saskatchewan, Strathcona County, Sturgeon County and Lamont County
AII	industrial total
ALF	available labour force
ALR	action leakage rate – leakage expected to occur through a synthetic impermeable liner having 2 holes of 2 mm in diameter every 1-ha of area
alumina catalyst	medium used to regenerate and recycle amines used to adsorb hydrogen sulphide gas
amine units	process units used to remove hydrogen sulphide from a gaseous process stream using amine compounds
anaerobic bacteria	bacteria that do not require oxygen to survive and grow
ANC	acid-neutralizing capacity
ANHIC	Alberta Natural Heritage Information Centre
ANPC	Alberta Native Plant Council
AO	aesthetic objectives
APA	Agricultural Policy Area
API	American Petroleum Institute
aquatics	aquatic resource conditions, including fish and benthic invertebrate habitat capability and their characteristics in waterbodies
aquifer	an underground porous geological formation that stores or carries water
ARET	accelerated reduction/elimination of toxics
ASIC	Alberta Soil Information Centre
ASL	ambient sound level
ASP	Alberta's Industrial Heartland Area Structure Plan/Lamont County

Acronym	Definition
asphalt bulk sulphur storage pad	storage pad used to stockpile formed sulphur pastilles in preparation for shipment
ASRD	Alberta Sustainable Resource Development
ASRL	Alberta Sulphur Research Ltd.
AST	Alberta Sulphur Terminals Ltd.
ASWQ	Alberta Surface Water Quality
AVI	Alberta Vegetation Inventory
AWI	Alberta Wetland Inventory
BC MWLAP	British Columbia Ministry of Environment, Lands and Parks
bioavailability	the degree to which toxic substances or other pollutants present in the environment are available to potentially biodegradative microorganisms
bitumen upgrader	term used for a refining facility that converts bitumen (heavy oil) into a lighter grade synthetic oil that can be further refined to make useable products such as gasoline and diesel
BSL	basic sound level
BTEX	benzene, toluene, ethylbenzene and xylenes
buffer	a solution or liquid with a chemical constitution allowing it to neutralize acids or bases without a great change in pH
^{o}C	degrees Celsius
CA	annual crop total
Ca^{2+}	calcium ion
$CaCO_3$	calcium carbonate
CALPUFF	California Puff Model
camlock	fitting used to quick-connect pipes and hoses
CanSIS	Canadian Soil Information System
capital spending	expenditures by a company for plant and equipment
carbonate alkalinity	carbonate alkalinity is a measure of the amount of negative carbonate and bicarbonate ions in solution
CASA	Clean Air Strategic Alliance
CCME	Canadian Council of Ministers of the Environment
CCS	CCS Income Trust
CCS	Canadian Crude Separators
CDWQG	Canadian Drinking Water Quality Guidelines
CEA	cumulative effects assessment
CEPA	Canadian Environmental Protection Act
CGCM3	Coupled Global Climate Model 3
Class II waste disposal facility	landfill facility that is designed and permitted to dispose of non-hazardous solid wastes in the Province of Alberta
clay soil liner	low permeability containment layer constructed using compacted clay soil
CLU	contemporary land use
cm	centimetre
cm y^{-1}	centimetres per year
CN	Canadian National Railway
CNR	Command Notification System
CO	carbon monoxide
CO_2	carbon dioxide
CO_3^{2-}	carbonate ion

Acronym	Definition
COD	chemical oxygen demand – used to indirectly measure the amount of organic compounds in water
collection hopper	receptacle that collects formed sulphur pastilles and directs those pastilles onto a conveyor belt
Compliance Source Emissions Testing	testing implemented on sources of air emissions, such as combustion stacks, to verify that those emissions comply with regulated standards
conditioning unit	unit in the sulphur forming process that regulates the rate and temperature of the liquid sulphur that is fed into the process
COPC	chemicals of potential concern
COSEWIC	Committee on the Status of Endangered Wildlife
CP	perennial crop total
CPNVI	Central Parkland Native Vegetation Inventory
CPR	Canadian Pacific Railway
CPR1	cardiopulmonary resuscitation
CPR2	uncultivated pasture total
CPUE	catch per unit effort
CR	concentration ratio
CSA	Canada Standards Association
CSL	comprehensive sound level
CWQ	Canadian Water Quality
CWS	Canada-wide Standards
dBA	A-weighted decibel
dBC	C-weighted sound levels
degassed sulphur	sulphur that contains less than 10 ppm by weight of hydrogen sulphide
DFO	Department of Fisheries and Oceans
DO	dissolved oxygen
DOC	dissolved organic carbon
double containment system	containment system for storing potentially hazardous liquids that includes two independent containment layers
draw down tube	tube used to control (reduce) fluid levels in a containment vessel
duplex filter	filter designed to remove two types of impurities, such as particulate and organic matter
dust suppression package	process component that suppresses dust that may be emitted to atmosphere at a material transfer point
EC	electrical conductivity
EC20	concentration that affects 20% of text organisms
EC50	concentration that affects 50% of test organisms
EIA	Environmental Impact Assessment
elemental	a pure substance that cannot be broken down into different kinds of matter
emergency response	the action taken after an event to minimize the consequences of an emergency
EMS	environmental management system
EMS	Emergency Medical Services
EOC	Emergency Operations System
EPEA	*Environmental Protection and Enhancement Act*
ER	exposure ratio
ERP	Emergency Response Plan
ESA	Environmental Significant Areas

Acronym	Definition
EUB	Alberta Energy and Utilities Board
FAP	Fort Air Partnership
feed tank	tank at the beginning of the sulphur processing system that is used to control the rate of sulphur feed to the forming process
ferrous iron	iron with an oxidation number of +2
fish/trap-hour	fish catch rate; fish caught per hour
FMZ	Fur Management Zone
FOLC	The Friends of Lamont County for Responsible Industrial and Community Development
FONG	open, non-patterned graminoid dominated fen
formed sulphur	sulphur that has been formed into solid pastilles using the Rotoformer process
fugitive dust	dust that is not emitted from definable point sources
fugitive sulphur emissions	sulphur emissions that are not emitted from definable point sources
FWHIS	Fish and Wildlife Historical Information System
g	the gravitational constant (9.8 m/s^2)
g s^{-1}	grams per second
GHG	greenhouse gases
GIS	geographic information system
GJ/mon	gigajoules per month
gm/t	grams per tonne
groundwater	water beneath the earth's surface in underground streams and aquifers
gypsum	a soft white mineral composed of hydrous sulfate of lime
H	Hour
H&S	Health and safety
H^+	hydrogen ion; the symbol for a proton
H_2CO_3	carbonic acid
H_2O	Water
H_2S	hydrogen sulphide
H_2SO_4	hydrogen sulphate
ha	hectare
HADD	harmful alteration, disruption, or destruction of fish habitat
HAZCO	HAZCO Environmental Services
HCO_3	bicarbonate
HDPE	high density polyethylene
HEC	human equivalent condition
HHRA	Human Health Risk Assessment
HNO_3	nitric acid
HP	horsepower
HRIA	Historical Resources Impact Assessment
HRV	historical resources value
hw	the symbol for liquid depth from the action leakage rate formula
hydraulic conductivity	the extent to which a given substance allows water to flow through it
hydrogen plant feedstock	plant that is used to generated hydrogen gas, which is in turn used in the heavy oil upgrading and/or oil refining process
hydrogeological	pertaining to the geology of ground water with emphasis on its chemistry and movement
i	hydraulic gradient in the surficial deposits

Acronym	Definition
I/C	Industrial/Commercial District
ICS	Incident Command System
infrastructure	basic facilities, such as transportation, communications, power supplies and buildings, that enable an organization, project or community to function
interstitial water	subsurface water contained in pore spaces between grains of rock and sediment
IPCC	Intergovernmental Panel on Climate Change
ISQG	Interim Freshwater Sediment Quality Guidelines
ITE	Institute of Transportation Engineers
K	hydraulic conductivity
K	degrees Kelvin
K^+	potassium ion
keq H^+/(ha•y)	kiloequivalents of hydrogen ions per hectare per year
kg	kilogram
kg s^{-1}	kilograms per second
kg/d	kilograms per day
kg/ha/y	kilograms per hectare per year
kg/t	kilograms per tonne
km	kilometres
km/h^{-1}	kilometres per hour
km^2	square kilometre
kPa	kiloPascals
kraft pulp	pulp produced by a process where the active cooking agent is a mixture of sodium hydroxide and sodium sulphide
Kw	kilowatt
L/min	litres per minute
L/s	litres per second
LCC	Lamont County Council
Le Chatelier's Principal	used to predict the effect of changing the amount of reactants, products, temperature or system volume on the composition of a chemical system at equilibrium
leak detection layer	layer located between the primary and secondary containment layers that is used to monitor the integrity of the primary containment layer
LEK	local environmental knowledge
L_{eq}	energy equivalent sound level
Level I fire	minor fire that can be isolated or controlled and is not of a serious nature
Level II fire	fire that cannot be isolated or controlled, but can be managed by local fire and emergency response service
Level III fire	fire that cannot be isolated or controlled and cannot be managed by local fire and emergency response service
L_{max}	maximum sound level for a given time period
load out conveyor	conveyor used to transfer formed sulphur onto rail cars
LOAEL	lowest observed adverse effect level
LOS	level of service
LSA	Local Study Area
LST	local standard time
LUB	Land Use Bylaw
LZ	landing zone

Acronym	Definition
m	metre
m/m	metres per minute
m/s^{-1}	metres per second
m/y	metres per year
m^2	metres squared
m^2/day	metres squared per day
m^3	cubic metres
m^3 h^{-1}	cubic metres per hour
m^3/day	metres cubed per day
m^3/s	metres cubed per second
m^3/y	metres cubed per year
MAC	maximum acceptable concentrations
Man-hours	number of workers multiplied by hours worked
masl	metres above sea level
mbgs	metres below ground surface
MDBP	Municipal Development Plan Bylaw
meq	milliequivalents
meq/L	milliequivalents per litre
metallic sulfides	compounds formed by metal elements bonding to sulphides
metering pump assembly	process unit that measures flow volumes and rates through a pump
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
mg/m^3	milligrams per cubic metre
Mg^{2+}	magnesium ion
mitigation	any action taken to permanently eliminate or reduce the long-term risk to human life, property and function from hazards
mL	millilitre
mL/minute	millilitres per minute
mm	millimetre
mm day^{-1}	millimetres per day
mm/y	millimetres per year
MP	McElroy-Pooler dispersion coefficient
MPC	Municipal Planning Commission
MPOI	maximum points of infringement
MRL	minimal risk limit
MSDS	Material Safety Data Sheets
MVC	motor-vehicle collisions
MWH/mon	power flux per month
N	Nitrogen
n	number of individuals
n.d.	not defined
n/a	not applicable
Na^+	sodium ion
NAAQO	National Ambient Air Quality Objectives

Acronym	Definition
$NaHCO_3$	sodium bicarbonate
NCIA	Northeast Capital Industrial Association
Ne	effective porosity
neutralization sludge	sludge formed by the neutralization of sulphuric acid using either caustic soda or lime
NGO	non-governmental organizations
NH_4NO_3	ammonium nitrate
NIA	noise impact assessment
NO	nitric oxide
NO_2	nitrogen dioxide
NO_2^-	nitrite ion
NO_3^-	nitrate ion
NOAEL	no observed adverse effect level
NO_x	nitrogen oxides
NPRI	National Pollutants Release Inventory
NR CAER	Northeast Region Community Awareness and Emergency Response
NRC	Natural Regions Committee
NRCB	Natural Resources Conservation Board
NTU	nephelometric turbidity unit
O_2	oxygen
O_3	ozone
OEL	Occupational Exposure Limit
off-specification sulphur	sulphur that does not comply with shipping specifications either because of excessive mineral or organic content
OH^-	hydroxide ion
OM	organic matter
oxidation	the removal of electrons from an element or compound
ozone precursors	chemical compounds, such as carbon monoxide, methane, non-methane hydrocarbons and nitrogen oxides, which in the presence of solar radiation react with other chemical compounds to form ozone
PAH	polycyclic aromatic hydrocarbons
PAI	potential acid input
PDA	Principal Development Area
PEL	probable effect levels
PEMS	Prairie Emergency Medical Systems
PET	potential evapotranspiration
PFRA	Prairie Farm Rehabilitation Administration
PG	Pasquill-Gifford dispersion coefficient or atmospheric stability class
pH	measure of the acidity or basicity (alkalinity) of a material when dissolved in water
piezometer	instrument which measures hydraulic pressures
PM_{10}	particulate matter with mean aerodynamical diameter less than 10 µm
$PM_{2.5}$	particulate matter with mean aerodynamical diameter less than 2.5 µm
PPE	personal protective equipment
ppb	parts per billion
ppm	parts per million
precipitate	separate as a fine suspension of solid particles
protons	positively charged particles forming part of atomic nuclei

Acronym	Definition
psi	pounds per square inch
PSL	permissible sound level
pump hanger	device for vertically positioning a pump
PW	pumping well
Q	symbol for action leakage rate from the action leakage rate formula; groundwater contributions
QA	quality assurance
QC	quality control
R.R.	Range Road
radial stacking conveyor	conveyor that places formed sulphur in a radial pattern
rail transfer loop	rail line placed in an approximately circular pattern
RCMP	Royal Canadian Mounted Police
Rd	road
Receiving tank	tank used to receive liquid sulphur delivered by rail or truck
recirculation loop	water circulation loop that returns spent cooling water to the start of the cooling water circuit
reduction	addition of electrons to an element or compound
RELAD	Regional Lagrangian Acid Deposition
RfC	reference condition
RGDR	regional gas dosimetry ratio
Rotoform emissions	particulate sulphur emissions for the Rotoform process
ROW	right(s) of way
RSA	Regional Study Area
runoff control system	system of ditches and culverts used to collect runoff from the sulphur processing area to the stormwater collection pond
S	Sulphur
s^{-1}	per second
S_2O_3	thiosulfate
SABA	supplied air breathing apparatus
Sandvik Rotoform process	sulphur forming process developed and patented by Sandvik and referred to as the Rotoform process
SAR	sodium adsorption ratio
SAR	species at risk
SARA	*Species at Risk Act*
saturated	most concentrated solution possible at a given temperature
SCA	soil correlation area
SCBA	self-contained breathing apparatus
SEIA	Socio-Economic Impact Assessment
SIL	survey intensity level
Site	Section 35-55-20 W4M
S^o	symbol for elemental sulphur
SO_2	sulphur dioxide
SO_4^{2-}	sulphate ion
sour gas	hydrogen sulfide gas; H_2S
SO_x	sulphur oxides
specific gravity	the ratio of the density of a material to the density of water

Acronym	Definition
spontaneous combustion	self-ignition of combustible material through the chemical action of its parts
stakeholders	people or organizations with an interest or share in an undertaking, such as a commercial venture
sulphur acidification	lowering of pH in soils or water by sulphur dioxide
sulphur forming	process of converting liquid sulphur into solid sulphur particles
sulphur pastille	sulphur pastilles of uniform shape, stability and quality formed by the Sandvik Rotoform process
sulphur recovery	separation and recovery of sulphur from a hydrocarbon refining process
sulphur train	a train used to convey liquid or solid sulphur
sulphuric acid	a strong acid; H_2SO_4
surface water	water that flows in streams and rivers, natural lakes, in wetlands, and in reservoirs constructed by humans
surface water runoff collection pond	pond used to collect and contain surface runoff from the sulphur forming and handling area
surge bin	bin used to collect and store surges in solid sulphur pastilles
sweet fuel gas	methane that is used as fuel and does not contain hydrogen sulphide
t/d	tonnes per day
t/y	tonnes per year
TDS	total dissolved solids
THE	total exactable hydrocarbons
temperature conditioned	sulphur that is conditioned and controlled to be in a specific temperature range
TIA	traffic impact assessment
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
TOR	Terms of Reference
totalizer	metering device that totals the volume of liquid passed through that meter
TP	total phosphorus
TPH	total petroleum hydrocarbons
TRV	toxicological reference values
TSS	total suspended solids; the weight of particles suspended in water
Twp	Township
UF	urban fringe
USEPA	United States Environmental Protection Agency
USGPM	US gallons per minute
USLE	universal soil loss equation
UTM	universal transverse mercator
V	Velocity
visible sheen	collection of hydrocarbons that is visible on the surface of a waterbody
VOC	volatile organic compounds
W4M	West of the 4th Meridian
vpd	vehicles per day
WA	*Water Act*
WCB	Workers' Compensation Board
wetland	area regularly saturated by surface water or groundwater and characterized by a prevalence of vegetation adapted for life in saturated soil conditions (e.g., swamps, bogs, fens, marshes and estuaries)

Acronym	Definition
WHMIS	Workplace Hazardous Materials Information System – national chemical hazard communication system for regulation of information pertaining to hazardous materials
WMU	Wildlife Management Unit
WVC	wildlife-vehicle collisions
y	year
µeq/L	microequivalents per litre
µg m^{-3}	micrograms per cubic metre
µm	microns (micrometres)
µS/cm	Microsiemens per centimetre

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FIGURES

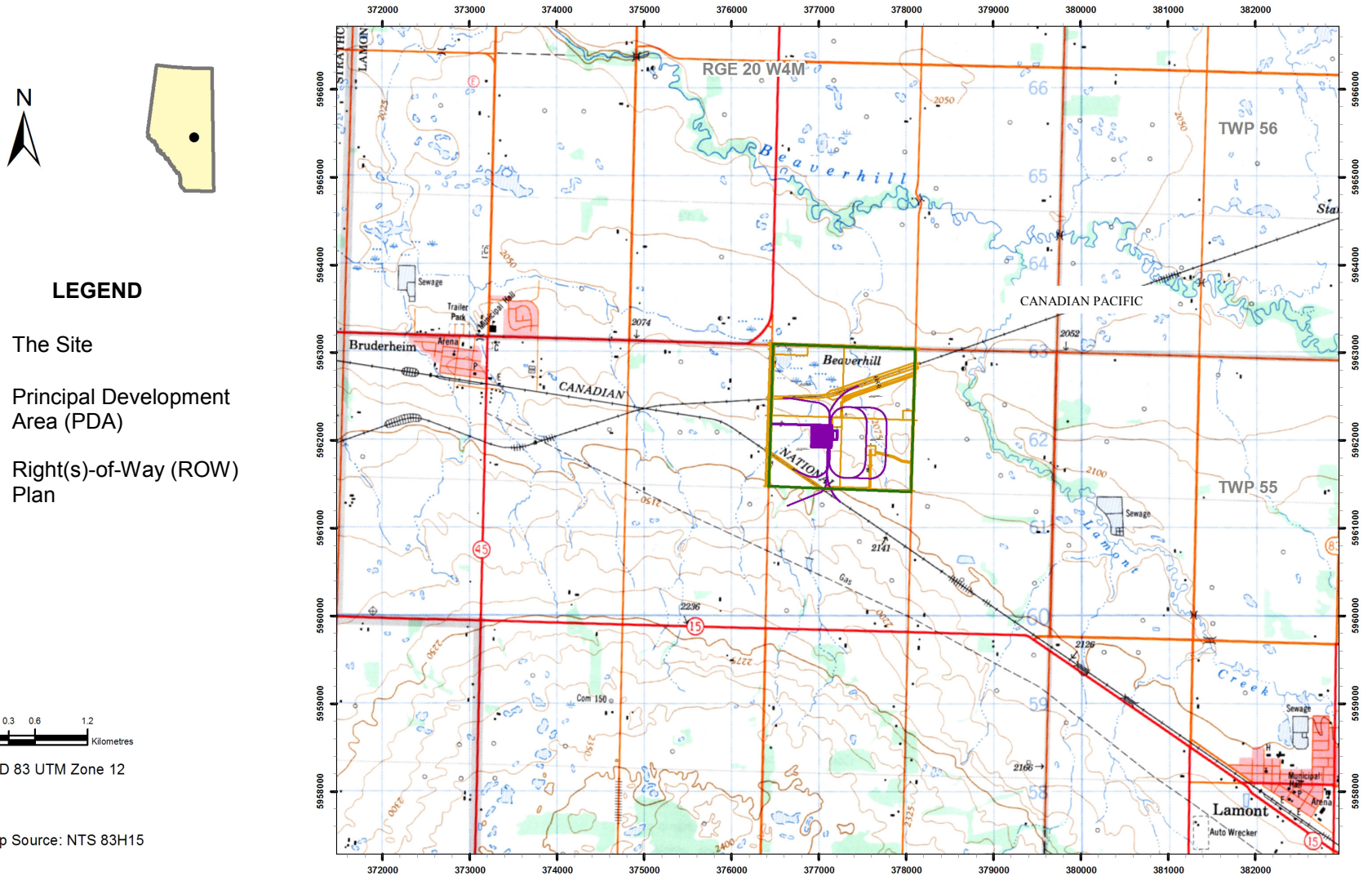


Figure 1: Site Plan for Section 35-55-20 W4M and PDA

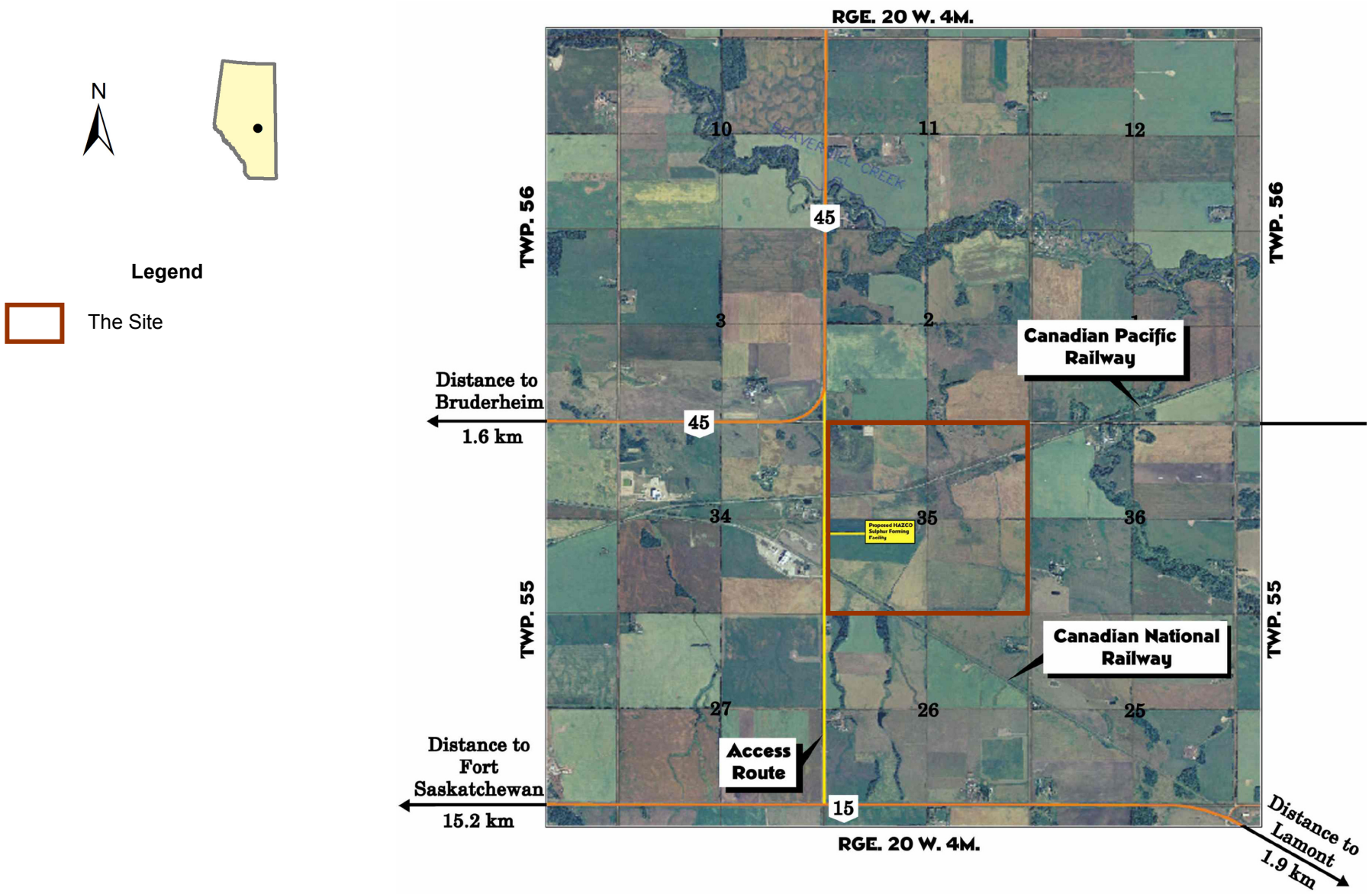


Figure 2: Aerial Photograph Depicting Site Location

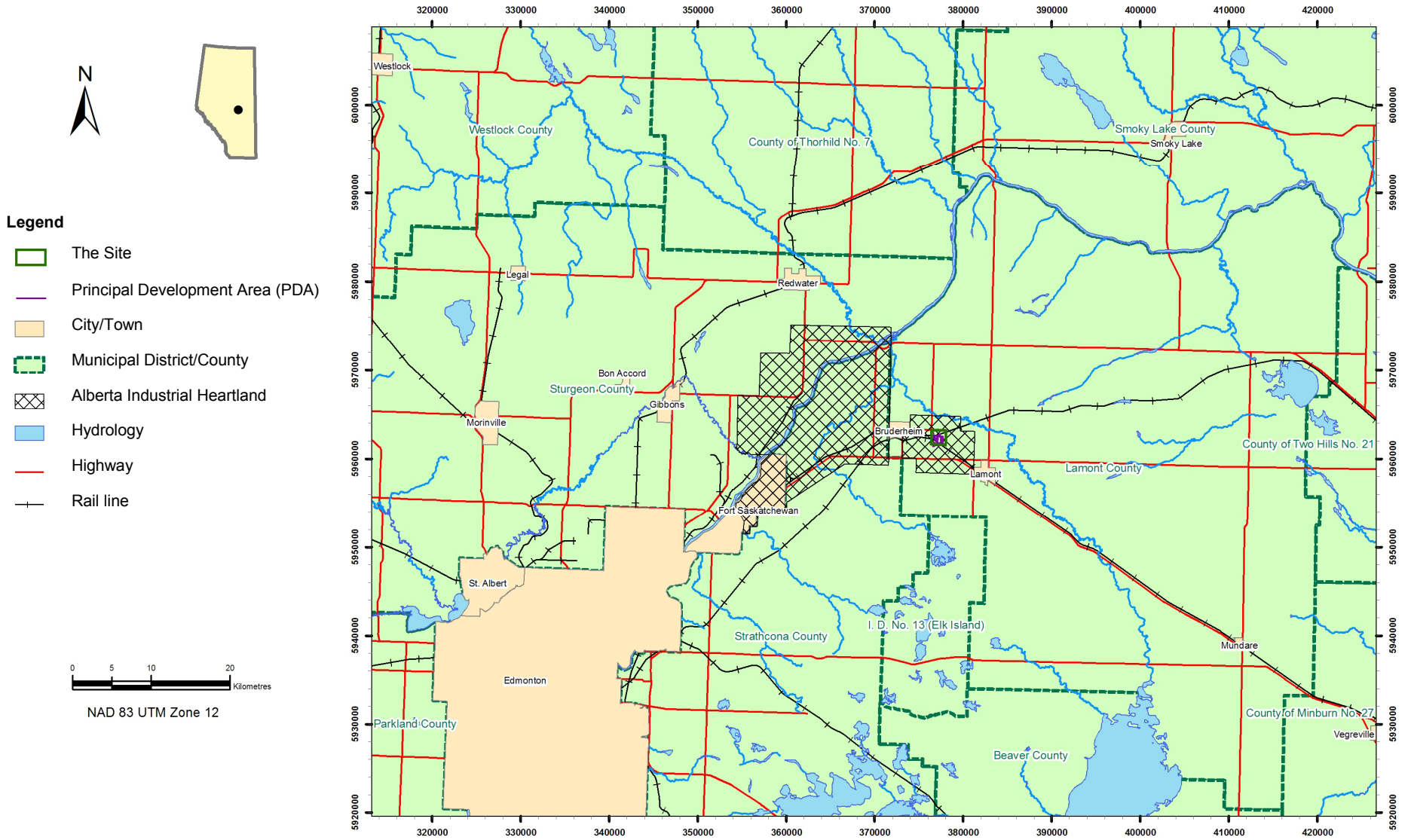


Figure 3: Section 35-55-20 W4M and Surrounding Land Use

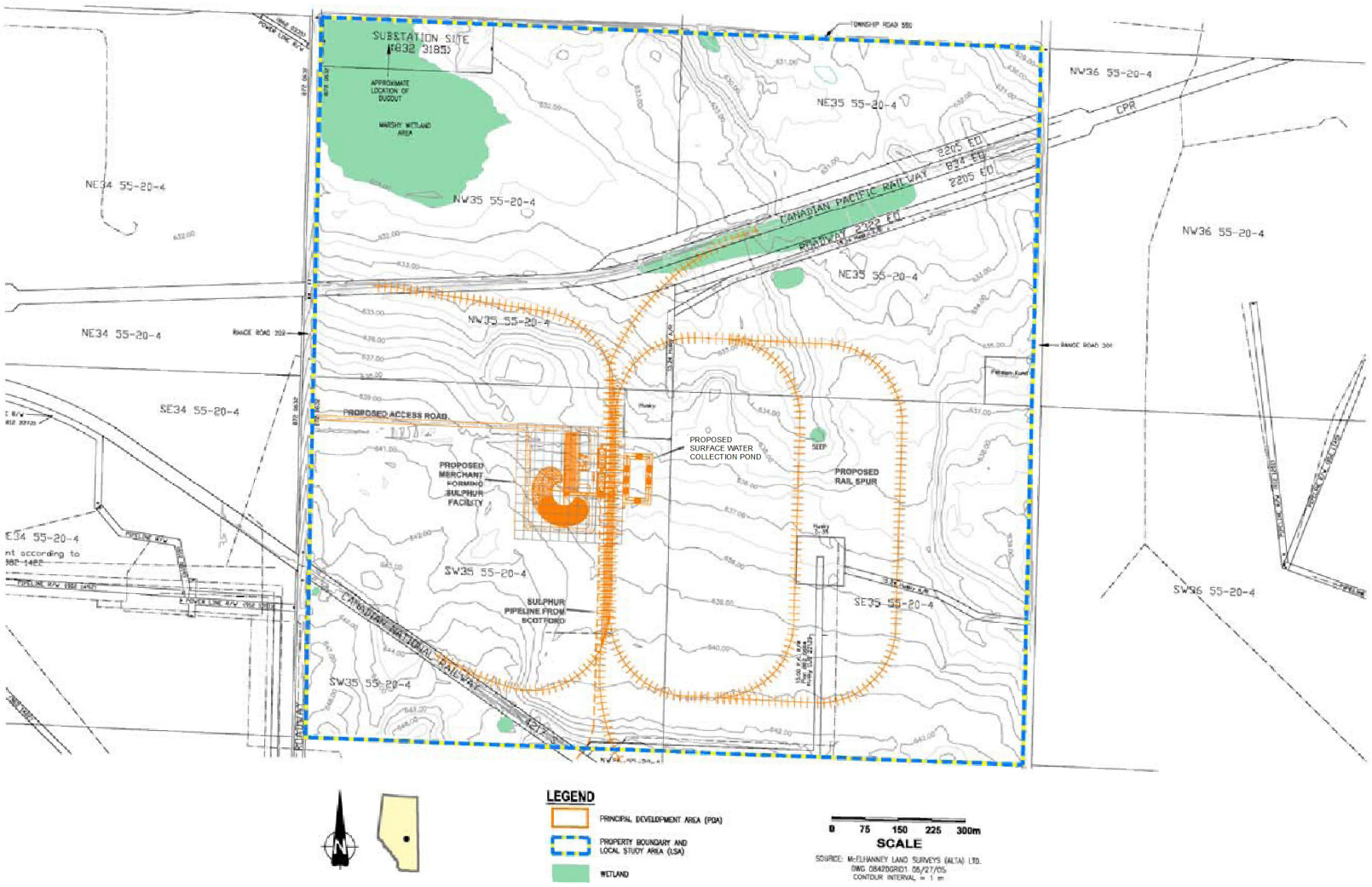


Figure 4: Principal Development Area of the Project

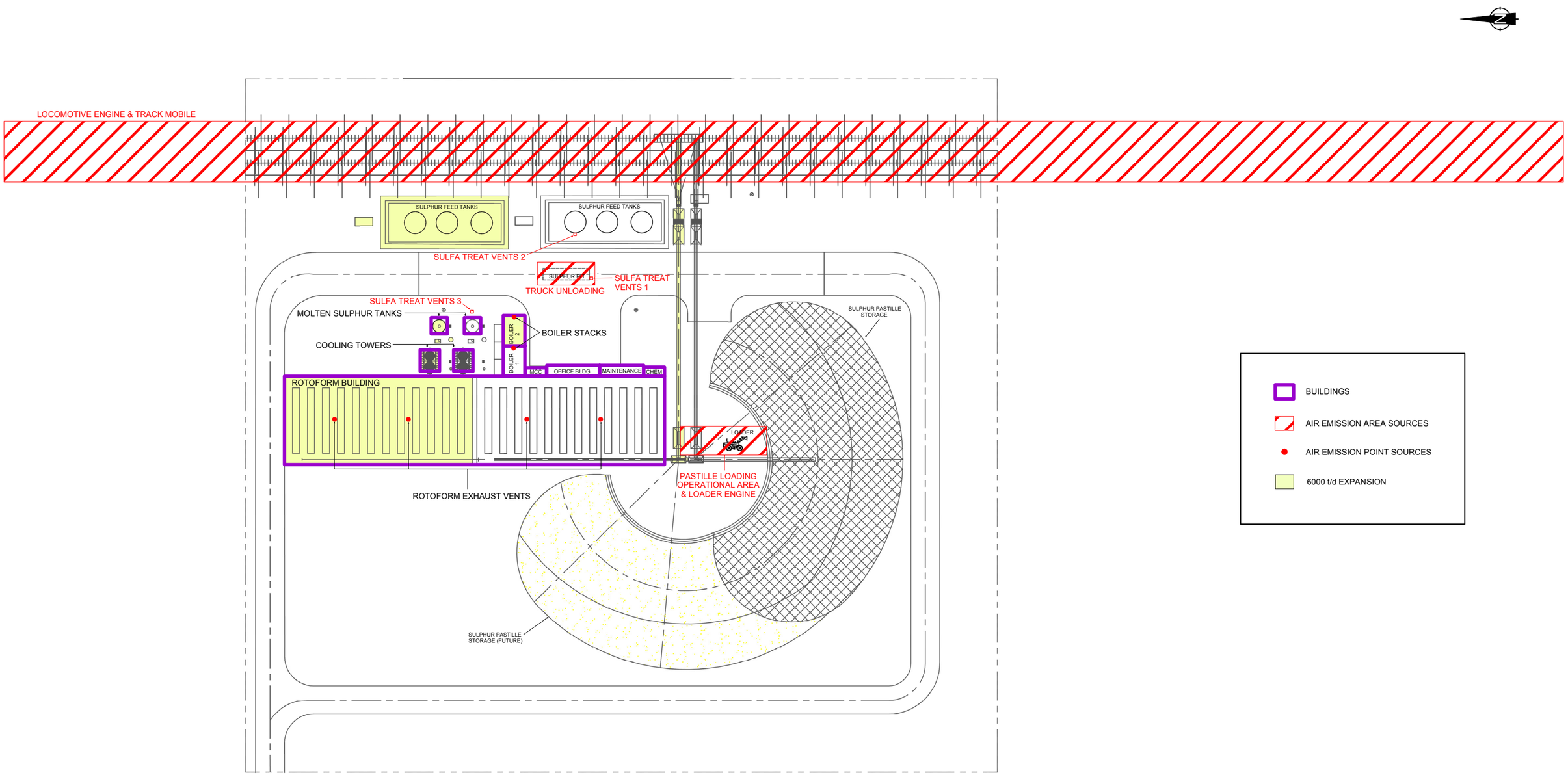


Figure 5: Plot Plan for Sulphur Forming and Shipping Operations in the PDA

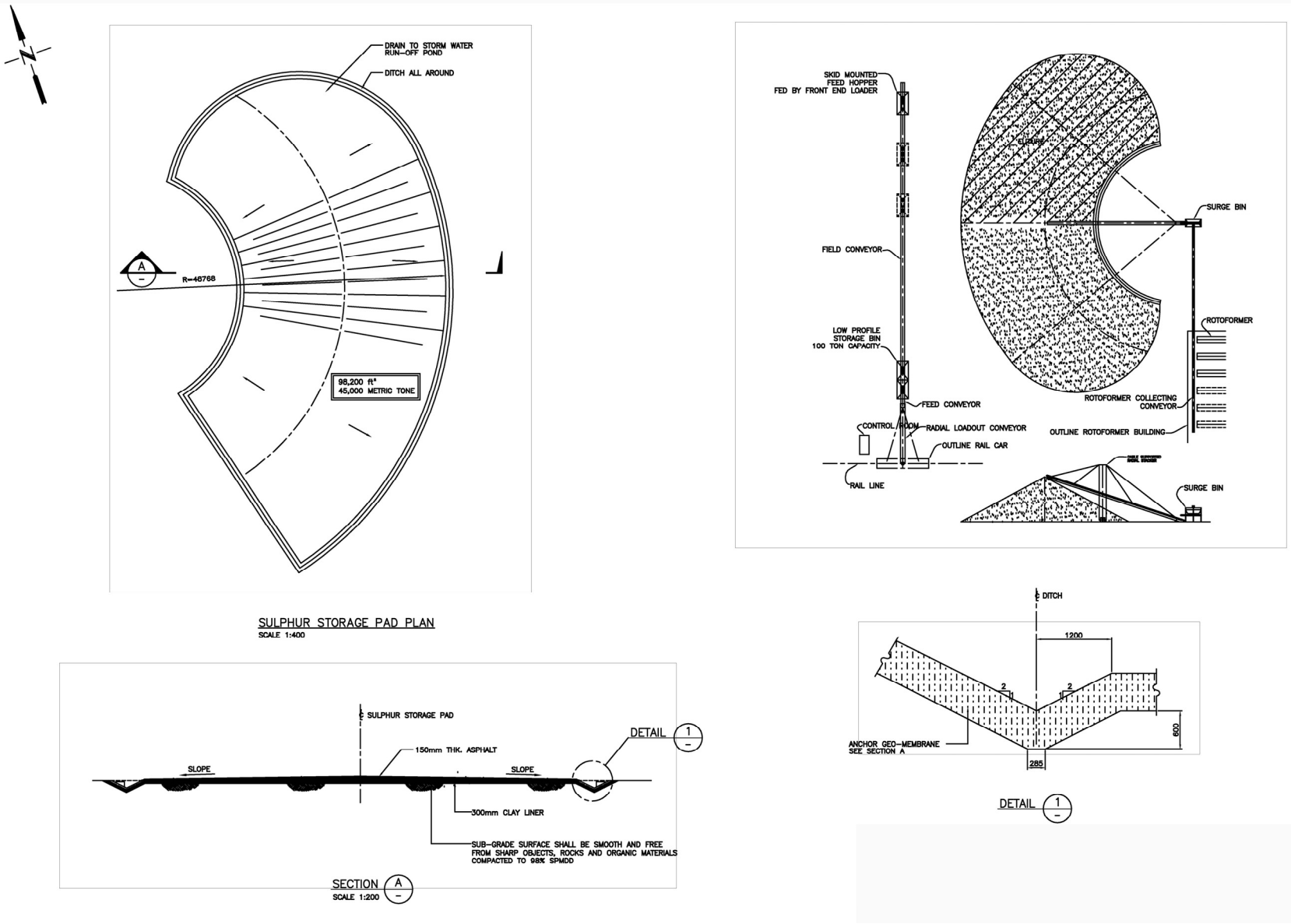
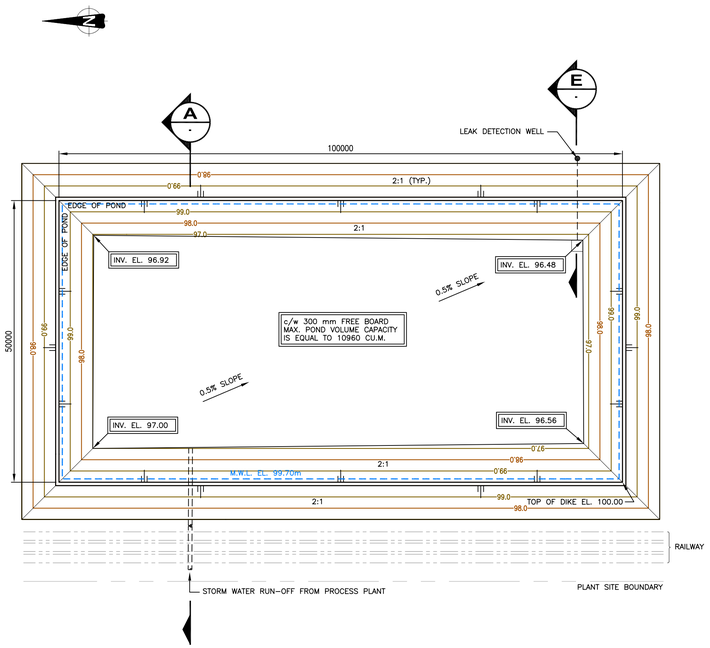


Figure 6: Sulphur Pad Design Details



PLAN
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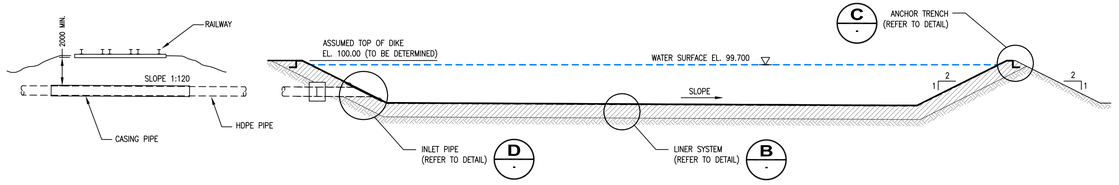

A **POND SECTION**
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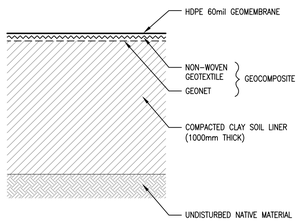

B **LINER SYSTEM DETAIL**
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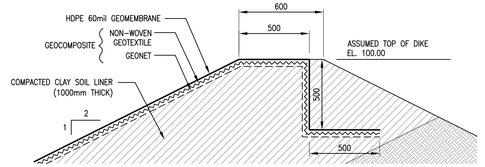

C **ANCHOR TRENCH DETAIL**
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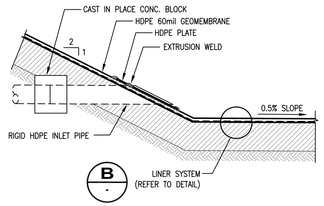

D **INLET PIPE DETAIL**
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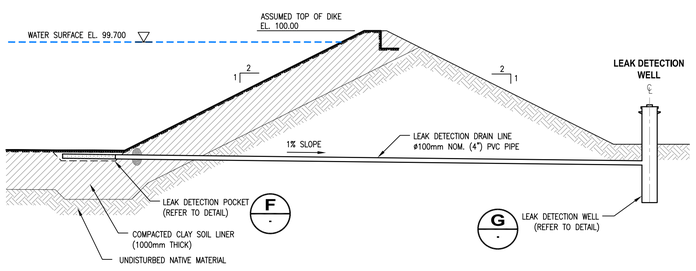

E **LEAK DETECTION - SECTION**
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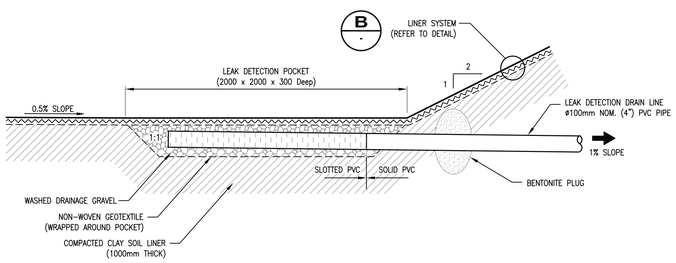
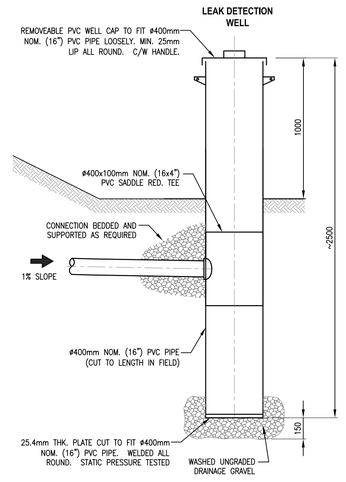


F **LEAK DETECTION - POCKET**
1 : 20



G **LEAK DETECTION - WELL**
1 : 20

Figure 7: Design of Surface Water Collection Pond

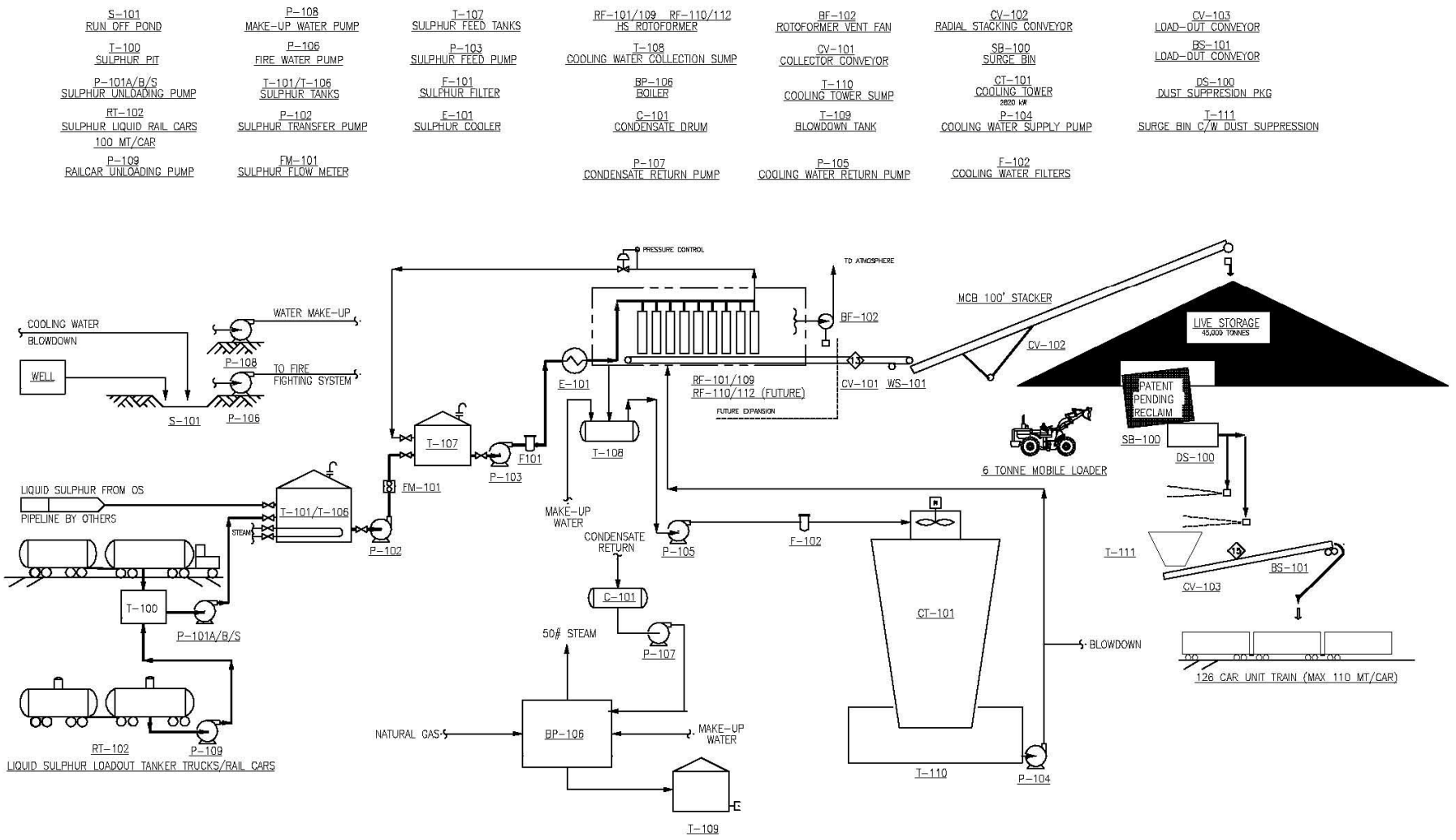


Figure 8: Process Flow Diagram

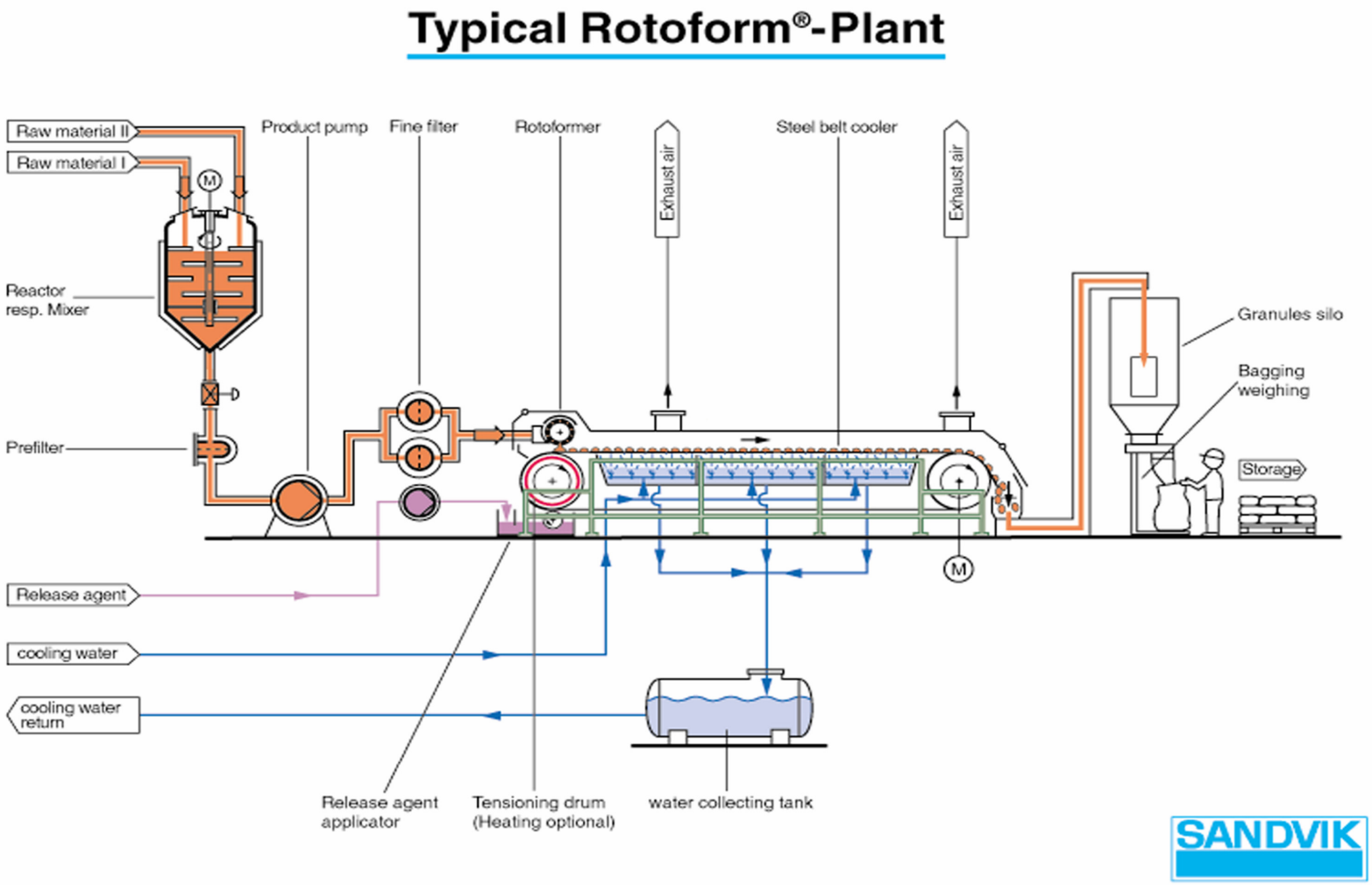


Figure 9: Schematic Illustration of Sandvik Process

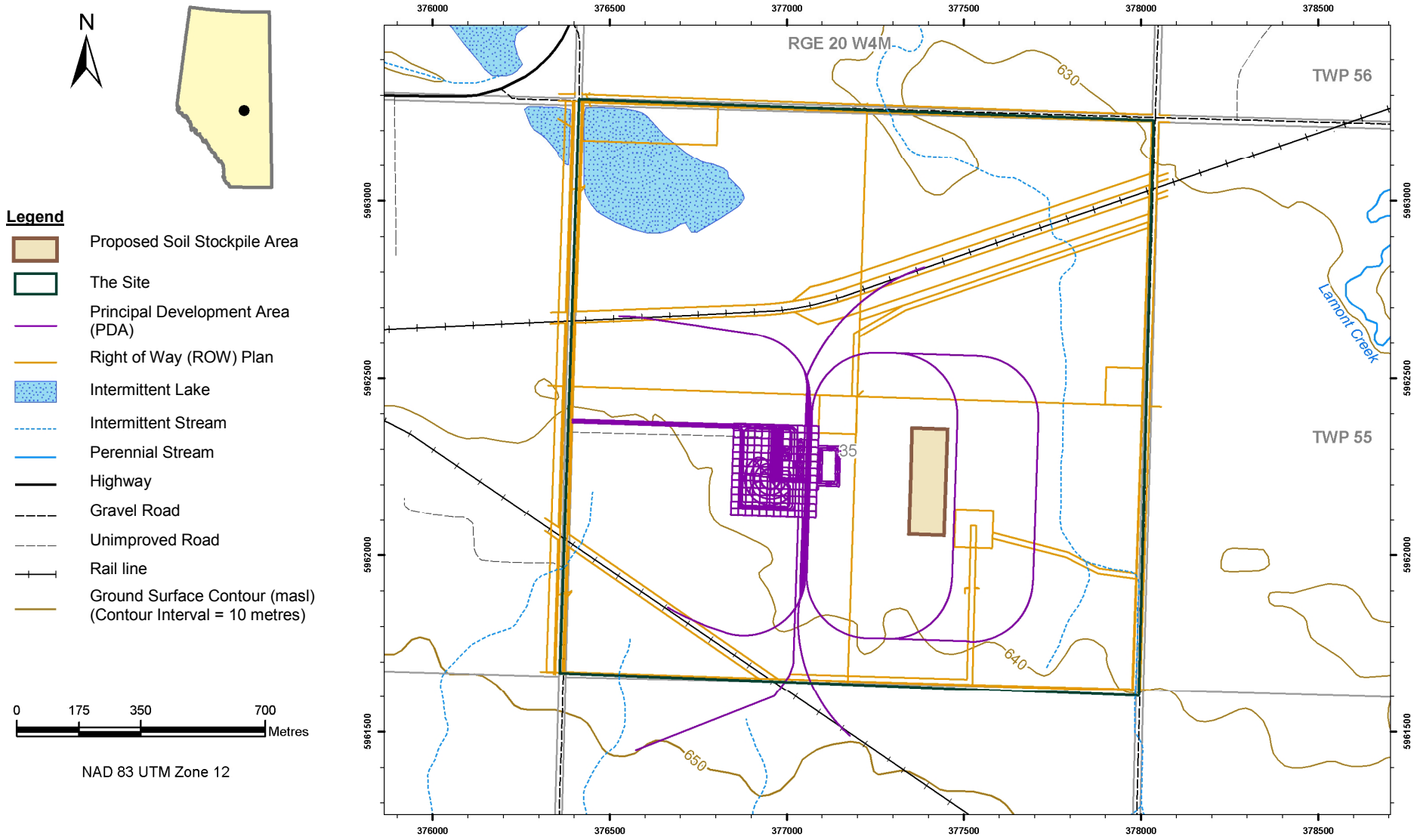


Figure 10: Proposed Soil Stockpile Location

Appendix 1 Application for Approval to Divert Water

June 14, 2007

OUR FILE: C62720100

Alberta Environmental Protection
Southern Region
200, 3115-12 Street NE
Calgary, Alberta
T2E 7J2

Attention: Claude Eckert

Dear Claude:

Re: Application for Approval to Divert Water
Alberta Sulphur Terminals Ltd., 35-055-20 W4M

1. INTRODUCTION

1.1 BACKGROUND

Alberta Sulphur Terminals Ltd. (AST), a division of HAZCO Environmental Services Ltd. (HAZCO), hereby submits an application for approval to divert surface water and groundwater for industrial purposes at its proposed sulphur forming and shipping facility (the Project). The proposed Project is located within a portion of Section 35, Township 55, Range 20, West of the 4th Meridian (35-55-20 W4M; the Site).

The sulphur forming process has a water use requirement of 12 USGPM (US gallon per minute) or 0.76 L/s (litres per second) or approximately 24,000 m^3 per annum. Average annual runoff from the developed plant site closed circuit drainage area (including the stormwater management pond) is estimated at approximately 22,650 m^3 (see Volume IIB, Section 3: Surface Water Quantity). A backup groundwater supply well is proposed to provide water for sulphur cooling whenever there is insufficient water available from the surface runoff collection pond. Groundwater investigations were undertaken to assess the ability of the underlying aquifers to support the water use requirements for the life of the Project (see Volume IIB, Section 2: Groundwater Quantity and Quality).

1.2 PURPOSE AND SCOPE OF LETTER

This letter serves to notify Alberta Environment of AST's request to divert water on a permanent basis at the Site. The objective of this program is to provide water to assist with sulphur cooling.

This letter provides the following information that we expect is useful to the Director in evaluating this proposal:

- a summary of the regional Site geology and hydrogeology;
- a summary of impacts on the local watershed and aquifers;
- a description of groundwater monitoring that will be completed during the period of water extraction and aquifer recovery;
- rationale for use of the groundwater extracted; and,
- a description of the amount of water that will be diverted and over what period of time.

We have also included an Application for Permanent Diversion of Water (Appendix I) for consideration by Alberta Environment.

2. SITE DESCRIPTION

2.1 GENERAL

The surface soils of the Site possess naturally low hydraulic conductivity which decreases the potential for downward and outward migration of potential contamination (i.e., sulphur acidity) and also reduces the effects on nearby surface waters and wetlands. The existing soil and groundwater conditions at the Site also possess significant natural buffering capacity.

The primary aquifer is a sandstone interval located in the upper bedrock zone at a maximum depth of approximately 15 metres below ground surface (mbgs). This zone appears to be used as a domestic and potable water supply for most rural residences in the vicinity of the Site. A second deeper sandstone interval was identified between depths of 81–87 mbgs. Due to the weathered or fractured nature of the upper shale portion of bedrock, the overburden groundwater appears to be somewhat hydraulically connected to groundwater in the upper sandstone interval. However, groundwater in the lower sandstone interval and deeper appears to be protected by a thick, competent shale unit.

2.2 REGIONAL GEOLOGY

Regionally, the bedrock topography dips north across the Regional Study Area (a circular radius within 3 km of the Site; RSA) towards Beaverhill Creek and then northwest towards the North Saskatchewan River (Andriashek 1987a). Near surface bedrock geology (within 300 m of ground surface) is mainly of the Late Cretaceous age and is comprised of the Belly River Formation, the Bearpaw Formation and the Horseshoe Canyon Formation (Hamilton et al. 1998). The beds within each formation dip gently southwest with older rocks present in the northeast portion of the region. The oldest bedrock formation that subcrops in the area is the Belly River Formation, which is non-marine in origin, consists of grey to greenish grey, thick bedded, feldspathic sandstone, grey clayed siltstone, grey and green mudstone and concretionary ironstone beds and has a thickness that ranges from 275–300 m locally (Stein 1976). The Belly River Formation subcrops at the RSA and is the bedrock formation encountered during intrusive investigations, which have extended to 91 m depth.

At the Site, sedimentary bedrock is comprised of mainly shale and sandstone. The bedrock materials are typically weak to moderately strong, brown and grey in colour and contain interbedded layers of siltstone, shale and sandstone throughout. A relatively well-defined sandstone interval appears to be present in the upper portion of the bedrock below the Site. The top of this sandstone interval was encountered at a minimum depth of 5.8 mbgs (05–10B) while the bottom of the sandstone was encountered at a maximum depth of 14.9 mbgs (05–01B/C). The maximum thickness of the sandstone is 7.8 m at 05–01B/C, where the sandstone is comprised of two intervals separated by about 1 m of shale. The geology encountered at PW06–01 during the lower bedrock groundwater exploration indicated that a competent shale interval exists between depths of about 35 and 61 mbgs. Siltstones and sandstones are predominant between 61 mbgs and the maximum depth of investigation of about 91 mbgs. Sandstone intervals within the Belly River Formation, such as those identified at the Site, generally are discontinuous and cannot be correlated at scales of about a kilometre or larger (Stein 1976).

2.3 REGIONAL HYDROGEOLOGY

The regional piezometric levels in the area are expected to be between 615–630 masl (Stein 1976). The regional groundwater flow direction appears to be controlled by the topography of the bedrock surface and is generally northward in the vicinity of the Site before turning northwest, towards the North Saskatchewan River. The average expected yield of groundwater in water wells in the area ranges from less than 7.0×10^{-5} m^3/s to 1.9×10^{-3} m^3/s. The main regional talweg (buried sand channel deposit that may act as an aquifer and which is located within a bedrock valley) is the Beverley Valley talweg in the present day North Saskatchewan River valley (Andriashek 1987a,b). A tributary talweg appears to originate east of Lamont and runs generally northward to intersect the Beverley Valley buried sand

channel about 20 km north-northeast of the Principal Development Area (PDA). The two talwegs are relatively distant from the PDA and therefore do not influence local groundwater flow patterns.

Information on typical groundwater recharge rates in the region is provided by:

- Farvolden (1963)
- Geoscience Consulting Ltd. (1976)
- Hydrogeological Consultants (1977)
- Alberta Environment (1978)

Taken together, these studies suggest typical recharge rates on the order of 1–5% of the annual precipitation of 460 mm over fine-grained till areas (i.e., on the order of 5–25 mm/y) and recharge rates of up to 20% of precipitation (i.e., on the order of 90 mm/y) over sand and gravel areas.

3. WATERSHED AND AQUIFER IMPACTS

Groundwater investigations were undertaken to assess the ability of the underlying aquifers to support the water use requirements for the life of the Project (see Volume IIB, Section 2: Groundwater Quantity and Quality). The upper bedrock aquifer has been identified as a potentially viable groundwater supply source; however, the potential response of the upper bedrock aquifer to long-term water withdrawals is subject to some uncertainty. Where the upper aquifer proves viable and is utilized, it appears that multiple wells will be necessary to meet the required yield. In addition, surface water runoff contained within the stormwater management pond will be used as the primary cooling water supply.

A long-term pump test will be completed in the summer of 2007 to quantify the adequacy of the water supply. Monitoring the aquifer being used to supply groundwater to the Project is proposed on a twice yearly basis to verify these conclusions.

It is expected that overall impacts of the hard surface development area will affect just 4.6% of the total watershed area (see Volume IIB, Section 3: Surface Water Quantity).

For more detailed information on the groundwater and surface water quantity results obtained during the environmental impact assessment please refer to Volume IIB, Sections 2 and 3, respectively.

4. USE OF DIVERTED WATER

AST will require approximately 24,000 m^3 of water per year to use as cooling water. It is estimated that approximately 22,650 m^3 of water will be obtained annually from plant site runoff. The remainder of the water needed for sulphur cooling would be obtained from a groundwater supply well. The maximum volume of groundwater extracted during the Project lifespan would be no more than 24,000 m^3 per annum.

5. CLOSURE

We trust that the information submitted at this time provides Alberta Environment with sufficient basis to issue a permanent licence to divert water and request your timely consideration in this regard. We have completed an application that is located in Appendix I. Should you have any questions or comments, please do not hesitate to contact the undersigned.

Respectfully,

WorleyParsons Komex

Gordon J. Johnson, M.Sc., P.Eng.

6. REFERENCES

Alberta Environment (AENV). 1978. *Edmonton Regional Utilities Study, Volume IV, Groundwater*. Material prepared by Research Council of Alberta, Groundwater Division. Compiled and edited by Alberta Environment and RPA Consultants Limited.

Alberta Environment (AENV), 2003. Groundwater evaluation guideline, information required when submitting an application under the Water Act, February 5, 2003.

Andriashek, L.D. 1987a. *Bedrock Topography and Valley Talwegs of the Edmonton Map Area*. Alberta Energy, Edmonton, AB.

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Farvolden, R.N. 1963. Rate of Groundwater Recharge near Devon, Alberta. In: R.N. Farvolden, W.A. Meneley, E.G. Breton, D.H. Lennox, and P. Meyboom (Eds.). *Early contributions to the groundwater hydrology of Alberta* (pp. 98–105). Research Council of Alberta Bulletin 12.

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Hydrogeological Consultants Ltd. 1977. *Edmonton regional utilities study groundwater inventory, including St. Albert, Villeneuve, Onoway, Stony Plain, Spruce Grove, Warburg, Breton, Winfield, Fort Saskatchewan, Josephburg, Bruderheim, Lamont and Chipman.*

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Stein R. (1976) *Hydrogeology of the Edmonton Area (Northeast Segment), Alberta*. Report 76-1, Alberta Research Council, Natural Resources Division, Groundwater Department, Edmonton, AB.

WorleyParsons Komex, 2007. Volume IIB – Water and Aquatic Ecology, Groundwater Quantity and Quality. Unpublished report prepared for Alberta Sulphur Terminals Ltd. C62720000. April 2007.

Application under the *Water Act*

Documents or information provided to Alberta Environment pursuant to section 15(1)(a) of the Water (Ministerial) Regulation are public records which are accessible by the public.

Check one or more of the following to indicate type of application:

Diversion of water ☒ Renewal of a licence ☐ Constructing Works ☐

Applicant:

Print Name or Company Name:		Home Telephone:	Bus. Telephone:
Alberta Sulphur Terminals Ltd.		( ) N/A	(403) 297-0444
Address (Street, PO Box, etc.):	**Place, Province:**	**Postal Code:**	**Fax:**
10501 Barlow Trail SE	Calgary, AB	T2C 4M5	(403) 253-3188

Are you the registered landowner? Yes ☒ No ☐ If no, please attach a copy of the consent from the landowner.

Consultant, Signing Authority, or Applicant's Representative (if applicable):

Print Name or Company Name:		Home Telephone:	Bus. Telephone:
WorleyParsons Komex		( ) N/A	(403) 247-0200
Address (Street, PO Box, etc.):	**Place, Province:**	**Postal Code:**	**Fax:**
Suite 100, 4500–16th Ave. NW	Calgary, AB	T3B 0M6	(403) 247-4811

Contact Person if not shown above:

Print Name or Company Name:	Telephone:	Fax:
Gordon Johnson	(403) 247-0200	(403) 247-4811

Project Description:

Tentative Starting Date: Late 2007 (if applicable)

Duration of Construction/Development: 2 months

Duration of Water Diversion/Use: Indefinite

Provide a detailed description including location of works and activities relating to the project and attach plans:

Site Location: 35-055-20 W4M

Please see attached letter titled, "*Application for Approval to Divert Water*".

Affected Water Sources (Location of Works and Activities):

Surface Water (if only constructing works, complete the first two columns):

Source (e.g. lake, stream, or name of source, if known)	Diversion/Activity Location ¼	sec	twp	rge	m	Annual Quantity (cubic metres)	Rate of Diversion (show units)	Is Construction or Development Required? (Yes or No)	Purpose
1. Surface Runoff		35	55	20	W4	Up to 24,000	Up to 40 L/min	Yes	Cooling water
2. N/A									
3. N/A									

Groundwater:

Date Well Drilled or proposed drilling date	Well (proposed) Locations ¼	sec	twp	rge	m	Total Depth (metres)	Production Interval (metres)	Pumping Rate (show units)	Annual Quantity (cubic metres)	Purpose
1. ASAP		35	55	20	W4	15	7 - 15	Up to 40 L/min	Up to 24,000	Cooling water
2. N/A										
3. N/A										

Please attach a separate sheet if you wish to provide more information.

Statement of Confirmation:

The information given on this form is true to the best of my knowledge.

Date of Signing	Signature	Print Name	Company Name (if applicable)
		Gordon Johnson	WorleyParsons Komex

Return the completed form to an Alberta Environment Regional office nearest you:

Northern Region, Peace River
Bag 900 – 5, Provincial Building
9621 – 96 Avenue
Peace River, AB T8S 1T4
Telephone **(780) 624-6167**
Fax: (780) 624-6335

Northern Region, Edmonton
Twin Atria
111, 4999 – 98 Avenue
Edmonton, AB T6B 2X3
Telephone: **(780) 427-5296**
Fax: (780) 427-7824

Central Region, Stony Plain
52322 Golf Course Road
Stony Plain, AB T7Z 2K9
Telephone: **(780) 963-6131**
Fax: (780) 963-4651

Central Region, Red Deer
304, Provincial Building
4920 - 51 Street
Red Deer, AB T4N 6K8
Telephone: **(403) 340-7654**
Fax: (403) 340-5022

Southern Region, Calgary
200, 3115 – 12 Street, NE
Calgary, AB T2E 7J2
Telephone: **(403) 297-6582**
Fax: (403) 297-2749

Southern Region, Lethbridge
2nd Floor, Provincial Building
200 - 5 Avenue, South
Lethbridge, AB T1J 4L1
Telephone: **(403) 382-4254**
Fax: (403) 381-5337

(call the Regional office for the location of area offices)

Office Use:

File Number:	Fee Receipt Number:	Approval ID: Operation ID:
Notice Information:	Application Completion Date:	Priority Number:

ATTACHMENTS

ATTACHMENT A

FOR COMPLETE APPLICATION REQUIREMENTS

Please complete the following chart (indicate NE where a particular waste is *never* encountered)

Waste	Storage Method and Location(s)	Precise Disposal Method and Locations
Liquid		
Surface runoff water	All surface water that comes in contact with the sulphur handling and pastille storage areas will be collected and stored in a surface water runoff collection pond, located east of the sulphur forming and shipping operations facility (See Volume I: Project Description – Section 3.5.2: Surface Water Management).	If necessary, excess water contained in the surface water runoff collection pond that is not utilized in the cooling process will be neutralized and monitored prior to being released to the surrounding watershed.
Boiler blowdown water	NE	NE
Cooler water blowdown	Surface water runoff collection pond located east of the sulphur forming and shipping operations facility.	Excess water contained in the surface water runoff collection pond that is not utilized in the cooling process will be neutralized and monitored prior to being released to the surrounding watershed (See Volume I: Project Description – Section 3.5.2: Surface Water Management).
Steam condensate	NE	NE
Water treatment wastewater	The sulphur forming and shipping operations do not generate wastewater that requires release to the environment.	Excess water contained in the surface water runoff collection pond that is not utilized in the cooling process will be neutralized and monitored prior to being released to the surrounding watershed.
Vessel drains	NE	NE
Produced water	There will be no significant waste streams generated by the process; however, minor volumes of water neutralization precipitates (primarily gypsum) are expected to be generated from time to time.	These materials will be disposed off site at approved facilities in accordance with Volume I: Project Management – Section 3.7: Hydrocarbon, Chemical and Waste Management.
Floor wash	Surface water runoff collection pond located east of the sulphur forming and shipping operations facility	Excess water contained in the surface water runoff collection pond that is not utilized in the cooling process will be neutralized and monitored prior to being released to the surrounding watershed (See Volume I: Project Description – Section 3.5.2: Surface Water

		Management)
Equipment wash	Surface water runoff collection pond located east of the sulphur forming and shipping operations facility	Excess water contained in the surface water runoff collection pond that is not utilized in the cooling process will be neutralized and monitored prior to being released to the surrounding watershed (See Volume I: Project Description – Section 3.5.2: Surface Water Management)
Vent/flare liquids	NE	NE
Filter backwash	Surface water runoff collection pond located east of the sulphur forming and shipping operations facility	Excess water contained in the surface water runoff collection pond that is not utilized in the cooling process will be neutralized and monitored prior to being released to the surrounding watershed (See Volume I: Project Description – Section 3.5.2: Surface Water Management)
Sanitary sewage	Domestic wastewaters generated at the Site will be collected in a septic tank and subsequently hauled off site for disposal at an approved sewage treatment facility.	See Volume I: Project Description – Section 3.7.2: Waste Management.
Engine oil	NE	NE
Compressor lube oil	NE	NE
Laboratory wastes	NE	NE
Amine	NE	NE
Glycol	NE	NE
Methanol	NE	NE
Other sweeteners	NE	NE
Other chemicals	See Volume I: Project Description – Section 3.7.1: Chemical Management	See Volume I: Project Description – Section 3.7.1: Chemical Management
Heat medium	NE	NE
Other turnaround wastes	NE	NE
Other	NE	NE
Sludges		
Tank bottoms	NE	NE
Reclaimer bottoms	NE	NE
Pond bottoms	Removal of accumulated sediments from the pond is expected to occur very infrequently given the pond's size and the controls that will be put in place to minimize potential	See Volume I: Project Description – Section 3.7.2: Waste Management.

	acidification of runoff water	
Septic tank	Domestic wastewaters generated at the Site will be collected in a septic tank and subsequently hauled off site for disposal at an approved sewage treatment facility.	See Volume I: Project Description – Section 3.7.2: Waste Management.
Cooling tower	Surface water runoff collection pond located east of the sulphur forming and shipping operations facility.	Excess water contained in the surface water runoff collection pond that is not utilized in the cooling process will be neutralized and monitored prior to being released to the surrounding watershed (See Volume I: Project Description – Section 3.5.2: Surface Water Management).
API separator	NE	NE
Diatomaceous earth	NE	NE
Other	Neutralization sludge may also be generated by the surface water neutralization facility.	This sludge will be solidified and stockpiled pursuant to disposal at an approved Class II waste disposal facility (See Volume I: Project Description – Section 3.7.2: Waste Management).
Solid		
Domestic garbage	A recycling program will collect and recycle plastics, cardboard and beverage containers.	All domestic garbage will be disposed at an authorized municipal solid waste landfill (See Volume I: Project Description – Section 3.7.2: Waste Management).
Carbon filters	NE	NE
Sock filters	NE	NE
Cartridge filters	NE	NE
Construction material	NE	NE
Catalyst	NE	NE
Desiccant	NE	NE
Iron sponge or other	NE	NE
Spill debris	NE	NE
Drums (> 20 L)	NE	NE
Capacitors	NE	NE
Ion exchange resin	NE	NE
Asbestos	NE	NE
Incinerator ash	NE	NE
Baghouse dusts	NE	NE

Waste sulphur	Any waste sulphur that is collected will be stored on the pastille storage pad until sufficient volumes are present to allow for efficient disposal.	Disposal will occur at an approved Class II waste disposal facility and will be managed and neutralized in accordance with that facility's operational requirements (See Volume I: Project Description – Section 3.7.2: Waste Management).
Other		
Waste received from off site	NE	NE
Drum wash	NE	NE
Pond skimming	NE	NE
Pigging waste	NE	NE
Waste	**Storage Method and Location(s)**	**Precise Disposal Method and Locations**
Dirty sulphur	All dust that is collected in the process will be recycled and placed back in the sulphur feed tanks to be formed. During operations, there may potentially be some waste or contaminated sulphur (sulphur that does not meet saleable product specifications) collected as part of equipment maintenance and on-going operations.	See Volume I: Project Description – Section 3.7.1: Chemical Management
Sulphur contaminated soil	Sulphur contaminated soil will be amended in situ with lime to ameliorate soil acidicity.	NE
Sulphur remelt waste	Any waste sulphur that is collected will be stored on the pastille storage pad until sufficient volumes are present to allow for efficient disposal.	Disposal will occur at an approved Class II waste disposal facility and will be managed and neutralized in accordance with that facility's operational requirements (See Volume I, Section 3.7.2).
Transformer oil	NE	NE
Other	None	None

ATTACHMENT B
INDUSTRIAL RUNOFF DRAINAGE SYSTEM

1. Topographic map(s) shall be submitted, showing the following:

   a) plant site with major facilities,

   See Figure 4 in the Application.

   b) any off-site areas contributing to storm water runoff to the site surface drainage system, and

   Not Applicable

   c) facilities provided for the collection, segregation, treatment and discharge of storm water runoff from the various areas of the site and off-site

   See Figures 4 and 7 in the Application.

   Note: The topographic map(s) should identify any proposed contour changes to the natural topography. Runoff from the plant undeveloped areas (i.e., minimal or no risk for contamination from air or water emissions) will normally not require runoff retention or monitoring. However, the areas should be designed as such on the map.

2. Describe the storm runoff according to the following:

   a) runoff volume from a one-in-ten year storm of 24-hour duration, based on the applicable rainfall data for the area (m^3), and

   The runoff volume from a one-in-ten year storm of 24-hour duration based on the applicable rainfall data for the area is 1.43 m^3/s.

   b) peak runoff from a one-in-ten year storm at point of discharge to a treatment facility (m^3/s).

   Not Applicable. The capacity of the surface water runoff pond exceeds the volume of runoff generated by the 1 in 25 years, 24 hour rainfall event. The capacity is 10,980 m^3, allowing for 300 mm of freeboard (see Volume I: Project Description – Section 3.5-2: Surface Water Management and Section 5.1: Surface Water Monitoring).

   Note: the Rational Formula can be used to estimate the runoff flow (please show calculations). Rainfall data is available from Environment Canada.

   Rational Formula: $Q = CIA$

   Where

   Q = runoff flow (m^3/s)
   C = rainfall coefficient (see Tables 1 and 2 for a guide)
   I = rainfall intensity (m/s)
   A = contributing area (m^2)

3. Describe the storm water facilities according to the following:

   a) design (volume, lining, etc.) of storm water treatment or retention facilities (attach drawings).

   See Figure 7 in the Application.

   b) safety factors used in sizing the above facility, and

   The surface water and wastewater management plans are outlined in Volume I: Project Description – Sections 3.5.2: Surface Water Management and Section 3.5.3: Wastewater Management.

   c) procedures used to minimize the contamination of storm water.

   Chemical and Waste Management Plans, described in Volume I Project Description – Section 3.7.1: Chemical Management and Section 3.7.2: Waste Management, outline procedures to minimize contamination of storm water.

STORMWATER

(✓ appropriate blank)

✓	Developed area is distinctly segregated from undeveloped area
n/a	Developed area is segregated into high potential contamination areas and low potential contamination areas.
✓	Undeveloped area runoff is not contained but follows natural drainage course.
	Stormwater is:
n/a	Discharged with effluent
✓	Discharged independent of effluent
✓	Recycled
n/a	Evaporated
✓	Other (Specify) Stored in the surface water runoff collection pond.

Stormwater quality/loadings are determined independent of effluent loadings. Describe

✓ If necessary, excess water contained in the surface water runoff collection pond that is not utilized in the cooling process will be neutralized and monitored prior to being released to the surrounding watershed. Monitoring of surface water quality will be implemented to preclude accidental release of acidic water from the surface water runoff collection pond. Grab samples will be collected immediately prior to release of any water to the environment. Any water that is potentially discharged from the Site will be sampled and tested to comply with generic criteria (see Volume I, Section 5.1).

n/a Stormwater is discharged with effluent and no monitoring is done.

If stormwater is combined with process wastewater, how is compliance with licence effluent limitations determined? Details n/a

Describe the monitoring equipment/procedures:

Samples will be collected and sampled on a batch basis prior to releasing treated water to the environment. Discharge limits for specific contaminants (if and when suspected) will be determined in accordance with the Water Quality Based Effluent Limits Procedures Manual (AEP 1995, as amended). Monitoring of water quality in the adjacent wetlands will be completed twice annually as an extension of the groundwater monitoring program (see Volume I, Sections 5.1 and 5.2).

How has the stormwater control system been operating?

n/a No problems

n/a	Occasional problems (specify)	
n/a	Frequent problems (specify	

Stormwater collected in product/raw material tank farm and storage dykes is:

✓	Disposed to stormwater system
n/a	Allowed to evaporate
n/a	Allowed to seep into the soil
n/a	Analyzed for contaminants first, then discharged to stormwater pond
n/a	Other (specify)

POND SIZING CRITERIA

n/a	1:10 year, 24-hour storm for (specify area(s) used)

1:25 year, 24-hour storm for (specify area(s) used)

The capacity of the surface water runoff pond exceeds the volume of runoff generated by the 1 in 25 years, 24 hour rainfall event. The capacity is 10,980 m^3, allowing for 300 mm of freeboard (see Volume I, Sections 3.5-2 and 5.1).

n/a	Other

Table 1: Runoff Coefficients for Urban Areas

Description of Area	Runoff Coefficient (C)
Flat, residential (about 30% of area impervious)	0.40
Moderately steep, residential (about 50% of area impervious)	0.65
Moderately steep, built up (about 70% of area impervious)	0.80

Table 2: Deductions from Unity to Obtain the Runoff Coefficient for Rural Areas

Type of Area	Deduction from Unity
Topography	
Flat land (average slopes of 1 ft. to 3 ft. per mi.)	0.30 a
Rolling land (average slopes of 15 ft. to 20 ft. per mi.)	0.20
Hilly land (average slopes of 150 ft. to 250 ft. per mi.)	0.10
Soil	
Tight impervious clay	0.10 b
Medium combination of clay and loam	0.20
Open sandy loam	0.40
Cover	
Cultivated lands	0.10 c
Woodland	0.20

Notes: The value of C for rural areas is obtained by subtracting the sum of the three factors (topography, soil and cover) from unit, that is: $c = 1 – (a + b + d)$

Additional information can be obtained from Gray, M. 1970. Handbook on the principles of hydrology. Water Information Centre, Inc.

ATTACHMENT C

A. Liquid Effluent Treatment Facility

1. Pretreatment (e.g., screening, grit removal, comminution units, etc.). If any, give a full description of the design, handling volume and efficiency (attach drawings).

   Not Applicable

2. Primary Treatment (e.g., sedimentation tank, clarifier, separator, etc.). If any, give a full description of the design, handling volumes, retention time, efficiency, etc. (attach drawings).

   Not Applicable

3. Secondary Treatment [e.g., activated sludge, trickling filters, oxidation ponds (biological lagoon), chemical treatment, etc.]. If any, give a full description of the design, handling volume, retention time, efficiency especially of the percent of BOD_5 and total suspended solids reduction (attach drawings).

   Not Applicable

4. Tertiary Treatment (e.g., supplemental sedimentation, nutrient removal, tertiary filtration, ion exchange, etc.). If any, give a full description of the design, handling volume, retention time, and efficiency (attach drawings).

   Not Applicable

5. Sewage
   [✓ appropriate blank(s)]

n/a	Discharged to on-site segregated sewer	
n/a	Combined with process wastewater	
n/a	Sewage connected to a municipal plant	
n/a	Treated – Primary/Secondary/Other (Specify	
✓	Discharged to septic holding tank	Sewage to be hauled to an authorized facility.
n/a	Septic tank, tile and filed	
n/a	Lagoon(s)	
n/a	Cesspool	
n/a	Other	

   Note: If sewage does not receive secondary treatment (is not hauled or conveyed to a sewage treatment plant; is not treated on site in a lagoon or treatment plant; or is not disposed to a septic tank, tile and field), then upgrading to a secondary treatment is necessary (i.e., BOD, TSS, <= 25 mg/L)

6. Industrial Wastewater (Liquid Effluent/Process Wastewater)
   [✓ appropriate blank(s)]

✓	Pretreated (specify)	Excess water will be neutralized and monitored prior to being released to the surrounding watershed.
n/a	No pretreatment (specify)	
n/a	No pretreatment – collected in segregated process wastewater sewer and discharged to collection pond(s)	

n/a	Treatment – collected in segregated process wastewater sewer and discharged to a treatment system
n/a	Evaporation pond
n/a	Irrigation pond
n/a	Other

7. Other Treatments

n/a	Chlorination
n/a	Activated Carbon
n/a	Deepwell Disposal
✓	Others: If excess surface water runoff requires neutralization prior to discharge to the surrounding watershed, the pH will be ameliorated using lime amendments.

B. Air Emissions Treatment Facilities/Emissions Reductions Facilities

List and describe the facilities, describe the design and operating features, capacities, effectiveness, etc. (attach drawings).

Please see the Application and Volume I: Project Description – Section 3.2: Process Description, Section 3.6: Air Emissions Management, and Section 5.4: Air Monitoring.

C. Industrial Waste Treatment/Removal Facilities

List and describe the facilities, describe the design and operating features, capacities, effectiveness, etc. (attach drawings).

Please refer to Volume I: Project Description – Section 3.7: Hydrocarbon, Chemical and Waste Management, Section 3.5.2: Surface Water Management and Section 3.5.3: Wastewater Management.

ATTACHMENT D

River Basin (Plant Site)	Lamont Creek is a tributary to Beaverhill Creek, which is a tributary to the North Saskatchewan River located approximately 11 km downstream from the Site.
River Basin (Discharge Point)	n/a

Discharge Details:

✓	Overland (i.e., ditches, gulleys)
n/a	Pipeline
n/a	Both
Comments	Excess water contained in the surface water runoff collection pond that is not utilized in the cooling process will be neutralized and monitored prior to being released to the surrounding watershed (see Volume I: Project Description – Section 5.1: Surface Water Monitoring).

n/a	Continuous	
n/a	Intermittent	
✓	Frequency	Only if necessary.
Comments	Discharge from the retention pond will only be required during extreme runoff events and will be subject to monitoring and release criteria (see Volume I: Project Description – Section 5.1: Surface Water Monitoring and Volume IIB, Section 5: Aquatic Resources – Section 5.5.8: Stormwater Discharge).	

Point of Compliance Location (Sampling Station)	See Volume I: Project Description – Section 5: Environmental Effects Monitoring.

No impacts to aquatic life are anticipated. Water quality and quantity monitoring of the adjacent wetlands will be completed as part of standard facility operations (see also Volume IIB, Section 5: Aquatic Resources – Section 5.5.8: Stormwater Discharge, Section 5.6: Cumulative Effects Assessment, and Section 5.7: Monitoring and Adaptive Management).

Discharge Location Coordinates

Longitude	112	Deg	51	Min		Sec	
Latitude	53	Deg	47	Min		Sec	

n/a	River Bank: Describe		
n/a	Under Water	✓	Visible (above water)
n/a	Single Orifice	n/a	Multiple Orifice
Comments			

n/a	Pipeline(s)	n/a	Single	✓	Other (Specify	Gravity drained to natural ephemeral watercourse.
n/a	Size	n/a	cm.	n/a	in.	

Comments	
River/Stream Discharged to	The wetland eventually drains to Beaverhill Creek, which is a tributary to the North Saskatchewan River located approximately 11 km downstream from the Site.

Monitoring Equipment:

n/a	Flow: Model	
	Type:	n/a
	Age:	n/a
	Calibration Procedure:	n/a
	Calibration Frequency:	n/a
	How is accuracy determined?	n/a
	Location:	n/a
n/a	pH: Model:	
	Type:	n/a
	Age:	n/a
	Licence pH limits:	n/a
	Calibration Procedure:	n/a
	Calibration Frequency:	n/a
	How is accuracy determined?	n/a

✓ Sampling Equipment Sampling Jars

Model: n/a

Type: n/a Composite ✓ Grab

n/a Flow Proportional n/a Time Proportional

Describe how it works: Excess surface water runoff will be grab sampled prior to discharge to the watershed.

Age: n/a

Calibration Procedure: n/a

How is accuracy determined?

Sampling Interval:

n/a Other Monitoring Equipment (Specify)

Age: n/a

Calibration Procedure: n/a

Calibration Frequency: n/a

How is accuracy determined? n/a

ATTACHMENT D-A1

Air Emission Sources

Identification No.	Location on Site Map	Description of the Source	Description of the Equipment Immediately Before the Source, e.g., Scrubber, ESP, etc.	Maximum Emission Quantity of the Contaminants							
				SO_2		NOx		CO	HC	PM	Others: list in a supple-mentary table
				kg/h	kg/d	kg/h	kg/d	kg/h	kg/h	kg/h	kg/h
Rotoform (x4)	Figure 5	The rotoform stacks and facility loading area will be sources of particulate emissions of sulphur. (Volume IIA, Section 2: Climate and Air Quality – Section 2.5: Application Case)	Boiler	–	–	–	–	–	–	0.378	H_2S 0.0432
Boiler (x2)	Figure 5	(Volume IIA, Section 2: Climate and Air Quality – Section 2.5: Application Case)		0.0036	0.0884	0.3636	8.7264	0.4428	–	0.0396	

ATTACHMENT D-A2

Air Emission Sources – Monitoring

Identification No.	Parameters Monitored	Continuous or Manual	Monitoring Equipment Make and Type	Monitoring Method if Manual
Rotoform (x4)	Compliance Source Emissions Testing on Rotoform emissions.	Continuous		
Boiler (x2)	Sulphur (Volume I: Project Description – Section 1.1.5.1: Sulphur Generation) CO_2 (Volume I: Project Description – Section 3.6.1: Greenhouse Gas Emissions)	Continuous		
Ambient Air Monitoring	H_2S and SO_2	Continuous; H_2S and SO_2 monitoring, only in the work area as a health and safety precaution for workers.	-Personal monitors on all personnel working in the sulphur forming and processing areas. -Continuous monitors in the vicinity of the liquid sulphur storage tanks, sulphur reception area and inside of the forming building.	
Ambient Air Monitoring	Elemental S	Manually, once a year.		

ATTACHMENT D-A3

Air Emission Sources – Physical Characteristics

Identification No.	Height of Stack	Diameter of Stack	Temperature of Effluent Stream (same exit temperature?)	Exit Velocity of Effluent Stream	Height of Building or Adjacent Building
Rotoform (x4)	18.3 m	0.39 m	36 (^{o}C)	16.7 (m/s)	-
Boiler (x2)	16.76 m	0.406 m	228 (^{o}C)	7.5 (m/s)	-

ATTACHMENT D-A4

Storage Tanks

Identification No.	Description of Tank	Size of Tank		Type of Tank	Contents Stored	Maximum True Vapour Pressure of Contents	Type of Vents	Fugitive Control Vapour Recovery System		Others
		Dia. (m)	Vol. (m^3)					Yes	No	
Sulphur Receiving Tanks (Volume I: Project Description – Section 2.3.1: Sulphur Reception, Section 2.3.3: Sulphur Forming, Section 3.2.5: Product Storage and Volume IIA, Section 2: Climate and Air Quality – Section 2.5: Application Case)	Insulated, vented and heated		1,667	Steel	Molten Sulphur		Sulpha treat vents	✓		Comply with EUB Directive 55 and API 650
Molten Sulphur Storage Tanks (Volume I: Project Description – Section 2.3.2: Sulphur Storage, Section 3.2.5: Product Storage and Volume IIA, Section 2: Climate and Air Quality –	Insulated, vented and heated		~1,667 (x2)	Steel	Molten Sulphur		Sulpha treat vents	✓		Comply with EUB Directive 55 and API 650

Section 2.5: Application Case)										
Molten Sulphur Feed Tank (Volume I: Project Description – Section 2.3.3: Sulphur Forming and Volume IIA, Section 2: Climate and Air Quality – Section 2.5: Application Case)	Insulated, vented and heated		1,667 (x3)	Steel	Molten Sulphur		Sulpha treat vents	✓		Comply with EUB Directive 55 and API 650

ATTACHMENT G

HYDROGEOLOGIC AND GROUNDWATER MONITORING

Groundwater Monitoring Programs for the plant shall include, but is not limited to, the following information:

(a) A hydrogeologic description and interpretation of the plant;

See Volume IIB, Section 2: Groundwater Quantity and Quality – Section 2.6: Application Case – Groundwater Quantity and Section 2.7: Application Case - Groundwater Quality

(b) A map and description of surface water drainage patterns for the plant;

See Figure 4 in the Application and Volume IIB, Section 3: Surface Water Quantity – Section 3.5.4: Local Hydrology and Figure 3.4-2

(c) A lithologic description and maps, including cross-sections, of the surficial and the upper bedrock geologic materials at the plant;

See Volume IIB, Section 2: Groundwater Quantity and Quality – Figures 2.4-2, 2.5-1, 2.5-3, 2.5-4, 2.5-5, and 2.5-8

(d) Maps showing depth to water table, patterns of groundwater movement and hydraulic gradients at the plant;

See Volume IIB, Section 2: Groundwater Quantity and Quality – Figure 2.5-8

(e) The hydraulic conductivity of all surficial and bedrock materials at the plant;

See Volume IIB, Section 2: Groundwater Quantity and Quality

(f) A map showing the location of existing and additional proposed groundwater monitor wells at the plant;

See Volume IIB, Section 2: Groundwater Quantity and Quality – Figures 2.4-2, 2.5-9 and 2.6-2

(g) Lithologs of all boreholes drilled at the plant;

See Volume IIB, Section 2: Groundwater Quantity and Quality – Appendix III: Borehole Logs

(h) Construction details of existing groundwater monitor wells;

See Volume IIB, Section 2: Groundwater Quantity and Quality – Section 2.4.6: Field Programs

(i) a rationale for proposed groundwater monitor well locations and proposed completion depths of those wells;

See Volume IIB, Section 2: Groundwater Quantity and Quality – Section 2.4.6: Field Programs

(j) a description of groundwater monitor well development protocols;

See Volume IIB, Section 2: Groundwater Quantity and Quality – Section 2.4.9.1: Baseline Field Data Quality Assurance and Quality Control

(k) a list of parameters to be monitored and the monitoring frequency for each groundwater monitor well or group of groundwater monitor wells at the plant;

See Volume IIB, Section 2: Groundwater Quantity and Quality – Section 2.9: Management and Monitoring

(l) a description of the groundwater sampling and analytical QA/QC procedures;

See Volume IIB, Section 2: Groundwater Quantity and Quality – Section 2.4.9.1: Baseline Field Data Quality Assurance and Quality Control

(m) details of a groundwater response plan specifying actions to be taken should contaminants be identified through the Groundwater Monitoring Program; and

A response plan or action plan will be developed to enable prompt courses of action in the event that routine monitoring detects an impact that may eventually become unacceptable. Following Project approval, a draft response plan should be prepared and submitted to Alberta Environment for review, comment and approval.

Volume IIB, Section 2: Groundwater Quantity and Quality

(n) any other information relevant to groundwater quality at the plant.

Note: This information is not required if the approval holder has submitted a similar report within the last ten years. When an existing system is upgraded, the new data obtained from the system upgrade can be included with their next annual report.